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***Board Diversity's effect on Stock Volatility***  
*An empirical study on the Swedish market*

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## **Abstract**

In recent years, group diversity has become a prevalent topic of discussion with regard to benefits and drawbacks. This thesis examines the impact of board diversity on stock volatility using data on board directors in Swedish companies over a ten-year period. Regression analysis is employed to investigate the relationship between board diversity and stock volatility. The main finding suggests no significant relationship between board diversity and stock volatility. However, the sensitivity analysis reveals a negative relationship between gender diversity and stock volatility, implying that increased gender diversity may reduce stock volatility. While considering the limitations, particularly the lack of data in the diversity index, further research with more comprehensive and conclusive data is recommended to validate or challenge these findings. Incorporating additional variables and exploring their interactions would deepen the understanding of this complex area. While this study does not establish a direct impact of board diversity on stock volatility, it offers valuable insights for investors and implications for corporate and national governance, particularly in relation to potential future quotas.

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# 1. Introduction

*The introduction will present background to the issue, descriptions of the problem as well as the purpose of the study.*

## 1.1 Background

In recent years, the interest of investors to make responsible investments has grown. Board diversity is one factor that has attracted further attention within the area. A global survey conducted in 2020 by the Institutional Shareholders Service showed that 85% of the respondents support the idea of engaging with companies that encourage board diversity (Langton 2020). Additionally, 56% answered that they were willing to vote against nominees where a lack of ethnic diversity could be seen. The survey shows that investors not only appreciate board diversity, but also take it into consideration when making their investment decisions. Further surveys have shown that younger investors, often under the name of Millennials or Gen-Z, are more willing to invest for environmental and social goals, whereas diversity falls under the social aspect (Gelfand 2022).

The investors' perception of board diversity is potentially affecting the firms when voting for their board directors, but larger actors are taking it into their own hands as well. The Nasdaq stock exchange in the United States accepted a board diversity rule, expected to be enforced in 2023. The rule implies that all companies must report their level of diversity of board directors for gender and underrepresented minorities (Nasdaq 2023). Further, the Financial Conduct Authority (FCA) in the United Kingdom has integrated a gender quota and a minimum requirement of one board director to originate from an ethnic minority (FCA 2022). One can think that gender still acts as the main equality factor, but as seen from these two initiatives, further diversity factors are considered.

Equality in terms of gender is one out of 17 Sustainable Developments Goals initiated by the European Union in 2015 with a deadline in 2030. One aim with the goal is to improve the rights of women including encouragement for leadership in the economy and politics (Globala Målen 2023). The European Union took a step forward in 2022 as they accepted a gender quotation on large companies of the member countries. The acceptance came on the second attempt, as the first one was rejected in 2012 (Europaportalen 2022). Equality in terms of gender has been a work in progress for decades, even centuries. As with everything, some

countries have come further in their development, while others lag behind. This might be one of the reasons for the tweet made by the President of the European Union commission, Ursula von der Leyen (2022), at the time of acceptance for the gender quotation:

*“The glass ceiling preventing women from accessing top positions in companies has been shattered. This is a truly historic and moving moment.”*

Almost 20 years earlier, Norway initiated a national gender quota by law, requiring a minimum representation of 40% of each gender for company boards. With Norway taking the lead, a few more countries have adopted similar quotas including Iceland, Belgium and Finland (Smith 2018). Sweden however, has not followed the initiative from its neighbor countries. Instead, Sweden was one out of only three countries in 2022 who voted against the gender quotation in the European Union (Europaportalen 2022). Sweden is often considered being at the forefront with its, compared to many others, socialist government. However, according to the latest statistics, Sweden is far from being best when it comes to gender diversity on company boards. The statistics show that Sweden's gender diversity is not more than a couple percentage points above the average member country of the European Union (Ekonomifakta 2023). As for now, Sweden is below the minimum diversity set by the newly accepted quota, meaning adjustments must be made in the following years.

Dismissing the moral aspect of equality and diversity, social psychological studies provide insights on the actual effect of diversity on group dynamics. Improvements in the process of decision-making and problem-solving as well as heightened creativity are some benefits that group diversity brings (Milliken & Martins 1996). Different perspectives from individuals are often strongly influenced by personal characteristics, experience and culture (Baranchuk & Dybvig 2009). Experience often comes with age, but age itself may be a factor that creates different perspectives. This reflects on the findings that younger individuals allow sustainability factors to influence their investment decisions to a greater extent than the elderly (Gelfand 2022). An additional perspective-creating factor is education. The level of education can most definitely say something about an individual's theoretical skills, but Bloomberg (2019) highlights the risk of educational institutes fostering similar perspectives potentially creating the phenomena groupthinking. Groupthinking corresponds to a situation, or a group dynamic, where the group experiences a lack of self-awareness, thus deteriorating the decision-making process (Blomberg 2019).

Combining the investors perception of board diversity with the social psychological studies on group dynamics, it is important for the firms to consider the diversity of the board. As for the younger investors, they have even agreed that responsible investments can be at the cost of the return. Meaning, they are willing to achieve a lower return for as long as their investments fulfill a bigger purpose (Gelfand 2022). If performance is of less interest, how about the risk? The common Risk-and-Return Trade-off theory suggests that an investor is prepared to engage in riskier investments, for as long as the return is expected to be higher (Chen 2023). Risk can be measured differently, but the most common and easily understood measurement is the stock volatility. Translating, the volatility is the value changes a stock experiences over a certain time period, where high volatility often is considered risky (Hayes 2023).

For now, one can conclude that major actors are making decisions in order to improve equality and diversity. One can also conclude that individuals bring different perspectives, often creating benefits for the group as a whole, but not necessarily only benefits. Lastly, investors are pro board diversity. As Sweden is soon to adopt the gender quotation, the board diversity will change, probably for more factors than just gender. From that point of view, the Swedish market is an interesting subject of investigation. The question is, are investors willing to invest with encouragement for board diversity purely out of principles and morality, or will risk impact their investment decision as well? With reference to the mentioned trade-off theory, one can not expect investors to look at performance solely. Therefore, it is of great importance to contribute with the potential risk perspective that board diversity might bring.

## **1.2 Problem Description & Problem Analysis**

Over the past years an increased amount of light has been shed on board diversity with the most recent gender quota introduced by the European Union. Sweden, who voted against the quota will be forced to acclimate to it, increasing the gender diversity, certainly changing the diversity overall. Studies in social psychology have shown that diversity can impact group dynamics, decision-making, problem-solving, and creativity. Furthermore, younger investors are more willing to invest in companies that fulfill social and environmental goals. Despite

the increased focus on diversity and the recently accepted quotas and rules, there is limited empirical evidence on the impact of diverse boards on the risk of the firm, measured as stock volatility, from an investors point of view. Therefore, this study aims to provide insight into the relationship and answer the question: Do board diversity have an impact on stock volatility? The study will be conducted on the Swedish market as it is highly appropriate for the soon to be implemented gender quota on large companies.

A comprehensive analysis of the relationship between board diversity and stock volatility requires examining multiple diversity factors in order to include several characteristics of the board directors. We will need to gather data of the diversity factors across the board directors of the Swedish stock market. Previous studies have mainly focused on one diversity factor such as gender. As the social psychological studies have shown that diversity demands multiple factors, we aim to include age, gender, nationality, education and experience. The factors include both observable and non-observable factors leaving us with a broader range of individualisation of the board directors. The study will have a demarcation, focusing on the time period from the first quota-voting to the recent, leaving the study with data between the years of 2012-2022. Recent studies have mainly studied the impact on performance, hence we aim to highlight the impact on risk. The data for the risk factor, stock volatility, to test for the relationship will be gathered over the same time period. The study will need to control for others factors that might impact stock volatility, such as company size, industry and performance. In order to draw valid and useful conclusions, statistical methods will be used on the data and later integrated with theoretical framework and previous studies.

### **1.3 Purpose**

The study aims to determine whether there is a relationship between board diversity and stock volatility in order to accommodate additional decision basis for investors. With the increased interest of investing in companies with a more diverse board, the relationship is an important issue for the investors to acknowledge. Not to dismiss, the result most likely will contribute with further insights for other market actors, government and the companies themselves. This study has the potential to shed light on an important issue at the intersection of equality, corporate governance and investor behavior.

## **1.4 Outline of Paper**

The research paper is organized as follows, section 1 presents a background and problem description. The second section provides the accurate theoretical framework, followed by section three with reviews of existing literature relevant for our topic. The section finishes with the development of the hypothesis. Section four presents the chosen method and arguments for the use of variables as well as specifications for our choice of regression model. In section five, the collection of data and a description of the cleaning process of the data is given, followed by the results in section six. Section seven discusses and analyzes the results. Lastly, a conclusion is drawn in section eight. Additional information to explain the use of variables is presented in an Appendix, with a following bibliography to support the thesis.

## **2. Theoretical Framework**

*The Theoretical Framework presents theories applicable for the research question. The theories are expected to support the empirical evidence to enable a conclusion.*

### **2.1 Stock Volatility**

Stock volatility is a widely researched and discussed subject. Auinger (2015) defines stock volatility as "The tendency for prices to change with respect to new information regarding the value of the underlying asset or due to the demand for liquidity by impatient traders". The definition captures the essence of the ongoing discussions concerning different origins when explaining stock volatility. Before further illustrations of the potential factors driving stock volatility, a brief review of stock volatility as a measure will be presented.

