Board Tenure Diversity and Firm Performance

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Department of Accounting and Financial Management
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Peter Lindgren
24783@student.hhs.se

Sepand Tabari
24618@student.hhs.se

Abstract

This paper studies the potential effect that board tenure diversity has on a company's firm performance, measured in terms of Return On Average Assets, Return On Average Equity and Tobin's Q. Long-tenured directors are experienced and knowledgeable but yield a higher risk of causing managerial entrenchment than short-tenured directors who, in contrast, lack experience. Having a mix of the two could therefore, in theory, be optimal to maximize firm performance. The study was done using multiple linear regression models with board data and financial data from companies in the S&P1500 index for every year between 2011 and 2021. However, the study fails to find relationships between board tenure diversity and any of the firm performance metrics as the results were not statistically significant. This can be explained by evidence suggesting that lower board tenure diversity leads to the company taking greater risks, which may have been a good strategy during the period we studied since the financial markets had a relatively strong performance during this time. There may also be less consensus on a board that has higher board tenure diversity, which might cause more indecisiveness and reduce the Board's capability to make decisions, thus reducing or completely neutralizing a theoretical positive impact that higher board tenure diversity has on firm performance.

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1 Introduction

1.1 Background

The Board of Directors is an essential part in all corporations as it is the second highest governing body in a company after the shareholders. The reason for the Board's importance stem from their fiduciary duty to the shareholders of hiring and monitoring the executive team to act in the best interest of the shareholders (Berk & DeMarzo, 2020). The main reason for constructing a Board of Directors is to reduce the cost of monitoring management, a task that otherwise would have to be carried by individual shareholders (Ibid). By outsourcing that duty to a smaller group of people by voting on the individuals the shareholders believe would best carry out that fiduciary duty, reduces the cost of monitoring for each shareholder.

Due to the essential duties of the Board of Directors, several aspects of its characteristics that may influence firm performance and firm value have been studied – among them board tenure. Board tenure is the time a director has been a member of the Board and is measured in years. One of the most influential papers on the subject was written by Huang and Hilary (2018) and studies how average board tenure affects firm performance. However, despite their findings of a seemingly optimal average board tenure, the results do not suggest an optimal composition of the Board for maximizing firm performance.

Bonini et al. (2022) instead focus more specifically on the composition of the Board by looking at long-tenured independent directors and their existence's impact on firm performance. They find that firms with long serving independent directors fare better than firms without such directors, which suggest that a specific component in how the Board of Directors is set up affects the outcome. This contradicts Huang and Hilary in some sense since their findings on average board tenure points towards a negative effect of having long-tenured directors while Bonini et al. provides evidence for the opposite. Our point with the contrast outlined above is to shine light on the need for additional research on how a specific board composition may affect firm performance and that a more granular study of all different aspects of board tenure may be required to better understand its implications. This paper will aim to add to that discussion by focusing on the composition of the directors' tenures. It will do this by studying the board tenure diversity in a company, i.e., the standard deviation of the board tenure, and its implications on firm performance.

1.2 Purpose

To add to the discussion of board composition, this paper will study the effect board tenure diversity may have on firm performance by looking at the same performance metrics as Huang and Hilary (2018) did in their study, i.e., Tobin's Q and Return On Assets, but also Return On Equity. The definition of board tenure diversity will then be similar to Li and Wahid's (2018) definition, i.e., the standard deviation of the tenure. The findings of this paper may provide a deeper understanding in the debate regarding limitations of board tenure as the issue of having longer average board tenures, as highlighted by Huang and Hilary, may not be as severe if that board is still quite diverse when looking at the actual composition of tenures. One may thus argue that limitations should not be set on individual directors' tenures, but rather on the tenure diversity on the Board as both long- and short-tenured directors seem to have positive and negative traits (see section 2).

1.3 Contribution

This paper contributes to the literature by looking at firm performance as a function of board tenure diversity. The subject has hitherto failed to provide any concluding evidence of a relationship and this paper may not be an exception. In any case, the paper will add more knowledge to the field. The paper also adds to the debate of limiting board tenure as the issue may not lie in the individual director's tenure but rather the lack of tenure diversity. Lastly, the paper will try and explain the discrepancy between different outcomes of previous research by using board tenure diversity in an attempt to align seemingly opposing results.

1.4 Delimination

The study is limited to the individual companies of each year in the S&P1500 between 2011 and 2021, meaning the paper only looks at data from the USA and results may differ between countries. As a result of conducting the research on publicly listed companies the results of this paper may not necessarily be applicable to private companies. The reason for choosing publicly listed companies in the S&P1500 is due to the availability of board tenure data and financial performance data over the chosen time period.

1.5 Disposition

The paper begins by discussing the literature on management entrenchment by explaining what it is and its potential implications on a firm. This is followed by a discussion on how different

board characteristics affect the firm to then end the literature review by connecting management entrenchment, firm performance and board tenure to provide the reader with a good background of the subject and to highlight the relevance of board tenure in relation to management entrenchment and firm performance. The paper then continues to argue for two hypotheses by including a deeper discussion regarding board tenure, board tenure diversity and management entrenchment. We then discuss our data collection process, the variables we will use in our models and also the models themselves with a short note on interdependence. We then present the results for all models and hypotheses together with comments on the specific outcomes. This is followed by a deeper discussion of how we should interpret the findings and the paper is then concluded with some final words in a conclusion section.

2 Literature Review and Hypothesis Development

The focus of this paper is board tenure, a board characteristic that has empirical support to affect firm performance. Since different board characteristics may influence how the company is being run (e.g., they can affect the Board's monitoring capabilities), this section first provide the reader with a background in management entrenchment due to its possible effect on how the Board monitor's management. The section then outlines different board characteristics' effects (including board tenure) on firm performance. The entirety is then concluded and used to develop two hypotheses.

2.1 Management Entrenchment and Firm Performance

Management entrenchment is defined by Berk and DeMarzo (2020) as "facing little threat of being fired and replaced," which leads to that "[...] managers are free to run the firm in their own best interest." Berk and DeMarzo continues to conclude that entrenched managers therefore may make decisions and take actions that are in their own best interest and might hurt shareholders. Understanding how management entrenchment generally affects firm performance is important in this paper as its appearance tends to be linked to different traits and aspects of the Board of Directors (see sections 2.2 and 2.3). One of those aspects is board tenure, which will be the main focus in this paper.

In general, management entrenchment is a problem for firms as it may increase the possibility for managers to increase their salary and enjoy larger perquisites from shareholders (Shleifer & Vishny, 1989). This is supported by both Faleye (2007), who show that staggered boards (i.e., boards in which not all directors' terms expire simultaneously) generally entrench

management, which then destroys firm value and therefore creates worse firm performance, and Chang and Zhang (2015) who also found evidence of that lower firm value could be explained by management entrenchment. In addition, Collins and Huang (2011) studied how management entrenchment is related to cost of equity capital and found that an increase in management entrenchment is associated to an increase in cost of equity capital. The consensus to calculate a firm's value by discounting all future cash flows is dependent on the cost of equity – the higher the cost, the lower the firm value. Therefore, management entrenchment is generally considered an issue in a company and should try to be avoided.

However, there are some scholars suggesting that management entrenchment result in less myopic behaviour within management, especially when considering earnings management where evidence is found that manipulation to achieve specific reporting goals is less likely to be pursued by entrenched CEOs as they face less pressure from the capital markets and shareholders that tempt them to engage in such actions (Di Meo et al., 2017). The findings thus suggest that entrenched management may lead to a focus on long-term strategy instead of short-sighted actions, which may help to improve firm value. However, the study was conducted on firms incorporated in Delaware where different laws apply in the action of hostile takeovers etc., which may have impacted the results. A general application of these findings could therefore be questioned. However, overall there seems to be a consensus that management entrenchment has negative implications on firm performance.

2.2 Board Characteristics and Firm Performance

Several aspects of the Board's composition have been studied by different scholars to find any potential implications on how its characteristics influence firm performance. One aspect is the notion of that independent directors, i.e., directors who are not part of the company's operations or executive team, help align management's interest with the shareholders. However, despite the theoretical advantages of having independent directors, there are some empirical findings that suggest a different outcome regarding independent directors. Fernandes (2008) show support for independent directors "paying higher wages to their executives" while companies with zero independent directors "have fewer agency problems and achieve a better alignment of shareholders' and managers' interests." Similar results were found by Liu et al. (2014) but with another approach. They looked at gender diversity and female directors and showed a positive relationship between board gender diversity and firm performance. The result showed that female executive directors had a greater effect on firm performance than independent female directors do, thus suggesting that independent directors may not be as effective as the theory

says. However, studies have been done when focusing on lead independent directors, i.e., directors that coordinate and lead the independent directors' actions on the Board. Krause and Withers et al. (2017) and Lamoreaux and Litov et al. (2019) all found evidence that appointing a lead independent director on the board is positive for firm performance and improves corporate governance quality. Even if the subject does not truly say if independent directors are to be preferred or not on the Board, this evidence provide a clear indication that the general opinion of independent directors is positive, which may be all that needs to be said on this topic as it is the opinion of the shareholders that ultimately controls the value of a publicly traded company. If the shareholders interpret independent directors as a positive phenomenon, then that will show in their valuation of the firm.

Board size is another widely studied topic where there is support for a negative relationship between firm performance and board size according to Nguyen et al. (2016). However, as often is the case, the results depend in the situation. In a study conducted by Larmou and Vafeas (2010) they showed that when smaller firms with poor operating performance see an increase in the board size, their share price performance improves. Board size therefore show a positive relationship with firm performance. This might be due to new directors exhibiting experience that can turn the company around and that the market believes that when something is happening in the Board that changes the basics, that could have a positive impact on the firm.