Stock volatility is mainly divided into two different objectives, the implied stock volatility and the realized stock volatility. Macroption (2023) simply deviates them as "Implied volatility is what you pay" while "Realized volatility is what you get". Further, they describe that implied stock volatility is future based, meaning it is a calculation of the expected realized stock volatility in the future. As for the scope of this research, implied stock volatility will not be discussed further. Realized stock volatility on the other hand, can be



both forward looking and based on historical numbers (Macroption 2023), the latter being relevant for our thesis. Realized stock volatility, from now on defined as stock volatility, is based on the past return of a stock for a given period of time (Berk & DeMarzo 2014). The formula for calculating the volatility of a stock is well recognized and given by Berk and DeMarzo (2014) as:

$$Volatility = \sqrt{\frac{\sum(R_t - R_{avg})^2}{(T-1)}}$$

where:

$(R_t =$  Continuously compounded return for period t)

$(R_{avg} =$  Average continuously compounded return over chosen time period)

$(T =$  Number of time periods)

Expressed in words, the mathematical definition of volatility is defined as the standard deviation of the continuously compounded returns for a given stock over a given period of time.

The explanations to the emergence of stock volatility deviates widely. Some argue for one specific factor being the driving force, while others take multiple factors into account in their explanation. As cited by Auinger (2015), price changes of underlying assets for the specific firm as well as individual investors' personal decisions might cause stock volatility. Auinger (2015) motivates the latter with impatience, which Shiller (1981) partly confirms as he finds that price fluctuations are driven by the investors' sentiments. However, Schiller also points out the investors expectations on the future as a driving force for price fluctuations. A recent study of Zhang et al. (2023) has shown that volatility is positively correlated with geopolitical risks and that the factor has a major impact on investors decisions. The effect on investors of geopolitical risks are exemplified with the ongoing Russia-Ukraine conflict causing investors to flee the market in search for less risky investments, thus increasing the stock volatility.

As Shiller (1981) highlights the non-fundamental changes that may impact the investors perception with a following increase in the stock volatility, he does not dismiss the impact fundamental changes might have on stock volatility. The well-known Eugene Fama (1991) argues that the market price is based on all available information, including fundamental

factors such as economic conditions, as well as non-fundamental factors referring to news or investor sentiment. Continuing, new information is reflected in the stock price rapidly. From that perspective, it is argumental that stock volatility can emerge from multiple factors in different volumes depending on the reception from the market.

Nevertheless, the fundamental factors are of great importance when discussing stock volatility. Schwert (1989) argued for leverage being correlated to the volatility of the stock. Exemplified with the occurrence of a firm issuing debt securities in a larger proportion than new equity, causing the capital structure of the firm to change, the volatility of the stock increased as well. This is in line with the Modigliani and Miller (MM) theory that argues for the principle that a firm with a high leverage should also face a higher equity volatility mitigating into an increased stock volatility (Modigliani 1958). Lastly, macroeconomic factors often induced by monetary policies, especially inflation and interest rates, have been seen to have a large impact on the stock volatility (Schwert 1989, Beltratti & Morana 2006)

As previously stated, multiple factors influence the stock volatility. Not yet mentioned is the findings of Bernile et al. (2018) who studied how the diversity of board directors impact stock volatility. Further recess from the study will be given later in the thesis, but as for the findings they conclude that board diversity decreases the stock volatility. For our analysis, this is an important reference while it as for the discussion must be kept in mind that multiple factors as presenter above might influence stock volatility.

## **2.2 Groupthinking**

Developed in 1971, groupthinking nuances the common view that decisions are best made in a group and not by a single individual. The theory includes conditions and as these are satisfied, the probability of groupthinking grows. Group cohesion is one condition that can emerge if a member prioritizes the belonging of the group at the expense of expressing its individual opinion. This can often be the consequence of a group that is highly respected or if the membership is considered difficult to gain. A second condition for groupthinking is structural disorders involving “isolation”. Commonly occurring in firms where the leadership or the board directors are distant from the operating business. Another structural disorder is homogeneity with concern to social and ideological background, including gender,

nationality and education to mention some. Lastly, a pressured environment qualifies as a condition for groupthinking. This can be due to external circumstances where quick decisions have to be made, but can also emerge with an increasing amount of deadlines (Blomberg 2019).

As the potential level of groupthinking arises as the conditions are met, the symptoms become visible. Overestimating the group's own ability is one of them, often driven by optimism causing the group to engage in riskier decisions. Another symptom is rationalization, making the group overlook information that contradicts their agreed opinion or decision. If members refrain from expressing their opinion as they believe it deviates from the rest, the group will appear as one unity. Therefore, the symptom goes under the name of a “false unity” (Blomberg 2019).

Applying groupthinking on this analysis will demand a two-step explanation. The theory itself does not impact stock volatility, but the decisions made by the board do. As presented under stock volatility, factors that influence stock volatility include price fluctuations in the underlying assets of the firm, or the level of leverage for example (Aunger 2015, Schwert 1989). As the board directors are the decision-makers of the firm, they have the largest influence on the direction of the firm. Consequently, the groupthinking theory is of major interest when it comes to analyzing and explaining why a diverse board may or may not be beneficial for the volatility of the stock. Bernile et al. (2018), who argues that more diverse boards decrease the stock volatility, suggests that the diversity contributes to a lower level of groupthinking, thus leading to a lower level of risk based on stock volatility.

### **2.3 Observable & Non-Observable Diversity**

Variety, difference and multiformity are synonyms to the word diversity (Dictionary 2023). In our analysis we refer to the diversity between directors on a firm board measured as the variety of personal factors. Milliken and Martins (1996) summarized earlier studies by highlighting two distinct categories of diversity factors presented below. They argue for the relevance of the categorisations as observable versus non-observable attributes may influence reactions caused by stereotypes or biases.

*Observable*, or readily detectable attributes, refers to visible things on a person. Exemplified with ethnicity, age and gender these are all personal attributes that others can understand by observing (Milliken and Martins 1996). Maznevski (1994) describes the exemplified diversity factors as non-changeable.

*Non-Observable*, can also be described as less visible or underlying attributes. These factors can be educational background, experience or personality characteristics (Milliken and Martins 1996).

### **3. Literature Review**

*A review of previous literature concerning the subject will be given, beyond the mentioned studies in the Theoretical Framework. The reviews will concern both economical and social psychological studies to address the subject.*

The “good old boys” club is the introduction in Zattoni et al.s (2023) report where they refer to the often found homogeneous board compositions. With the development of board diversification, an increased amount of studies have been made on the subject. Although, it might be the other way around, the studies are the reason for increased diversification of directors on firm boards. Zattoni et al. (2023) report that during the years from 1996 until 2021 a total of 184 articles on board diversity have been written. Out of these, 128 are published during the last 10 years where 50,54% concerned diversity from the perspective of gender. Further, 80 out of the total number of articles referenced to finance and accounting. 33,7% investigated the impact of board diversity on performance, while risk qualifies under “other” with 5,98%, leaving the subject rather unresearched.

#### **3.1 Board Diversity & Volatility**

The majority of the existing research on board diversity has investigated its impact on firm performance as presented above. As this paper aims to investigate stock volatility from a risk perspective, the presented literature will focus on this. In addition, the diversity factors differ between the studies presented below.

Giannetti and Zhao (2019) is one of the few to analyze the relationship between board diversity and stock volatility. For their study though, stock volatility is defined as a performance factor while the board diversity is investigated through the lense of ancestral origin. Further, the volatility is parted into total return volatility, fundamental volatility and idiosyncratic volatility. In all cases, they conclude that board diversity with regards to ancestral origin has a positive relationship with volatility, meaning an increased ancestral diversity increases the stock volatility. Contradicting, Jizi and Nehme (2017) found that diversity decreased stock volatility. However, this study investigated the impact from gender diversity and measured stock volatility as a risk factor. Yet, the different diversity factors came to different conclusions. An additional study by Bernile et al. (2018) analyzed the relationship between board diversity and stock volatility. The definition of board diversity is more extensive in this study and is decided by six characteristics, described as three demographics (age, gender and ethnicity) and three cognitive factors (education, financial expertise and experience). The result shows that board diversity has a negative relationship with stock volatility, meaning that firms with a higher level of diversity of their board directors experience a lower level of stock volatility. Deepening their analysis further, they examine each diversity characteristic's sole effect on the stock volatility, as well as parting the demographic from the cognitive factors. The outcome indicates that no factor alone, or none of the two parted group factors alone, results in a lower stock volatility.

Ahern and Dittmar (2012) examined the market response in 2003 in Norway when they announced the gender quotation mentioned in the introduction. The quota demands a minimum of 40% female board directors. The initial response was a sharp decline in stock value at the time of the announcement, larger for firms with a low number of female board directors. The report does not necessarily report on the following stock volatility, but rather on the firm value. The decline in stock value should therefore be seen as the market's reaction to the announcement with respect to future expectations, not on actual changes in firm characteristics at the time.

### **3.2 Board Diversity & Fundamentals**

Continuing on the fundamental values, studies have shown differing results on the effect of diverse boards. Bernile et al. (2018) finds that diverse boards tend to invest more in Research and Development (R&D). Continuing, they note the observation as particularly interesting as such investments often are considered riskier with reference to an increased volatility in the fundamentals. Their result is therefore two-sided as the decrease in stock volatility concludes less firm-risk, while the increase in R&D investments concludes the opposite. Midavaine et al. (2016) comes to the conclusion that board diversity in terms of education and gender invests more in R&D. Shafqat Mukarram et al. (2018) has gained similar results whereas women, in an otherwise male-dominated industry, have a positive relationship with investments in R&D. The investment in R&D is considered risky, as they also point out the contradictory factor regarding women often being considered risk-averse. Zhang (2015) validates the relationship between risk and R&D investments, whereas the risk is defined as the risk of delisting as an effect of bad firm performance. Further, he highlights that the results are stronger for firms who have a higher level of financial constraints.

Contradictory, Gianetti and Zhao (2019) argues that ancestral diverse boards do not participate in more risky decisions compared to other firms. One reason for the argument is that they are equally alike to engage in Mergers and Acquisitions (M&A), another form of investment, as firms with less ancestral diversity. Moreover, they report that ancestral diversity contributes to a higher level of cash holding. These results are reversed in the study by Ahern & Dittmar (2012). Following Norway's initiated gender quota, an increase of acquisitions could be seen as well as a reduction of cash holdings.