2.3 Board Tenure, Management Entrenchemnt, and Firm Performance

Board tenure is different among firms where some companies have a board with several long-tenured directors while others have a high concentration of short-tenured members. An important paper for this study was written by Huang and Hilary (2018) in which they argue that average board tenure impacts financial performance of a firm. They found that firm performance, measured in terms of Tobin's Q and Return On Assets, had an inverse U-shaped relationship to average board tenure. The study motivates how a short-tenured board may face less governance problems but lack experience and knowledge of the firm while long tenured boards have more experience and knowledge but has a greater risk of being entrenched.

Ji et al. (2021) makes a similar argumentation in their study but use board tenure diversity and its impact on firm risk. They argue how boards with long-tenured directors are "subject to alignment with management" while short-tenured directors have less experience and knowledge, which may result in more risk as they fail to correctly monitor the CEO. Since there are both pros and cons with having short- and long-tenured directors, the article tries to find the implications of that fact, and concludes that firm risk is negatively associated with board tenure

diversity and that tenure diversity increases effectiveness on risk oversight. While someone may use the argument that a tenure heterogenous board risks leading to less consensus and, therefore, an unstable company, the results prove the opposite according to Ji et al.

Li and Wahid (2018) highlight the fact that several firms have introduced limits on how long a director may sit on the board, which implicitly suggests that the corporate world is aware of potential issues with long-tenured directors; but the terms tend to be long. However, there has historically not been a consensus regarding monitoring of management. Li and Wahid suggest that some scholars believe that long-tenured boards do a better job of monitoring the CEO due to the theoretical reduced risk of being susceptible to management influence. Other scholars argue that long-tenured directors tend to fall in-line with status quo and being entrenched, which can result in weaker monitoring. The latter argument is also emphasized using a different view by Ji et al. (2021) as they claim that long-tenured directors tend to befriend the CEO, which may result in worse monitoring and a higher risk of management entrenchment and thus worse firm performance. The issues with having directors being friends with the CEO is also emphasized by Rose et al. (2014) as they found that friendship ties between directors and CEO can worsen the monitoring of the CEO and thus impair the independence that the directors should have in relation to management.

Bonini et al. (2022) also adds to the discussion by mentioning the worsened monitoring that could result from directors befriending management and that this tends to occur to a greater extent among directors that have served for a long time. However, they also argue that several scholars suggest that long-tenured directors are good for firms since they can stand up to management and are more experienced advisors. To close this gap, they look at "very long-tenured independent directors" and find that by just having one such director makes the firm perform better compared to firms without any long-tenured independent directors. Bonini et al. therefore highlight the importance of having long-tenured directors but with a specific trait, independence.

In general, the literature shows clear evidence of average board tenure having an impact on firm performance. Further, board tenure diversity seems to be influential when monitoring management and the CEO, which in theory would impact firm performance since the meaning of monitoring is to make sure that management acts in the best interest of the shareholders – and shareholders, most likely, want to maximize firm value. Since we argue that board tenure diversity is a way to understand the actual board composition – which was proven to be important by Bonini et al. when they found partly contradicting evidence to the notion of long-tenured directors having a negative impact on firm performance – the relationship between board tenure diversity and firm performance is interesting to study. Consequently, this paper will aim to an-

swer the question:

Research question: *Does board tenure diversity influence firm performance?*

2.4 Hypothesis Development

As mentioned in the literature review, managerial entrenchment may cause problems for the firm's shareholders as the agent's own interests might go against those of the principal and thus yield worse firm performance. Several board characteristics could potentially influence firm performance and also if management becomes entrenched or not. Board tenure is one aspect that has been discussed and the time each director has spent on the board come with different advantages and drawbacks. In a paper by Vafeas (2003), he discusses two hypotheses regarding long-tenured directors: the expertise hypothesis and the management friendliness hypothesis. The expertise hypothesis argues that the long-tenured directors tend to know more about the company they monitor and have longer experience, which make them more competent to carry out the Board's duties. In contrast, the management friendliness hypothesis instead argues that long-tenured directors are more likely to befriend management and thus result in worse monitoring, a form of managerial entrenchment. Vafeas also points to a study by Katz (1982) who found that longer board tenures lead to diminished intra-group communication and key information sources are thus exclusive to only a few individuals. The contrast in opinions shines light on both the positive and the negative effects of having long-tenured directors on the board. Chang and Zhang (2015) also contributes to the discussion as they suggest that longer director tenures tend to result in more managerial entrenchment. Managerial entrenchment may take many forms but the common effect of all its shapes is that they are detrimental to shareholders since entrenched managers reduce firm value.

The alternative to long-tenured directors are short-tenured directors, who also have their positive and negative aspects. Short-tenured directors are less likely to directly befriend management and align with status quo in the company, which result in less risk of management entrenchment. However, they simultaneously run a higher risk of being "captured" by the CEO (i.e., being influenced by the CEO to act in the best interest of the CEO instead of the shareholders) and lack experience and knowledge of the company (Elms & Pugliese, 2022). Therefore, having only short-tenured directors on the board could be detrimental to the organisation and shareholders as well. One might thus suggest that a mix of both long- and short-tenured directors is optimal for companies and shareholders as the short-tenured directors will keep the entire board from being entrenched while the long-tenured directors provide experience and

knowledge.