Furthermore, Bernile et al. (2018) conclude that the innovation output measured in dollars are improved in more diverse boards. From the specific diversity factor of tenure, alike with experience, studies have found that diversity has a positive relationship with investment efficiency (Phuong 2022). Overinvestment as well as underinvestment are both seen as inefficiencies in a firm's investment strategy. The findings in the study shows that a higher level of tenure diversity decreases both of the inefficient investments. Meanwhile, Zou et al. (2021) examined the impact of diversity from an ethnicity perspective on the efficiency of

their investments. The results show that this particular diversity factor tends to underinvest, thus decreasing the efficiency of the firm's investments.

Other firm specific factors where a relationship to board diversity that has been found concerns leverage. Leverage, as mentioned in the theory, is believed to affect the volatility of the stock. Schopohl et al. (2021) argues that females on the board, especially in the position of a CFO, reduce the leverage of the firm. Continuing, the possibility of leverage reduction increases with the overall diversity, in terms of gender, age and nationality of the board. Faccio et al. (2016) investigate the corporate risk-taking and level of leverage and conclude that a reduction in both cases can be seen if there is a female CEO. However, the CEO may only have a managerial position and do not necessarily serve on the board. The same goes for the CFO. Additional studies have found that female board directors overall have a decreasing impact on firm leverage (Garcia and Herrero 2021). The results are contradicting with the ones found by Ahern & Dittmar (2012) who found that female representation had a negative effect on the leverage causing it to increase.

An important detail in the study done by Ahern & Dittmar (2012) is that the gender quota had a major impact on other director characteristics. The average age decreased dramatically whereas the new female director was approximately eight years younger than their manly predecessor. Further, there was a decrease in board experience as well while the level of education increased. They explicitly highlight that the result of their study might not solely originate from the gender factor but that other factors are likely to affect as well. This might explain the different outcomes of the studies, including their finishing result that the quota increased the firm size in the following years. This result agrees with the results of Arnegger et al. (2014) who found a positive relationship between firm size and board diversity in terms of occupational and international background. Within occupational, the experience of the board director are included among other factors.

### **3.3 Group Dynamics**

Arguments for what a well-diversified group is as well as its benefits are widely spread, whereas the risk of Groupthinking is one (Blomberg 2019). However, the subject is not left without questioning and motivations for potential deficits that can emerge. Milliken &

Martins (1996) summarize the complexity of diverse groups as it may depend on the type of diversity, the organization or a specific decision on a task.

The diversity categories presented in the theoretical framework by Milliken and Martins (1996), are one origin for the discussion of diversity. Apart from the categorisation, Milliken & Martins (1996) acknowledge the benefits of diversity including increased creativity, improved problem solving and an enhanced decision-making process. As for problem solving, Frigotto & Rossi (2012) found that more diverse groups were indeed more creative as well as better at solving problems. The underlying argument for the outcome was that diversity creates multiple perspectives, thus improving the decision-making process. Hong & Scott (2004) compared the ability of solving problems between a randomly selected diverse group with a group of the best performing. The results showed that the diverse group outperformed the other, concluding that diversity improved problem-solving. Adam et al. (2010) argues for similar results when investigating the effect of gender diversification. Not only do they conclude that gender diversity contributes with a broader range of perspectives, they also argue for an increased risk management. The differences in perspectives often originate from experiences that in turn have developed into various takes on problem-solving (Jackson et al. 1991). Therefore, it is expected from a diverse group to improve the overall process.

Nevertheless, the benefits do not come without drawbacks. Frigotto & Rossi (2012) also argued for an increased difficulty with communication within a diverse group. In turn, this could easily lead to confusion and misunderstandings causing disagreements. Milliken & Martins (1996) agrees and empathizes with the importance of developing strategies to optimize the benefits of a diverse group while managing the potential deficits. Effective communication and conflict management strategies are some suggestions of strategies as well as fostering an inclusive culture. Maznevski (1994) observes conflicts within diverse groups where the diversity originates from inherent dimensions. This type of diversity is described as unchangeable, often leading to an unsolved conflict due to the lack of understanding from the different parties. Bernile et al. (2018) argues for the difficulties emerging when quick decisions must be made. A homogeneous group is more likely to agree, whereas the process of making a decision in a heterogeneous group is potentially more time-consuming. Further studies even suggest that homogeneity within a board can be beneficial for the firm (Anderson et al. 2011). The diversity factors are both observable and non-observable and



their results show that within a complex operation, homogeneity might be beneficial for the firm efficiency.

The type of diversity is possibly of significance when examining conflicts or disruptions within a group. The observable factors are easy to detect while the non-observable factors may be the ones causing the most conflicts. Assumptions, beliefs and the general thinking-process may differ largely between individuals even though the observable factors are alike (Milliken & Martins 1996). Therefore, one can not only account for diversity by looking at one factor, perhaps especially if it is an observable factor. This is conclusive with the thought of Baranchuk & Dybvig (2009) who came to the conclusion that diversity can not be measured by one diversity factor alone. Their study on the decision-making process is consistent with the result of Bernile et al. (2018) who examined the combined effect of diversity factors as well as one factor alone. Their result suggested that stock volatility decreased, but only when measured through all of the diversity factors combined. If separated, the stock volatility could not be explained by the specific diversity factor.

### **3.4 Hypothesis Development**

The previous research analyzed in the text shows mixed results regarding the relationship between board diversity and stock volatility. While Giannetti and Zhao (2019) found a positive relationship between ancestral diversity and stock volatility, Jizi & Nehmi (2017) found a negative relationship between gender diversity and stock volatility. Meanwhile, Bernile et al. (2018) found a negative relationship between board diversity, including both observable and non-observable factors, and stock volatility. Further, Ahern & Dittmar (2012) reported a decline in stock value in response to the announcement of a gender quota, but the report does not necessarily report on the following stock volatility. Therefore, it is unclear whether the decline in stock value translates to higher stock volatility in the future.

In conclusion, there is no clear consensus among previous research on the relationship between board diversity and stock volatility. The diversity factors differ among the studies, making the outcome inconclusive. As we aim to include multiple diversity factors, we believe, based on previous studies, that board diversity decreases stock volatility. Therefore,

the formulation for this study's hypothesis that will be employed throughout the models will be: Diversity of the Board of Directors has a negative relationship to stock volatility.

## **4. Method**

*The selected method will be presented in the chapter as will a descriptive specification of the chosen Diversity Index. We will also argue for the chosen variables for the thesis and how standard errors will be calculated for. A model specification will be given for the later conducted regressions.*

### **4.1 The Method in General**

To test our hypothesis we use the regression model Ordinary Least Squares (OLS) through STATA. All of the data will be winsorized in order to rule out the impact of potential outliers that may lead to a skew result. Initially, we run a regression on the relationship between our chosen control variables and the Diversity Index itself. This in order to examine if any significant relationship can be found between board diversity and the fundamental characteristics of the firm. The results will show which boards are more diverse when examining the fundamental features. Following, we run a regression on the relationship between the diversity index and volatility to test for our hypothesis. The fundamental characteristics will be included as control variables to minimize the risk of endogeneity problems. For this regression, all of the independent variables will be standardized for a mean of 0 and a standard deviation of 1, including the diversity index. The standardization will not impact the results, but as the variables experience different units and scales, the standardization will ease the interpretation. Following the reasoning of potential endogeneity problems, industry and year fixed effects will be included in both of the regression models. The fixed effects will rule out specific industry shocks as well as time-dependent shocks to ensure that the results are not biased.

The regressions will be conducted in multiple stages, starting with the independent variables impact on the dependent variable without further controls. Next, the control variables will be added followed by industry and year fixed effects separately. Lastly, the control variables will

be included as well as the fixed effects for industry and year. The results will be studied in order to examine whether or not board diversity has an impact on stock volatility.

## 4.2 Diversity Index

The diversity index works as the independent variable when testing for the impact of board diversity on stock volatility. Previous research has shown a significant relationship between one diversity factor and the decision-making process as well as the fundamental characteristics of the firm (Gianetti and Zhao 2019, Phuong 2022, Schopohl et al. 2021, Garcia and Herrero 2021, Adam et al. 2010). Further research has shown that the effect of diversity emerges only when multiple diversity factors are included (Baranchuk & Dybvig 2009, Bernile et al. 2018). To account for this, multiple diversity factors will be included in order to construct the index. The factors included are both observable and non-observable factors. The index is calculated for each firm and year as it may vary over time. The factors included are:

*Gender*, as the ratio of women-to-men.

*Nationality*, as the ratio of “other nationalities”-to-Sweden.

*Age*, calculated as the standard deviation of the board directors age.

*Education*, calculated as the standard deviation of the total number of degrees.

*Experience*, calculated as the standard deviation of total number of boards sat on.

Gender and nationality is presented as a ratio where our assumption will be that a higher ratio will indicate a more diverse board. We argue for the assumption since women are underrepresented on boards in general. “Others” in the ratio for nationality does not necessarily account for a diversification between multiple nationalities, but we assume a larger ratio increases the plausibility of it. Further, education refers to the number of degrees on undergraduate level and above, otherwise calculated as 0. Arguably, education can create different perspectives received from theoretical knowledge. Experience accounts for the total amount of current and historical boards sat on as a director. The level of experience from practical knowledge can just as with education create different perspectives. Age, education

and experience are calculated for through the standard deviation, assuming a larger standard deviation translates into a more diverse board.

Each factor in the diversity index is standardized for a mean of 0 and a standard deviation of 1, thus enabling comparison between firms. As previous research highlights the importance of multiple factors for full diversity, no unambiguous study shows that one factor uniquely has a larger effect. Therefore, the factors are weighted equally to carry the same value for the board diversity. The index is constructed as follows:

$$\text{Board Diversity} = \text{Stdz (Gender ratio)} + \text{Stdz (Nationality ratio)} + \text{Stdz (Standard deviation Age)} + \text{Stdz (Standard deviation Education)} + \text{Stdz (Standard deviation Experience)}$$

Note that the above construction of the diversity index is not yet standardized as described in “The Method in General” when testing for our hypothesis.

### **4.3 Variable Selection**

The above described construction of the diversity index is our variable of interest when testing for our hypothesis. Stock volatility, the dependent variable, is calculated as the standard deviation of the weekly log normal price returns over the past year, annualized with a factor of 52 for the 52 trading weeks in a year. Apart from that, control variables are taken into account with motivations stated below.

To control for firm-specific fundamental characteristics, a selection of variables and ratios are included in the regression. As shown in the theoretical framework, value changes in the underlying assets of a firm or a change in capital structure might cause stock volatility (Auinger 2015, Schwert 1989, Shiller 1981). Beyond fundamental characteristics affecting stock volatility we also aim to control for factors with correlation to board diversity based on previous research (Shafqat Mukarram et al. 2018, Bernile et al. 2014, Garcia and Herrero 2021, Zou et al. 2021).

To control for firm size we use the natural logarithm of the firm's total assets. According to Perez-Quiros & Timmermann (2000), large firms tend to experience a lower level of stock

volatility than smaller firms. By including return-on-asset (ROA) we control for the performance and efficiency of the firms (CFI team 2023). Jensen (1986) argues that the control of board directors concerning the cash holding of a firm might conflict with the best interest of the shareholders. The situation can appear if the managers refrain from dividends payout in order to hold more cash, motivated by future investments and the following uncertainty on external resources. Therefore, we control for cash through the cash-to-asset ratio, as well as dividends payouts through a dummy variable. Jensen (1986) also reports that historical events have shown that changes in capital structure have caused changes in the stock price. This is consistent with the previously presented result of Schwert (1989), who found that leverage is positively correlated to stock volatility. With regards to this, we control for both leverage and asset tangibility. Investments in R&D are also included as a control variable through the R&D-to-assets ratio as studies have found that diverse boards tend to invest more in R&D (Midavaine et al. 2016, Bernile et al. 2018)

#### 4.4 Model Specification

With regards to the above description, the initial model will test to see which boards are more diverse from the view of fundamental characteristics. The model specification will be as following:

$$Diversity\ Index = \beta_0 + \beta_1 \ln Asset_{i,t} + \beta_2 Market - to - Book_{i,t} + \beta_3 Leverage_{i,t} + \beta_4 AssetTangibility_{i,t} + \beta_5 \frac{Cash}{Assets_{i,t}} + \beta_6 IfDividend_{i,t} + \beta_7 ROA_{i,t} + \beta_8 \frac{R\&D}{Assets_{i,t}} + \beta_9 \ln BoardSize_{i,t} + \delta t + Industry\ FE + \varepsilon_{i,t}$$

To test for our hypothesis, the relationship between board diversity and stock volatility, description on calculation given above, the model specification is constructed as:

$$Volatility = \beta_0 + \beta_1 Diversity\ Index_{i,t} + \beta_2 \ln Asset_{i,t} + \beta_3 Market - to - Book_{i,t} + \beta_4 Leverage_{i,t} + \beta_5 AssetTangibility_{i,t} + \beta_6 \frac{Cash}{Assets_{i,t}} + \beta_7 IfDividend_{i,t} + \beta_8 ROA_{i,t} + \beta_9 \frac{R\&D}{Assets_{i,t}} + \beta_{10} \ln BoardSize_{i,t} + \delta t + Industry\ FE + \varepsilon_{i,t}$$

For the above models, the explanation for each term is defined as:

i = firm 1, ..., 216

$t$  = time period 2012, ..., 2022.

$\delta$  = Year fixed effects

FE = Industry fixed effects

$\varepsilon$  = Error term

#### **4.5 Standard Errors**

Standard error is a measure in statistics which gives an estimate of the variance in our regressions and their accuracy. It is an expression of how well the sample relates to the true values from the population. As we suspect that the data may experience serial correlation over the time periods, clustering at the firm level will combat correlated observations from each firm over time. The inclusion of clustering at firm level is expected to produce a more trustworthy result.

### **5. Data**

*This chapter will go over how the data used for our regressions has been gathered. This will be followed by a description of how the data have been cleaned from missing values followed by descriptions of the data.*

#### **5.1 Data Collection**

We have gathered data from two different databases, BoardEX and Capital IQ. The data regarding board directors profiles of observable and non-observable factors are received from BoardEx. The information regarding the firm's fundamental characteristics, the company profiles and market data is gathered from CaptalIQ.

Since our thesis concerns the Swedish market, we have collected data in BoardEX on firms with their headquarter in Sweden. Further, the data has been cleaned to receive public firms to ensure that price data on the stock volatility is possible to obtain in Capital IQ. The data has been collected over a ten year period, from 2012 to 2022.

The data for constructing the diversity index is collected from BoardEX. The industry each firm belongs to, as well as the size of the board is also gathered from BoardEX. The size of the board is measured as the number of board directors. CapitalIQ provides the data for the stock volatility variable as explained in section 4.3. The rest of the data concerning the control variables are accumulated from Capital IQ; total assets, market cap, total debt, tangible assets, cash/assets, dividends, return on assets, R&D expenses. The data is used to construct the chosen variables, often ratios, that will be used as control variables in the regression. The motivation behind the variables are found in Method section 4.3. A thorough explanation of the variables and the calculations behind them are found in Appendix A.

## **5.2 Cleaning the Data**

The initial sample consisted of 557 companies and was narrowed down to 216 companies after cleaning of the data. The total number of observations consists of 2155, but 2085 are frequently used overall. Companies that were active during the time period but lacked data regarding our variables were disregarded in the final data sample. If a company had some data points such as R&D expenses but missed information about market capitalization, total debt or volatility for instance, the observation was deleted from our sample. The data is also winsorized to rule out outliers outside the scope of the 1st and 99th percentile. This in order to achieve regression with more trustworthy results. These outliers are replaced with a value closest to the extreme value but within the 1st and 99th percentile. All of our variables underwent winzorising including the variable of interest, diversity index.

### 5.3 Descriptive Statistics

*Table 1*

The table contains a summary of all variables used in the regression. The summary contains mean, standard deviation, median and 25th and 75th percentile. Table 1 summary statistics is created with the values post winsorizing.

	Mean(1)	Std. Dev. (2)	Median	25th pct.	75th pct.
Volatility	37,101	17,745	32,471	24,653	45,267
Gender ratio	0,314	0,139	0,333	0,222	0,4
NationalityMix	0,204	0,249	0	0	0,4
Age	7,561	2,416	7,5	5,7	9,1
Experience	2,749	1,324	2,8	1,7	3,7
Education	0,991	0,363	1	0,7	1,2
Ln(Assets)	8,703	2,169	8,649	7,149	10,366
M/B	3,692	4,046	2,372	1,299	4,259
Leverage	0,229	0,179	0,214	0,073	0,343
Asset Tang.	0,263	0,337	0,224	0,012	0,468
Cash/Asset	0,143	0,185	0,075	0,033	0,162
Dividend	0,659	0,474	1	0	1
ROA	0,012	0,193	0,049	0,008	0,083
R&D/Assets	0,045	0,110	0,001	0	0,033
Ln Board Size	1,982	0,294	1,946	1,792	2,197
Board Size	7,580	2,250	7	6	9
Diversity Index	0,016	0,475	0,033	-0,334	0,376

For variable description, see Appendix A

In table 1 of the descriptive statistics table, a summary of the variables used in the regression analysis is provided. The summary includes key statistical measures such as the mean, standard deviation, median, and the 25th and 75th percentiles for each variable. The panel begins by presenting information on the volatility, which gives information of the variability and mean. Following the volatility details, the table provides information on the variables that contribute to the construction of the diversity index. The summary statistics for these variables aid in understanding the distribution and characteristics of the diversity index. Additionally, the panel includes details on control variables, which are factors included in the regression analysis to account for potential confounding effects or other influences on the relationship with diversity and volatility. The descriptive statistics of these control variables help assess their variability and influence on the regression results. Lastly, the diversity index itself is summarized, providing statistics such as the mean, standard deviation, median, and percentiles. This allows for a deeper understanding of the diversity index's distribution and variation.



## 6. Empirical Results

The empirical evidence for the study will be presented in Tables for the two model specifications. Following, a short conclusion of the findings will be given in text. The analysis will move on into a sensitivity analysis for a deepened research.

### 6.1 Correlation Analysis

Before introducing our models, we acknowledge that the diversity factors might be ambiguous, meaning that observable factors possibly affect the non-observable factors. To control for this in our analysis, we conduct a correlation analysis as presented in Table 2:

*Table 2*

*Correlation analysis between the Diversity Index and the included factors.*

	Diversity Index	Age	Gender	Nationality	Education	Experience
Diversity Index	1,000					
Age	0,357	1,000				
Gender	0,451	-0,047	1,000			
Nationality	0,451	-0,1102	-0,017	1,000		
Education	0,582	0,027	0,027	0,135	1,000	
Experience	0,613	0,178	0,155	0,091	0,257	1,000

The correlation coefficients shown are not significantly large as they can take a value between -1 and 1, but some can be highlighted. The highest correlation is found between experience and education as a positive correlation of 0,257. Education is also positively correlated to nationality with 0,135 while nationality is negatively correlated to age with -0,110. A notable positive correlation is between experience and gender 0,155. All components have a somewhat large correlation with the diversity index, as expected.