As previously mentioned, Huang and Hilary (2018) studied a potential relationship between average board tenure and firm performance using Tobin's Q and return on assets as estimates of firm performance. Their results showed an inverse U-shaped relationship between the two thus suggesting that board tenure is a determining factor of firm performance. More specifically, the study shows that for each year of tenure added to short-tenured boards, learning increases, which boosts firm performance while each year of tenure added to long-tenured boards leads to increased entrenchment costs. However, even if Huang and Hilary's paper suggests an optimal average board tenure, the results lack ability to provide an optimal board composition with regards to tenure. The paper fails to answer the question whether the optimal board tenure should be created by having as many people as possible close to that specific tenure or if it should be composed of some directors with very long tenures and some with very short tenures.

One way to answer this question would be to study the board tenure diversity, which Li and Wahid (2018) did. They looked at board tenure diversity and its implications on CEO monitoring and the quality of other board duties. They found support for diverse tenured boards being better at monitoring the CEO. They presented empirical evidence showing how tenure-diverse boards are "less frequently associated with accounting restatements," they are "more likely to replace the CEO if a restatement occurs," and they are "less likely to overcompensate the CEO." However, Li and Wahid did not look at board tenure diversity's potential effect on firm performance, but they do mention the possible relationship between board tenure diversity and firm performance as having ambiguous support in the literature.

Based on the discussion above there is both support for, and resistance against, long-tenured directors. We believe that these ambiguous findings lack information of the board composition, which we believe is better studied by looking at board tenure diversity. We see evidence of both positive and negative aspects of having long-tenured directors while the same is true for short-tenured members. Therefore, we think a mix of the two is optimal, which result in our first hypothesis:

H1: *Board tenure diversity has a positive linear relationship to firm performance, more specifically, higher board tenure diversity yields better firm performance.*

Huang and Hilary argued for an inverse U-shaped relationship between average board tenure and firm performance, meaning that after a certain average tenure threshold, firm performance begins to deteriorate. One of the causes is simply that directors tend to befriend

management, which may result in worse monitoring and thus less alignment to shareholder's interests, according to the management friendliness hypothesis (Vafeas, 2003).

However, as previously mentioned, Bonini et al. (2022) found that long-tenured independent directors are good for firm performance, which implies that long-tenures are not necessarily bad. Another group of scholars, Livnat et al. (2021), also argues that long board tenures have positive implications for the firm. More specifically, the group finds that board tenure is better than any other variable in predicting financial stability and that the longer the board tenure is, the higher the correlation to better future stock performance – a proxy for firm performance. Since both papers seem to make arguments that contradicts Huang and Hilary – the former in a specific setting with a focus on independent directors and the latter on board tenure in general – there is a discrepancy in the literature, which creates somewhat of a paradox. We believe board tenure diversity can be used to explain the contradicting results and close the gap between these finding. More specifically, we argue that Huang and Hilary fail to find the optimal board composition in their study – they only find an optimal average board tenure. This means that if the average board tenure is found to be optimal according to empirical evidence, it is optimal no matter its composition and it implicitly gives the notion that long-tenured directors are bad for firms. However, since Bonini et al. and Livnat et al. provide evidence that long-tenured directors yield better firm performance, the composition of the directors' tenures must play a role in the company. By using board tenure diversity to investigate the composition of the board, we may be able to explain the paradox. To exemplify, if the board is composed of several senior directors and only a few junior members, the average may still be optimal according to Huang and Hilary, but the weight is tilted towards a longer tenured board, which then is favourable according to Bonini et al. and Livnat et al. In contrast, if the board has an optimal average board tenure, but the weight is tilted towards shorter tenured directors, that company may yield worse firm performance than the other alternative.

By using average board tenure in relation to the board tenure diversity may enable us to better explain the board composition and its possible effect on firm performance. The following hypothesis would, in theory, be able to close the gap between the findings as it basically states that long-tenured directors are favourable if accompanied with some short-tenured director(s):

H2: *High average board tenure in relation to a high board tenure diversity yields better firm performance than high average board tenure and low board tenure diversity.*

3 Methodology

3.1 Data and Data Collection

The data used in this study has been accessed through WRDS, more specifically, Institutional Shareholder Services (ISS), Compustat, and Center for Research in Security Prices (CRSP). Our initial selection are the companies represented in the S&P1500 for each individual year between 2011 and 2021, which is data provided by ISS. We also use data from 2010 to make some calculations for 2011 (see 3.1 about lagging board data). ISS also outputs data on the Board of Directors for these companies. If there is one or more data points missing for a company, all data associated with that company for that specific year have been removed from the data set to ensure that all companies in the study have a full range of data. Further, the selection of companies from ISS after revision are used as the benchmark for selecting companies from Compustat. More specifically, the entire database of US companies and their corresponding desired data was pulled from Compustat and then matched to the selection created by ISS in Excel based on their unique ticker. Again, the companies where Compustat could not find data were removed. The same process was done with CRSP but for market data, i.e., outstanding shares and stock price at the end of each year specified, which was required to calculate market value and thus Tobin's Q.

Lagging Board Data and Average Data

Since the paper aims to test how the board tenure diversity influences firm performance, we want to order our data in such a way that the board data influences the dependent variables outlined in the section below. To do this, we are using lagging board data from the previous year to explain the dependent variable of the current year. More specifically, since the Board of Directors usually sit for a one-year term, the Board will take actions during that entire time and eventually generate a result – the result we aim to explain. To capture the actions that the Board of Directors make during its term, the board data at the end of, e.g., 2012 will be used to explain the firm performance at the end of 2013 etc. We have adopted this method since Huang and Hilary (2018) used lagging director data in their paper regarding average board tenure.

We also want to highlight our definition of the average total assets data and average total equity data we will use in this paper to calculate our dependent variables. The same method will also be used in some of our control variables. We use average data following the discussion of lagging directors above. Since the directors take part in some of the investment decisions made over the entire year and have other responsibilities that affect the firm's structure

of assets, liabilities and equity, we deem it most correct to use average assets and average equity to generate the results we will measure and the variables we control for. We aim to use the most accurate information possible of how the Board has influenced firm performance to best explain a possible causality.

3.2 Variables

Dependent Variables

Three dependent variables will be used to evaluate the financial performance of a company: Return On Average Assets (*ROAA*), Return On Average Equity (*ROAE*), and Tobin's Q (*TQ*).

ROAA is calculated by dividing net income by total average assets over the year. "Average assets" is calculated by adding the book value of total in-going assets and the book value of total outgoing assets and divide that value with two (see Table 12 in Appendix). The ratio shows how profitable a company is in relation to the average assets it has used to generate that profit. A higher value indicates a higher generated profit in relation to the company's assets.

ROAE is calculated by dividing net income by total average equity over the year. "Average equity" is calculated by adding the book value of the total in-going equity and the book value of the total outgoing equity and divide that value with two (see Table 12 in Appendix). The ratio shows how profitable a company is in relation to the average equity it has used to generate that profit, i.e., how much the shareholders receive for investing in that company. A higher value indicates a higher generated profit in relation to the company's invested equity.

TQ is calculated by dividing the market value of the company with the average book value of total assets (see Table 12 in Appendix). *TQ* is used as a performance measure to show the market's view on the company's value in comparison to what the firm's assets are worth. The ratio indicates if the firm's market value is higher or lower than the sum of its total assets. A value below one indicates a potential undervaluation while a value above one indicates a potential overvaluation. A high value on *TQ* may also indicate that the market thinks the company will grow in the future while a low value on *TQ* may indicate that the market thinks difficult times are ahead.

Independent Variables

The independent variables are: Board Tenure Standard Deviation (*BTStdev*) and Average Tenure Relative Tenure Diversity (*AvgBT_BTStdev*).

BTStdev_PY is measured by taking the population standard deviation of the board tenure

in a company. The higher the value, the greater the spread of tenures in the company's board. The variable is used in its raw form in the first hypothesis and combined with another variable in the second hypothesis (see below).

AvgBT_BTStdev (also referred to as *Ratio*) is a ratio between *AvgBT* and *BTStdev* in which *AvgBT* is divided by *BTStdev* (see Table 12 in Appendix). Creating ratios when studying board tenure diversity is nothing new since Li and Wahid (Li, Wahid 2018) pursued the same strategy (although a different ratio) in their study, which included board tenure. The ratio is used in the second hypothesis only.

Control Variables

Several control variables will be used to explain the dependent variables. These variables are divided into two categories, Board characteristics and Firm characteristics. Board characteristic variables include Board Size (*BS_PY*), Average Age (*AvgAge_PY*), Female Director Ratio (*FemD_PY*), Average Board Tenure (*AvgBT_PY*), and Independent Director Ratio (*IndD_PY*). Firm characteristic variables include Total Average Assets in Logarithmic form (*TotAA*), Leverage (*Lev*), and Sales in Logarithmic form (*Sales*).

BS_PY represents the number of directors on the board and only takes on discrete values. The variable was shown to have an impact on market valuation and Tobin's Q in a paper by Yermack (1996), which suggested that smaller board sizes were more effective and is therefore included in the control variables. The data is from the previous year in relation to the dependent variable's data (see section 3.1 for explanation).

AvgAge_PY is the population standard deviation of the directors' ages on the Board. Age diversity was concluded to affect firm performance according to Fernández-Temprano and Tejerina-Gaite (2020) and will thus be used as a control variable. The data is from the previous year in relation to the dependent variable's data (see section 3.1 for explanation).