Continuing, the control variables to be used might correlate with the dependent variable, stock volatility, and the independent variable diversity index. Therefore, further correlation analysis is conducted before proceeding. The results are presented in Table 3:

*Table 3*

*Correlation analysis between Volatility, Diversity Index and control variables.*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Volatility (1)	1,000										
Diversity Index (2)	-0,145	1,000									
Ln (Assets) (3)	-0,302	0,354	1,000								
MB (4)	0,123	-0,119	-0,335	1,000							
Leverage (5)	-0,086	0,033	0,394	-0,274	1,000						
Asset Tangibility (6)	0,116	-0,061	-0,301	0,123	-0,516	1,000					
Cash/Assets (7)	0,289	-0,104	-0,528	0,385	-0,432	0,469	1,000				
Dividends (8)	-0,386	0,177	0,478	-0,100	0,174	-0,206	-0,405	1,000			
ROA (9)	-0,3266	0,062	0,346	-0,072	0,074	-0,156	-0,436	0,429	1,000		
R&D/Asset (10)	0,257	-0,089	-0,418	0,341	-0,296	0,278	0,544	-0,340	-0,631	1,000	
Board Size (11)	-0,235	0,400	0,595	-0,125	0,080	-0,224	-0,243	0,337	0,176	-0,124	1,000

The correlation coefficients for the dependent variable, volatility, are not concerning, yet volatility experiences a negative correlation for dividends and ROA, while the correlation is positive for R&D/asset and cash/asset. When examining the diversity index, the results that stand out are Ln(assets), from here on referred to as firm size, and board size, both showing a positive correlation. Further correlations that are noticeable are between R&D/assets and ROA with a coefficient of -0,631, R&D/assets and cash/assets with 0,544 and firm- and board size with 0,595. Firm size is also negatively correlated to cash/asset with -0,528. No variables experience a perfect correlation but some are still concerning. No correlation is over  $|0,7|$  which is a commonly used threshold for collinearity called the Pearson's correlation (Nettleton 2014). The risk is that some of the variables with higher correlation capture similar information when explaining the dependent variable, making it difficult to determine their individual effect. This will be taken into account when examining our model results.

## 6.2 Which Firms are more Diverse?

The first model represents the firm fundamental characteristics relationship to board diversity. The regressions were runned in multiple steps as explained in the method section. The results are presented in the Table 4:

**Table 4**

*This table reports regression estimates where the dependent variable is the Diversity Index, calculated as described in Method section 4.2. For all regressions, standard errors are clustered at firm level. The t-tests are reported in parentheses. Significance level are given by \*\*\*, \*\* and \* responding to a significance level of 1%, 5% and 10% respectively.*

Diversity Index				
	(1)	(2)	(3)	(4)
Ln (Assets)	0,054*** (3,22)	0,039** (2,51)	0,054*** (3,13)	0,039** (2,41)
MB	-0,005 (-1,02)	-0,007* (-1,64)	-0,048 (-1,01)	-0,007* (-1,67)
Leverage	-0,179 (-1,08)	-0,016 (-0,10)	-0,176 (-1,06)	-0,009 (-0,06)
Asset Tangibility	0,021 (0,25)	0,103 (1,04)	0,0245 (0,29)	0,107 (1,08)
Cash/Assets	0,192 (1,44)	0,006 (0,05)	0,188 (1,41)	-0,001 (-0,01)
IfDividend	0,030 (0,70)	0,078** (2,04)	0,269 (0,59)	0,079* (1,93)
ROA	-0,169 (-1,47)	-0,126 (-1,10)	-0,180 (-1,54)	-0,136 (-1,17)
R&D / assets	-0,171 (-0,73)	-0,301 (-1,31)	-0,173 (-0,74)	-0,296 (-1,27)
Ln (BoardSize)	0,462*** (4,85)	0,533*** (5,64)	0,466*** (4,75)	0,539*** (5,59)
Industry fixed effects	No	Yes	No	Yes
Year fixed effects	No	No	Yes	Yes
Observations	2085	2085	2085	2085
R-squared	0,1922	0,2482	0,1958	0,2518

Many of the estimates are insignificant when examining the relationship to the diversity index, indicating that no statistical relationship exists. Throughout the regression, one can conclude that firm size has a positive relationship to the diversity index. The results show that the diversity of the board increases as the firm size increases. A slight negative relationship can be seen between MB and the diversity index. However, the results are only significant at the 10% level, shown when including industry fixed effects. Dividends show a relationship under the same circumstances, the relationship is positive at a stronger significance level

though, 5%. Lastly, a strong positive relationship can be seen between board size and board diversity indicating an increased board size strongly increases the diversity of the board.

The results give an insight into firm fundamental characteristics and their relationship to board diversity. Large firms with large boards tend to have an increased board diversity. Additionally, they tend to payout further dividends while the market-to-book value is slightly lower. However, the results do not address the hypothesis for the thesis and further analysis is conducted in order to conclude on the hypothesis.

### **6.3 Does Board Diversity affect Volatility?**

Continuing, regressions on stock volatility are conducted in order to test the hypothesis. The results displays the relationship between volatility and the independent variable, diversity index presented in Table 5:

#### Table 5

*This table reports regression estimates where the dependent variable is Volatility, calculated as described in Method section 4.3. The independent variable Diversity Index and the control variables are standardized by its sample mean and standard deviation. For all regressions, standard errors are clustered at firm level. The t-tests are reported in parentheses. Significance level are given by \*\*\*, \*\* and \* responding to a significance level of 1%, 5% and 10% respectively.*

Volatility					
	(1)	(2)	(3)	(4)	(5)
Diversity Index	-3,749*** (-3,31)	-1,089 (-1,00)	-0,631 (-0,73)	-0,984 (-0,93)	-0,595 (-0,72)
Ln (Assets)		-0,849 (-0,91)	1,296 (0,81)	-2,211** (-2,14)	-0,461 (-0,25)
MB		2,208* (1,70)	2,469* (1,84)	1,309 (1,04)	1,658 (1,23)
Leverage		0,735 (0,90)	1,280 (1,15)	0,631 (0,77)	1,023 (0,89)
Asset Tangibility		-0,525 (-0,74)	0,586 (0,67)	-0,514 (-0,76)	0,272 (0,30)
Cash/Assets		2,411** (2,60)	2,410*** (2,66)	2,018** (2,38)	2,040** (2,35)
IfDividend		-6,191*** (-8,05)	-5,732*** (-8,81)	-4,837*** (-5,40)	-4,351*** (-5,77)
ROA		-5,512*** (-3,31)	-5,807*** (-3,90)	-5,317*** (-3,17)	-5,519*** (-3,67)
R&D / assets		-0,005 (-0,00)	0,419 (0,37)	0,429 (0,32)	0,841 (0,74)
Ln (BoardSize)		-1,891*** (-2,67)	-3,573*** (-3,10)	-1,419* (-1,78)	-2,774** (-2,05)
Industry fixed effects	No	No	Yes	No	Yes
Year fixed effects	No	No	No	Yes	Yes
Observations	2085	2085	2085	2085	2085
R-squared	0,0206	0,2031	0,2319	0,2478	0,2760

The regression in column 1 only includes the diversity index, without any control variables. In this regression the diversity index demonstrates a negative relationship with volatility, significant at a 1% level. The coefficient of determination, R-Square, is very low which entails that the proportion of variation in volatility that can be predicted by the diversity index is very low. The negative relationship remains between diversity index and volatility over the following regressions when industry- and year fixed effect is progressively controlled for, stopping at a negative 0,595 in column 5. However, the statistical significance of the relationship between diversity index and volatility disappears, even at a 10% level for the following regressions. Therefore, due to lack of statistical significance we are unable to confirm the hypothesized relationship between board diversity and stock volatility.

The control variables that bear statistical significance in the final regression (5) are cash/assets, dividends, ROA and board size. Cash/assets experience a positive relationship with volatility with an estimate of 2,040, significant at a 5% level. Dividend has a 1%

statistical significance and is strongly negatively related to volatility with a coefficient of -4,351. ROA has a similar relationship with volatility with a coefficient of -5,519, significant at the level of 1%. Further, board size has a negative relationship with volatility, significant at a 5% level. Dividends and ROA have the same significance level, strong at 1%, throughout the regressions with no major changes of their impact on volatility by looking at their coefficients. The significance level of cash/assets increase when controlling for only industry fixed effects, otherwise the significance level is found at 5%. Board size has a strong significance when no fixed effects are included, the significance level worsens when controlling for industry- and year fixed effects but are better in the regressions where only industry fixed-effects are included. This indicates that the industry might have a larger influence on significance level and board size, as industry-specific factors have an impact on the significance of board size in the regressions.

As the model overall lacks significance in the variables, but especially for the diversity index, the regression is repeated, adding one control variable at the time. The findings showed us that even when only including firm size, the diversity index becomes insignificant. The results indicate that firm size has a larger impact on volatility than board diversity.<sup>1</sup>

A sensitivity analysis will be conducted for further analysis in order to establish our results, or show if potential model changes will impact the outcome.

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<sup>1</sup> Rerunning the regressions with robust standard errors instead of clustering, results in the same coefficients. The magnitude and the directions of the estimates for the relationships are consistent with the initial findings in Table 5. The p-values are improved, yet the coefficient of the diversity index is still insignificant as are many of the control variables. However, the improved p-values indicate a better fit of the model with reduced standard errors. The results can reveal a heterogeneity problem in the data set that robust standard errors handle more effectively. The insignificant coefficient for the diversity index still indicates that no statistical relationship exists between board diversity and stock volatility, hence we are still unable to reject the null hypothesis.