FemD_PY is measured as a ratio by dividing the number of females on the board with the board size. The variable is therefore continuous with a minimum and maximum value of 0 and 1 respectively. Gul et al. (2011) provides evidence that more gender diversity leads to better stock price informativeness and may thus result in less information asymmetry. The result will most likely impact the financial performance of the firm and is therefore included as a control variable. The data is from the previous year in relation to the dependent variable's data (see section 3.1 for explanation).

AvgBT_PY is measured by taking the arithmetic mean of all the directors' tenures. Huang and Hilary (2018) showed that average board tenure show an inverse U-shaped relation-

ship with firm performance and is thus highly relevant to control for in this multiple regression analysis. The data is from the previous year in relation to the dependent variable's data (see section 3.1 for explanation).

IndD_PY represents the percentage of the board that are labeled as "independent directors". The metric is used by Li and Wahid (2018) and is therefore considered relevant to control for in our model. The data is from the previous year in relation to the dependent variable's data (see section 3.1 for explanation).

TotAA is the value of total average assets and is used to measure firm size of a company. $Log(TotAA)$ will be used to reduce fluctuation between firm's sizes. The variable is used in this way by both Huang and Hilary (2018) and Li and Wahid (2018) and is therefore considered an important control variable.

Lev is calculated as average debt (liabilities) divided by average equity and the variable expresses how much leverage the company is using to finance its total assets. The variable is used by both Huang and Hilary (2018) and Li and Wahid (2018) and is thus considered highly relevant to control for in the multiple regression model.

Sales is the total revenue a company has managed to generate over a year. This paper will use $log(Sales)$ as it results in smaller fluctuations between the companies and may thus show better results as the fluctuations in *TQ*, *ROAA* and *ROAE* are generally smaller in absolute size. The variable is used by Li and Wahid (2018) and is thus considered a relevant control variable.

Fixed Effects

Two fixed effects variables will be used in our models to control for specific effects that may influence our regression: Year fixed effects (*Year*) and Industry fixed effects (*Industry*).

Year is a variable that will take the values 2011 to 2021 and represent the year the dependent data point belongs to. The variable is important due to macro events and other factors that may cause a specific year to show specific and/or anomalous behaviour. To control for such fixed effects will possibly result in a more accurate model to explain our hypotheses.

Industry is a nominal variable based on the North American Industry Classification System (NAICS). There are 20 unique broad industry classification, which have all been given a number from 1 to 20 that will be used to classify the data point in the multiple regression analysis. A company's industry is used to control for specific industry effects, e.g., the tendency for some industries to possess a higher *ROAA* than other industries. This variable is also used to control for the fixed effect that a company in a specific industry might be subject to.

Table 1: Definition and description of variables used in the regression models

Variable	**Definition**
Dependent Variables	
ROAA	Return on Average Assets
ROAE	Return on Average Equity
TQ	Tobin's Q
Independent Variables	
BTStdev_PY	Standard Deviation of Board Tenture
Ratio_PY	Ratio between AvgBT_PY and BTStdev_PY
Control Variables	
BS_PY	Board size, previous year
AvgAge_PY	Average age in board, previous year
FemD_PY	Proportion of board members being females, previous year
AvgBT_PY	Average board tenure, previous year
IndD_PY	Independent Directors, previous year
logTotAA	Total Average Assets, in logarithmic form
Lev	Leverage
logSales	Sales, in logarithmic form
Fixed Effect Variables	
Year	Year fixed effects
Industry	Industry fixed effects

3.3 Models

Multiple linear regression models will be used to answer the research question and test our hypotheses. A multiple regression model is a regression model that tests several independent variables' effect on one dependent variable and allows for determination of simultaneous effect that these independent variables might have on the dependent (Newbold, 2013). The method

uses least squares principles meaning it minimizes the error to the observed data when fitting the model (Ibid). A summary of all models used in this report can be found in Table 11 in the Appendix.

First Hypothesis Models

The first hypothesis is tested by conducting a multiple regression analysis per dependent variable, i.e., one for *ROAA*, one for *ROAE* and one for *TQ*. The independent variable used in these three models is *BTStdev_PY*. All three models will use the same control variables and fixed effect variables.

$$ROAA = \beta_0 + \beta_1 * BTStdev\_PY + \boldsymbol{\gamma X}' + \beta_{10} * Industry + \beta_{11} * Year + \epsilon \quad (1)$$

$$ROAE = \beta_0 + \beta_1 * BTStdev\_PY + \boldsymbol{\gamma X}' + \beta_{10} * Industry + \beta_{11} * Year + \epsilon \quad (2)$$

$$TQ = \beta_0 + \beta_1 * BTStdev\_PY + \boldsymbol{\gamma X}' + \beta_{10} * Industry + \beta_{11} * Year + \epsilon \quad (3)$$

Where the **X**-vector consists of all control variables defined above and the $\boldsymbol{\gamma}$-vector of each corresponding coefficient. The ϵ is the error term.