## 6.4 Robustness Test

### 6.4.1 The Magnitude & Type of Board Diversity

To extend the analysis beyond the relationship between the full diversity index and stock volatility, further investigations on what factors that may power the outcome are established. First, we aim to separate the heterogeneous firms from the homogeneous firms, referred to as low and high diversity respectively. The separation will occur at the median of the diversity index. The result will provide further insight to the potential relationship between stock volatility and a certain level of board diversity, with all of the diversity factors included. Second, we divide the diversity index by the observable versus the non-observable factors and create two separate diversity indexes with the respective types of factors. The indexes will be calculated as the original diversity index, and weighted alike to still define the factors as equally important. The separation of observable and non-observable factors will provide us with results showing whether or not one diversity type has a relationship to stock volatility. This will potentially contribute with insights of what diversity factors to consider on board directors. The results are shown in Table 6:

#### Table 6

*This table reports regression estimates where the dependent variable is Volatility, calculated as described in Method section 4.3. In column 1 and 2, the independent variable Diversity Index is divided by its median, where 1 represents firms with a board diversity below the median defined as “Low”, while 2 represents those above the median, defined as “High”. In column 3 and 4, the independent variable Diversity Index is divided into observable and non-observable components. The Diversity Index and control variables are standardized by its sample mean and standard deviation. For all regressions, standard errors are clustered at firm level. The t-tests are reported in parentheses. Significance level are given by \*\*\*, \*\* and \* responding to a significance level of 1%, 5% and 10% respectively.*

Volatility				
	(1)	(2)	(3)	(4)
	Low	High	Non-observable	Observable
Diversity Index	-2,869 (-2,19)	1,310 (0,86)	0,069 (0,11)	-0,964 (-1,20)
Ln (Assets)	0,452 (0,15)	-1,772 (-1,55)	-1,012 (-0,58)	-0,443 (-0,25)
MB	4,199** (2,37)	-2,341 (-1,11)	1,357 (1,01)	-1,556 (1,16)
Leverage	0,863 (0,47)	1,689 (1,39)	1,123 (0,99)	1,066 (0,93)
Asset Tangibility	0,042 (-0,03)	0,604 (0,54)	0,462 (0,51)	0,371 (0,41)
Cash/Assets	1,473 (1,12)	2,439** (2,47)	1,769** (2,10)	2,014** (2,32)
IfDividend	-4,408*** (-3,53)	-4,527*** (-4,70)	-4,464*** (-5,97)	-4,337*** (-5,75)
ROA	-8,534*** -3,89	-1,766 (-1,07)	-5,661*** (-3,72)	-5,477*** (-3,69)
R&D / assets	-0,915 (-0,60)	2,715 (1,31)	-0,865 (0,79)	0,893 (0,80)
Ln (BoardSize)	-2,256 (-1,16)	-2,633** (-2,34)	-2,922** (-2,12)	-2,756* (-1,96)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	1042	1043	2155	2085
R-squared	0,2497	0,4473	0,2845	0,2767

The two coefficients presented in column 1 and 2 strongly contradict each other. Firms with low board diversity have an essentially larger negative relationship on -2,869 to stock volatility than to the results presented in Table 5, whereas firms with high board diversity have a positive relationship on 1,310 to stock volatility. The estimates indicate that a low board diversity decreases stock volatility, while a high board diversity increases stock volatility. However, in both regressions the coefficient is insignificant, hence no statistical relationship on stock volatility can be found. Although, the coefficient of determination is greatly improved for firms with a high board diversity, indicating that the regression for the “High” diversity index is better at explaining the variety of the dependent variable, volatility.



The results in column 3 and 4 show opposite signs and less spread for the estimate of the diversity index. The non-observable factors show a small positive relationship while the observable factors show a negative relationship with stock volatility. The results are once again insignificant, concluding that no statistical relationship can be found to stock volatility.

#### **6.4.2 Diversity Factor & Stock Volatility**

Continuing, we separate the factors in the diversity index in order to investigate whether a relationship exists between one sole factor and stock volatility. The outcome may show that one diversity factor is of importance in explaining stock volatility. The results are presented in Table 7 below:

##### Table 7

*This table reports regression estimates where the dependent variable is Volatility, calculated as described in Method section 4.3. The columns represent each of the diversity factors as an independent variable. For all regressions, standard errors are clustered at firm level. The t-tests are reported in parentheses. Significance level are given by \*\*\*, \*\* and \* responding to a significance level of 1%, 5% and 10% respectively.*

Volatility					
	(1)	(2)	(3)	(4)	(5)
Age	-0,255 (-1,05)				
Gender		-8,218** (-2,25)			
Nationality			-1,284 (-0,38)		
Education				1,395 (1,08)	
Experience					-0,249 (-0,49)
Ln (Assets)	-0,531 (-0,70)	-0,373 (-0,47)	-0,206 (-0,23)	-0,492 (-0,63)	-0,439 (-0,55)
MB	0,153 (1,02)	0,138 (0,92)	0,188 (1,26)	0,150 (1,01)	0,149 (1,00)
Leverage	5,829 (1,02)	5,613 (0,95)	5,546 (0,93)	5,999 (1,02)	5,821 (0,97)
Asset Tangibility	1,609 (0,62)	0,851 (0,32)	0,807 (0,31)	1,422 (0,54)	1,322 (0,50)
Cash/Assets	8,649* (1,89)	10,019** (2,21)	11,077** (2,42)	9,383** (2,09)	9,502** (2,12)
IfDividend	-9,429*** (-5,89)	-8,997*** (-5,75)	-9,317*** (-5,56)	-9,446*** (-5,91)	-9,372*** (-5,98)
ROA	-22,189*** (-3,73)	-21,917* (-3,71)	-21,668*** (-3,64)	-21,797*** (-3,71)	22,238*** (-3,79)
R&D / assets	5,967 (0,76)	6,474 (0,85)	6,501 (0,81)	6,653 (0,86)	6,021 (0,77)
Ln (BoardSize)	-9,119* (-1,94)	-9,349* (-1,92)	-9,777** (-1,98)	-10,146** (-2,08)	-9,418** (-2,04)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	2154	2155	2085	2155	2155
R-squared	0,2839	0,2860	0,2757	0,2848	0,2846

When dividing the factors in the diversity index one by one and rerun the original regression, statistical significance at a level of 5% appears for gender. The relationship is negative, indicating that an increased number of women on boards decrease the stock volatility. As for the other diversity factors, no statistical relationship between diversity on age, nationality, education or experience on stock volatility can be found. An interesting finding is the dividends, where the coefficient for the gender regression is the smallest of all diversity types on -8.997. The coefficient indicates that when controlling for gender, an increased dividend yields less stock volatility compared to other diversity factors. The results conducted in the table are yet insufficient to reject the null hypothesis. As the study aimed to investigate board diversity over multiple factors, the outcome presented in Table 5 is complete. However, the results found in Table 7 are not useless for the discussion.

## 7. Discussion

*In the discussion section, we analyze and interpret the results obtained in relation to existing research. By examining the data, we aim to draw meaningful conclusions and insights.*

*Additionally, we acknowledge the potential limitations and data issues encountered during the research process, which may have influenced the outcomes and should be taken into consideration when interpreting the results.*

### 7.1 Results

The results indicate that board diversity does not have a relationship with stock volatility on the Swedish stock market during the investigated time period. A possible drawback of the model construction is the inclusion of control variables, potentially making it too complex, creating an overfitting problem. Although, the control variables used are almost identical to the ones used in Bernile et al. (2018), who found statistical significance for board diversity to decrease stock volatility. Therefore, our results contradict previous studies where board diversity is calculated over multiple factors. The construction of the diversity index differs and so does the handling of missing data, potentially explaining the differing outcomes. Prominently, the studies are conducted on different markets which can have an impact, and the sample size may be one possible reason as to why the results are insignificant, or simply that no relationship exists between board diversity and stock volatility on the investigated market.

Only when regressing the diversity index alone (Table 5, column 1), with no controls or fixed effects, the coefficients are significant. When excluding control variables the risk of omitted variable bias emerges, occurring when an excluded variable is correlated to both the dependent and independent variable. The excluded variables are possibly driving the observed correlation, potentially resulting in a misleading relationship. In Table 3, a positive correlation appears between firm size and stock volatility, whereas a negative correlation can be seen with board diversity. As presented in the empirical evidence under Table 5, the regression was rerun while only controlling for firm size, immediately causing the diversity index to become insignificant. This potentially reveals the issue when excluding control variables but also that firm size most likely has a larger impact on stock volatility than board diversity has. The coefficient of determination shown in column 1, Table 5, is

extremely small, indicating the limited explanatory power of board diversity in relation to stock volatility. With the given reasonings, the results are not trustworthy to establish a relationship between board diversity and stock volatility, even though the coefficient is significant.

When examining the fundamental characteristics impact on board diversity, which boards are more diverse, in Table 4, some are worthy to highlight. A positive relationship between board diversity and board size is found at a high statistical significance level, whereas the variables also experience a positive correlation in Table 2. One can expect the board diversity to increase with board size as the number of possible varieties over factors increase, our finding aligns with this reasoning. Further, firm size experiences a positive relationship with the diversity index. The result agrees with recent studies who have found that firm size increases the diversity of the board (Arnegger et al. 2014). Continuing, other studies argue that firm size often tends to experience a lower level of stock volatility (Perez-Quiros & Timmermann 2000). From the correlation analysis in Table 3, a positive correlation is seen for board size and firm size against the diversity index. Meanwhile, a negative correlation is found for firm size, board size and diversity index against stock volatility. The correlation analysis agrees with previous studies, yet our result in Table 5 only shows a statistical relationship between board size and stock volatility, contradicting the previous studies regarding board diversity. Further, diversity has been studied through the lens of firm investments where Bernile et al. (2018) found that diverse boards tend to invest more in R&D, conclusive with the finding of Shafqat Mukarram et al. (2018) for gender diversity. Our results suggest otherwise, that no relationship can be found between board diversity and R&D investments. The investments are considered riskier, whereas an effect on the stock volatility is expected. As presented in Table 4, R&D do not experience a relationship to stock volatility.

In Table 6, we aim to see if a relationship exists between stock volatility and homogeneous or heterogeneous boards, independently of the included diversity factors. Previous literature suggest that homogeneous groups, with low board diversity, are swifter in their decision-making process and experience less conflicts, preferable in volatile market conditions (Milliken & Martins 1996, Bernile et al. 2018). Assuming this, a positive relationship can be expected to be found between the diversity index in “Low” and stock volatility. Meanwhile, other studies have found the risk of groupthinking to emerge with a low level of diversity, potentially causing riskier decisions as the perspectives are few

(Blomberg 2019). As for this theory, one can expect the diversity index in “High” to experience a negative relationship to stock volatility. Yet, the outcome of the estimates are reversed indicating that the firms with a low level of board diversity decreases the stock volatility, while firms with a high level of board diversity increases the stock volatility. The coefficients are not significant though and no relationship can be found between the level of board diversity and the stock volatility. As for the scope of this research, the above theories are not applicable when estimating the group dynamics effect on stock volatility.

Maznevski (1994) argues for conflicts to be more consistent if a group experiences diversity in observable factors. Plausibly, a positive relationship could be seen between the diversity index for observable factors and stock volatility, based on the above mentioned argument that the board tends to accept riskier decisions. The findings in Bernile et al. (2018) contradicts the theory, as they find no separate diversity type to increase the stock volatility. As presented in Table 6, our results are consistent with the ones found by Bernile et al., as the estimate is insignificant for both observable and non-observable factors in board diversity. When separating the diversity index by factors, as presented in Table 7, significance appears for gender. Bernile et al. (2018) argued that no factor alone drives stock volatility, Giannetti and Zhao (2019) found that diversity in ancestral origin increases stock volatility, while Jizi and Nehme (2017) found that gender diversity decreased stock volatility. Therefore, our results are consistent with the ones found by Jizi and Nehme, whereas Bernile et al. are contradicting. Giannetti and Zhao (2019) investigated the impact from an ancestral origin which can be compared to nationality but might also differ to a large extent. A comparison of our results are therefore uncertain and left without further conclusion.

The relationship found between gender diversity and stock volatility is highly accurate with the newly adopted gender quota in the EU that is soon to impact Sweden. The results indicate that a gender quota might possibly decrease the stock volatility. Recent studies suggest that gender diversity increases the risk management and reduces the leverage of the firm (Adam et al. 2010, Schopohl et al. 2021, Garcia & Herrero 2021). This in turn has been argued to decrease stock volatility (Schwert 1989), potentially explaining the relationship. Contradictory, Ahner and Dittmar (2012) saw an increased stock volatility when Norway's gender quota was accepted, although only measured at the time of the announcement. Baranchuk & Dybvig (2009) argue that diversity must come from multiple factors to have an effect, while our results suggest otherwise enabling us to argue against. However,

acknowledgements must be made towards the fact that their study is not conducted on stock volatility but rather on group dynamics and the decision-making process. Our results suggest that only one diversity factor, gender, affects the stock volatility but how the actual decision-making process proceeds in the firm is unknown.

## **7.2 Limitations**

Potential limitations can be found in the construction of the diversity index. With inspiration from Bernile et al. (2018), changes have been made and differences in calculations can be seen as well. As mentioned in the method, the nationality factor is a ratio between Swedish and other nationalities. We have assumed a higher ratio indicates a large diversification within the board, but acknowledgements must be made toward the potential limitations of the assumption. As multiple nationalities can achieve the same results as only two nationalities, a high ratio does not necessarily indicate a large diversification, Therefore, the ratio of nationality is potentially misleading when accounting for diversity. Further, ethnicity would have been better suited to account for diversity but due to lack of data nationality was used instead. For both gender and nationality, the ratio is obtained directly from BoardEx for each firm, the underlying data for the ratio is unknown and we are unaware of how potential lack of data is handled. The same applies to the data for age, education and experience. Education and experience may be essentially misleading if lack of data is calculated as 0, instead of removed. As the calculations from BoardEx are unknown, there is a risk that the overall diversity index is misleading depending on how unable data is handled throughout the gathering. Lastly, the mix of ratio and standard deviation may skew the results even though the index is weighted. The index will potentially be influenced to a lesser extent from the factors with a ratio as it never exceeds 1.

Further, an improved version of the dependent variable volatility would have been desired. In the study, volatility is measured as the average weekly returns of the stock price. Bernile et al. (2018) used the average daily stock price which would have been desirable for full insight in the stock volatility. Due to lack of data availability on daily stock prices we were unable to reach the desired data. Therefore, the next best option, weekly average, was used.

An additional and perhaps obvious limitation concerns the data set. After cleaning the data the number of companies and observations are noticeably smaller. The sample size is not in itself insufficient for enabling statistical significance. However, compared to Bernile et al. (2018) who used over 21 000 observations, the sample size used is fairly small. Initially, BoardEx delivered observations for 557 companies, whereas many were disregarded when CapitalIQ could not provide data for stock volatility and/or control variables. The cleaning process did reduce a lot of data, potentially causing a misleading result depending on what observations that were removed. Therefore, we acknowledge the potential limitation emerging when the two data sets were unable to gather matching information, reducing the sample size sufficiently.

There could be an endogeneity problem, meaning that the diversity index could be correlated with the error term. This would be the case if there is a missing control variable that has an explanatory power of the dependent variable. However, as the study uses the same variables as Bernile et al. (2018) who received a significant result, it is unlikely that an endogeneity problem solely limits the study. Since we include relevant control variables, as motivated in the method, as well as controlling for industry and year fixed effects, the problem with endogeneity should be minimized and not too conflicting in our study. On the contrary, it is not stated that the problem does not exist and potentially limits the result of the study.

## **8. Conclusion**

The aim with the thesis is to test whether board diversity has an impact on stock volatility. Relevant data has been collected on board directors in Swedish companies as well as firm specific data and the responding volatility for the past ten years. From the collected data, a series of regressions have been carried out to investigate the relationship between board diversity and volatility.

The main findings from our research are that board diversity does not experience a relationship to volatility, indicating that no impact exists. The main regression concluded an insignificant relationship between the board diversity and volatility, strengthened by the results found in the extended sensitivity analysis. Therefore, we are unable to reject the null hypothesis, stating that no significant relationship exists between board diversity and stock

volatility. The results may indicate that a homogenous group may not be to a disadvantage of stock volatility, potentially contradicting the criticism with groupthink. Further findings in the sensitivity analysis showed that gender, as a sole independent component, experiences a negative relationship to stock volatility, denoting that an increased gender diversity reduces stock volatility. The outcome indicates that from the view of stock volatility, board diversity is of less concern, whereas it should be acknowledged that it might be of interest from an equality perspective. The results in the sensitivity analysis are especially accurate for the soon to be implemented gender quota in Sweden, contributing with knowledge for investors. Even though the study aims to accommodate further decision bases for the investors, it might also be of interest for corporate and national governance on future potential quotas.

One should bear in mind that the underlying lack of data, especially in the diversity index, might influence the result wrongfully. Therefore, we suggest further research with deeper and more conclusive data to investigate the area in order to establish or oppose the findings in the study. Additionally, as the relationship between board diversity and stock volatility is two-sided when accounting for the moral aspect, and not only the firm resulting effect, the area is of importance to investigate further. Conducting research that incorporates additional variables and explores the interactions between board diversity and control variables would offer valuable insights into the complicated nature of the relationships, thereby deepening the understanding of the complex area. As for this study, we are unable to conclude that board diversity has an impact on stock volatility.



## Appendix A

Variable	Description
Volatility	Annualized average of weekly stock returns for any firm.
Diversity Index	Diversity Index Consists of the standardized variables: Gender, Nationality, Age, Education, Experience. Standard deviation of Number of Qualifications(degrees), Standard Deviation of Education, Standard deviation of Experience. Each component is equally weighted.
Gender	Number of Females divided by board size
Nationality	Number of other Nationalities (than swedish) divided by board size
Age	Standard Deviation of Age on firm board
Education	Standard Deviation of total Number of degrees
Experience	Standard Deviation of Total Number of corporate boards that a director has served on, currently and historically
InAssets	Natural logarithm of book assets.
Market-to-Book	Market capitalization divided by book equity
Leverage	Total book debt divided total book assets
Asset Tangibility	Sum of a firm's tangible assets divided by total asset
Cash/Asset	Cash and short-term equivalent divided by book asset
Dividends	A dummy variable which is equal to 1 if a company has paid out dividend, otherwise set to 0
Return on Assets	Net income divided by book equity
R&D/Assets	Research & Development expenses divided by Book assets.
InBoardSize	Natural logarithm of number of board members.

## Bibliography

Adams, R. B., Hermalin, B. E., & Weisbach, M. S. (2010). The Role of Boards of Directors in Corporate Governance: A Conceptual Framework and Survey. *Journal of Economic Literature*. 48(1), 58–107.

<https://doi.org/10.1257/jel.48.1.58>

Ahern, K. R. and Dittmar, A. K. (2012). The Changing of the Boards: The Impact on Firm Valuation of Mandated Female Board Representation. *The Quarterly Journal of Economics*. 127(1), 137-197. <https://doi.org/10.1093/qje/qjr049>

Anderson, R. C., Reeb, D. M., Upadhyay, A. Zha, W. (2011). The Economics of Director Heterogeneity, *Financial Management*. 40(1), 5-38

<https://doi-org.ezproxy.ub.gu.se/10.1111/j.1755-053X.2010.01133.x>

Arnegger, M., Hofmann, C., Pull, K., Vetter, K. (2014). Firm size and board diversity. *Journal of Management & Governance*. 18, 1109-1135.