Second Hypothesis Models

The second hypothesis is tested by conducting a multiple regression analysis per dependent variable (same as above) but the independent variable is now *AvgBT_BTStdev* (*Ratio*). The models are:

$$ROAA = \beta_0 + \beta_1 * Ratio + \boldsymbol{\gamma X}' + \beta_{10} * Industry + \beta_{11} * Year + \epsilon \quad (4)$$

$$ROAE = \beta_0 + \beta_1 * Ratio + \boldsymbol{\gamma X}' + \beta_{10} * Industry + \beta_{11} * Year + \epsilon \quad (5)$$

$$TQ = \beta_0 + \beta_1 * Ratio + \boldsymbol{\gamma X}' + \beta_{10} * Industry + \beta_{11} * Year + \epsilon \quad (6)$$

Where the **X**-vector consists of all control variables defined above and the $\boldsymbol{\gamma}$-vector of each corresponding coefficient. The ϵ is the error term.

3.4 Execution of First Hypothesis

The actual execution testing and evaluating the models will be done by first finding outliers in the data set. Finding and handling outliers will be done by winsorizing the data set of the 1st and 99th percentiles. This will be done on the entire data set and the "cleaned" data will then be used in each of the models to test the first hypothesis. The interdependence between the variables

will be evaluated and combined with different statistical metrics, such as VIF (Variance Inflation Factor), to determine if there is too much multicollinearity in our model. Further, the statistical significance of each variable in the output of the final model will be evaluated. We set the threshold for statistical significance (p-value) to 0.05.

3.5 Execution of Second Hypothesis

The independent variable that will be used to execute the second hypothesis and explain the dependent variables *ROAA*, *ROAE*, and *TQ* is *Ratio*. However, the hypothesis tries to explain the paradox between Huang and Hilary's (2018) implied conclusion compared to Bonini et al.'s (2022) and Livnat et al.'s (2021) conclusions. To test this, the data of interest will be when the average board tenure exceeds the seemingly optimum number of years since longer average board tenure generally results in a decline in firm performance according to Huang and Hilary. However, the empirical optimum of 10 years that Huang and Hilary have suggested using their data, cannot be considered a universal fact that applies to our data set as well. Another paper by Beckvid and Erikson (2021), conducted a similar study to Huang and Hilary but instead used Swedish data and found the optimum level for average board tenure to be 14 years. Thus, in this study we will create two regression models for hypothesis 2, Model 2 and Model 3. The data for the first model will, as mentioned above, only include companies where the average board tenure exceeds 10 years and will be referred to as "Model 2". The second model will only include data for firms where the average board tenure exceeds 14 years and will be referred to as "Model 3". The only difference between the models will be the data used in them, which is filtered on the average board tenure. In all other regards, the construction of the models is exactly the same and will follow the structure mentioned in Section 3.3.

The ratio will provide another dimension to the analysis by showing how long average board tenure in relation to the board tenure diversity potentially affects firm performance. A low result on *Ratio* will indicate a relatively high board tenure diversity in relation to average board tenure as our minimum average board tenure is relatively large in both Model 2 and Model 3. In contrast, a high value on *Ratio* will indicate a low board tenure diversity in relation to average board tenure.

3.6 VIF-Evaluation

Table 2: VIF-scores for variables included in Model 1

	GVIF	DF	GVIF^(1/(2∗Df))
BTStdev_PY	2.332	1	1.527
BS_PY	1.762	1	1.327
AvgAge_PY	13.354	1	3.654
FemD_PY	1.423	1	1.193
AvgBT_PY	2.480	1	1.575
IndD_PY	1.274	1	1.129
logTotAA	6.776	1	2.603
Lev	1.286	1	1.134
logSales	5.364	1	2.316
factor(Year)	16.198	10	1.149
factor(Industry)	3.403	17	1.037

Output for the VIF-scores in Model 1 showing GVIF, DF (Degrees of Freedom) and GVIF-adjusted scores for all independent and control variables.

Table 3: VIF-scores for variables included in Model 2

	GVIF	DF	GVIF^(1/(2∗Df))
Ratio	1.113	1	1.055
BS_PY	1.684	1	1.298
AvgAge_PY	14.159	1	3.763
FemD_PY	1.405	1	1.185
AvgBT_PY	1.235	1	1.111
IndD_PY	1.267	1	1.126
logTotAA	6.034	1	2.456
Lev	1.477	1	1.215
logSales	4.312	1	2.077
factor(Year)	17.677	10	1.154
factor(Industry)	4.957	17	1.048

Output for the VIF-scores in Model 2 showing GVIF, DF (Degrees of Freedom) and GVIF-adjusted scores for all independent and control variables.

In Table 2, the scores for VIF for Model 1 are presented. The GVIF-score can be interpreted as the VIF-score for the variables where DF equals 1. As a threshold for this model, a VIF-score above 10 is an unacceptable level which would result in the exclusion of that specific variable. However, as the high VIF-scores comes from a control variable (*AvgAge_PY*), they can safely be ignored (Allison, 2012).