<https://doi-org.ezproxy.ub.gu.se/10.1007/s10997-013-9273-6>

Auinger, F. (2015). **The Causal Relationship between the SP 500 and the VIX Index Critical Analysis of Financial Market Volatility and Its Predictability**. Wiesbaden: Springer Gabler Wiesbaden

Baranchuk, N. and Dybvig, P. H. (2009). Consensus in Diverse Corporate Boards. *The Review of Financial Studies*. 22(2), 715-747. <https://doi.org/10.1093/rfs/hhn052>

Beltratti, A. and Morana, C. (2006). Breaks and persistency: macroeconomic causes of stock market volatility. *Journal of Econometrics*. 131(1), 151–177.

<https://doi.org/10.1016/j.jeconom.2005.01.007>

Berk, J. and DeMarzo, P. (2014). **Corporate Finance**. 3th ed., Essex: Pearson Education Limited

Bernile, G., Bhagwat, V., & Yonker, S. (2018). Board diversity, firm risk, and corporate policies. *Journal of Financial Economics*. 127(3), 588–612.

<https://doi.org/10.1016/J.JFINECO.2017.12.009>

Blomberg, J. (2019). **Management Organisations- och Ledarskapsanalys**. 2th ed., Lund: Studentlitteratur

Chen, J. (2023). *Risk-Return Tradeoff: How the Investment Principle Works*.

<https://www.investopedia.com/terms/r/riskreturntradeoff.asp> accessed 7 May 2023

CFI Team. (2023). *Return on Assets & ROA Formula*.

<https://corporatefinanceinstitute.com/resources/accounting/return-on-assets-roa-formula/>

accessed 29 April 2023

Dictionary. 2023. *Diversity*. <https://www.dictionary.com/browse/diversity> accessed 3 May 2023

Ekonomifakta. 2023. *Kvinnor i styrelser - internationellt*.

<https://www.ekonomifakta.se/fakta/arbetsmarknad/jamstalldhet/kvinnor-i-styrelser/> accessed

7 May 2023

Europaportalen. (2022, november 22). *Kvotering till bolagsstyrelser godkänt*.

<https://www.europaportalen.se/content/kvotering-till-bolagsstyrelser-godkant> accessed 7 May

2023

Europaportalen. (2022, mars 11). *Majoritet i EU väntas stödja könskvotering – Sverige säger nej*.

<https://www.europaportalen.se/2022/03/majoritet-i-eu-vantas-stodja-konskvotering-sverige-sa-ger-nej> accessed 7 May 2023

Faccio, M., Marchica, M-T., Mura, R. (2016). CEO gender, corporate risk-taking, and the efficiency of capital allocation. *Journal of Corporate Finance*. 39, 193-209.

<https://doi.org/10.1016/j.jcorpfin.2016.02.008>

Fama, E. F. (1991). Efficient capital markets: II. *The Journal of Finance*. 46(5), 1575-1617.  
<https://doi-org.ezproxy.ub.gu.se/10.2307/2328565>

Financial Conduct Authority. 2022. *FCA finalises proposals to boost disclosure of diversity on listed company boards and executive committees*. [Press Release]  
<https://www.fca.org.uk/news/press-releases/fca-finalises-proposals-boost-disclosure-diversity-listed-company-boards-executive-committees> accessed 7 May 2023

Frigotto, M. L. and Rossi, A. (2012). Diversity and Communication in Teams: Improving Problem-Solving or Creating Confusion? *Group Decis Negot*. 21, 791–820.  
<https://doi-org.ezproxy.ub.gu.se/10.1007/s10726-011-9250-x>

García, J. C., and Herrero, B. (2021). Female directors, capital structure, and financial distress. *Journal of Business Research*. 136, 592-601.  
<https://doi.org/10.1016/j.jbusres.2021.07.061>.

Gelfand, A. (2022). The ESG Generation Gap: Millennials and Boomers Split on Their Investing Goals: Younger investors are more willing to put money behind environmental and social goals — even if it's costlier.  
<https://www.gsb.stanford.edu/insights/esg-generation-gap-millennials-boomers-split-their-investing-goals> accessed 7 May 2023

Giannetti, M. and Zhao, M. (2019). Board ancestral diversity and firm-performance volatility. *Journal of financial and quantitative analysis*. 54(3), 117-1155.  
<https://doi.org/10.1017/S0022109018001035>

Globala Målen. (2023). Om Globala Målen.  
<https://www.globalamalen.se/globala-malen-pa-lattlast-svenska/> accessed 7 May 2023

Hayes, A. (2023). *Volatility: Meaning In Finance and How it Works with Stocks*.  
<https://www.investopedia.com/terms/v/volatility.asp> accessed 7 May 2023

Hong, Lu and Scott E. (2004). Groups of diverse problem solvers can outperform groups of high-ability problem solvers. *Economic sciences*. 101(46), 16385-16389

<https://doi.org/10.1073/pnas.0403723101>

Jackson, S. E., Brett, J. F., Sessa, V. I., Cooper, D. M., Julin, J. A., & Peyronnin, K. (1991). Some differences make a difference: Individual dissimilarity and group heterogeneity as correlates of recruitment, promotions, and turnover. *Journal of Applied Psychology*. 76(5), 675–689. <https://doi.org/10.1037/0021-9010.76.5.675>

Jensen, M. C. (1986). Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. *The American Economic Review*. 76(2), 323-329. <https://www.jstor.org/stable/1818789>

Jizi, M. I. and Nehme, R. (2017). Board gender diversity and firms' equity risk. *Equality, Diversity and Inclusion: An International Journal*. 36(7), 590-606. DOI 10.1108/EDI-02-2017-0044

Langton, J. (2020). *Investors endorse action on board diversity: Survey finds appetite for transparency, engagement to encourage diversity*. Investment Executive. <https://www.investmentexecutive.com/news/research-and-markets/investors-endorse-action-on-board-diversity/> accessed 7 May 2023

Macroption. 2023. *Difference between Implied, Realized and Historical Volatility*. <https://www.macroption.com/implied-vs-realized-vs-historical-volatility/> accessed 28 April 2023

Maznevski, M. L. (1994). Understanding our differences: Performance in decision-making groups with diverse members. *Human Relations*. 47(5), 531. <https://www.proquest.com/scholarly-journals/understanding-our-differences-performance/docview/231418961/se-2>

Midavaine, J., Dolfsma, W., Albers, A. (2016). Board diversity and R & D investment. *Management Decision*. 54(3), 558-569. <https://doi-org.ezproxy.ub.gu.se/10.1108/MD-09-2014-0574>

Milliken, F. J., and Martins, L. L. (1996). Searching for Common Threads: Understanding the Multiple Effects of Diversity in Organizational Groups. *The Academy of Management Review*. 21(2), 402–433. <https://doi.org/10.2307/258667>

Nasdaq. 2023. *NASDAQs board diversity rule: What companies should know*. <https://listingcenter.nasdaq.com/assets/Board%20Diversity%20Disclosure%20Five%20Things.pdf> accessed 7 May 2023

Nettleton, D. (2014). **Commercial Data Mining**. Morgan Kaufmann. <https://doi.org/10.1016/C2013-0-00263-0>

Modigliani, F. and Miller, M. H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*. 48(3), 261-297. <http://www.jstor.org/stable/1809766>

Perez-Quiros, G. and Timmermann, A. (2000). Firm Size and Cyclical Variations in Stock Returns. *The Journal of Finance*. 55(3), 1229-1262. <https://doi.org/10.1111/0022-1082.00246>

Shiller, R. J. (1981). Do stock prices move too much to be justified by subsequent changes in dividends? *The American Economic Review*. 71(3), 421-436. DOI 10.3386/w0456

Schopohl, L., Urquhart, A., Zhang, H. (2021). Female CFOs, leverage and the moderating role of board diversity and CEO power. *Journal of Corporate Finance*. 71, 101851. <https://doi.org/10.1016/j.jcorpfin.2020.101858>

Schwert, W. G. (1989). Why Does Stock Market Volatility Change Over Time?. *The Journal of Finance*. 44(5), 1115-1153. <http://dx.doi.org/10.1111/j.1540-6261.1989.tb02647>

Shafqat Mukarram, S., Ajmal, T., Saeed, A . (2018). Women directors' propensity towards risk in technology firms. *Corporate Governance*. 18(2), 353-367. <https://doi.org/10.1108/CG-09-2017-0213>

Smith, N. (2018). Gender quotas on boards of directors. *IZA World of Labor*. doi: 10.15185/izawol.7.v2

Phuong, T. T., Le, A-T., Ouyang, P. (2022). Board tenure diversity and investment efficiency: A global analysis. *Journal of International Financial Markets, Institutions and Money*. 81, 101657. <https://doi.org/10.1016/j.intfin.2022.101657>

von der Leyen, U. [@vonderleyen]. (2022, november 22). After 10 years since the @EU\_Commission proposal, we will now have an EU law for gender equality on company boards [Tweet]. Twitter. <https://twitter.com/vonderleyen/status/1595028543347609602> accessed 7 May 2023.

Zattoni, A., Leventis, S., Van Ees, H., De Masi, S. (2023). Board diversity's antecedents and consequences: A review and research agenda. *The Leadership Quarterly*. 34(1), 101659. <https://doi.org/10.1016/j.leaqua.2022.101659>

Zhang, Wei. (2015). R&D investment and distress risk. *Journal of Empirical Finance*. 32, 94-114. <https://doi.org/10.1016/j.jempfin.2015.03.009>

Zhang, Y., He, J., He, M., Li, S. (2023). Geopolitical risk and stock market volatility: A global perspective. *Finance Research Letters*. 53, 103620. <https://doi.org/10.1016/j.frl.2022.103620>

Zou, Y., Zhong, Z., & Luo, J. (2021). Ethnic diversity, investment efficiency, mediating roles of trust and agency cost. *Economic Analysis and Policy*. 69, 410-420. <https://doi.org/10.1016/j.eap.2020.12.017>