In Table 3, similar to the case with Model 1, the results of a VIF-analysis are presented. With the same threshold of 10, the only variables breaching that threshold is again *AvgAge_PY*. As was the case with hypothesis 1, the high VIF-scores are in this case acceptable as they originate from control variables (Allison, 2012).

Lastly, a comment must be made on the fixed-effect variables, *Year* and *Industry*, which both have DF above 1 and thus have to be evaluated with the DF-adjusted version of GVIF. For *Year*, they have a GVIF-adjusted score of 1.149 for hypothesis 1 and 1.015 for hypothesis 2. For *Industry*, the GVIF-adjusted score is 1.037 for hypothesis 1 and 1.048 for hypothesis 2. The threshold chosen for the GVIF-adjusted score is typically the square root of the threshold for the VIF-score (R, n.d.). From that, one can see that the threshold is not exceeded, and the fixed-effect variables are accepted.

There is a trade-off between including variables and removing them because of multicollinearity. On the one hand, one wants to build a model without overfitting the data, but on the other hand, one wants to include variables that are important in the context of what is being tested. Even though the above results of the VIF-variables generally should be accepted, we have performed one more test to measure if the results achieved with the model will change. The variable *AvgAge_PY* is removed for that test and a new VIF-table is presented below. The new model is referred to as Model 4 and is a model which is the exact same as Model 1 without the variable *AvgAge_PY*.

Table 4: VIF-scores for variables included in Model 4

	GVIF	DF	GVIF^(1/(2∗Df))
BTStdev_PY	2.331	1	1.527
BS_PY	1.762	1	1.327
FemD_PY	1.422	1	1.193
AvgBT_PY	2.433	1	1.560
IndD_PY	1.272	1	1.128
logTotAA	6.774	1	2.603
Lev	1.286	1	1.134
logSales	5.364	1	2.316
factor(Year)	1.295	10	1.013
factor(Industry)	3.392	17	1.037

Output for the VIF-scores in Model 4 showing GVIF, DF (Degrees of Freedom) and GVIF-adjusted scores for all independent and control variables.

From Table 4, it can be seen that the VIF-scores are under 10 for all variables. As stated previously, VIF-scores above 10 is the threshold that we consider removing variables and from here on no more variables will be removed.

4 Results

4.1 Regression Model's Summary Statistics

Table 5: Summary Statistics of Model 1

Statistic	N	Mean	St. Dev.	Min	Max
ROAA	10,633	0.043	0.074	−0.257	0.274
ROAE	10,633	0.118	0.318	−1.244	1.883
TQ	10,633	1.358	1.497	0.051	8.844
BTStdev_PY	10,633	5.935	3.090	0.000	16.055
BS_PY	10,633	9.492	2.215	5	16
AvgAge_PY	10,633	48.121	25.986	0.000	71.571
FemD_PY	10,633	0.169	0.109	0.000	0.455
AvgBT_PY	10,633	8.749	3.625	1.714	21.143
IndD_PY	10,633	0.810	0.100	0.500	0.929
logTotAA	10,633	8.529	1.668	5.263	13.113
Lev	10,633	2.771	4.284	−8.164	28.269
logSales	10,633	7.745	1.514	4.670	11.621

Table 5 summarizes the key statistics from the winzorised data set. Looking at the board data, the total number of firms studied were $10,633$. The average board tenure standard deviation is around 5.94 years with the average board size being 9.5 board members. Furthermore, the average age for board members is 48.12 years and the percentage of females represented on the board is on average 17%. The proportion of independent board of directors is on average 81%. For the financial data, the *ROAA* is on average 4.3% while the *ROAE* is 11.8% and Tobin's Q 1.36. Total Average Assets is on average 8.529 in logarithmic form and Leverage is on average 2.771. Lastly, sales in logarithmic form is on average 7.745.

Table 6: Summary Statistics of Model 2

Statistic	N	Mean	St. Dev.	Min	Max
ROAA	3,176	0.049	0.071	−0.257	0.274
ROAE	3,176	0.124	0.264	−1.244	1.883
TQ	3,176	1.411	1.571	0.051	8.844
BTStdev_PY	3,176	8.605	3.106	0.497	16.055
BS_PY	3,176	9.278	2.281	5	16
AvgAge_PY	3,176	52.231	25.532	0.000	71.571
FemD_PY	3,176	0.142	0.104	0.000	0.455
AvgBT_PY	3,176	13.093	2.795	10.003	21.143
IndD_PY	3,176	0.770	0.108	0.500	0.929
logTotAA	3,176	8.267	1.495	5.263	13.113
Lev	3,176	2.702	4.050	−8.164	28.269
logSales	3,176	7.448	1.366	4.670	11.621
Ratio	3,176	1.735	1.056	0.644	25.102

For hypothesis 2, the summary statistics from Table 6 give an insight into the data set used in Model 2. After the data was winzorised and sorted on data points with *AvgBT_PY* exceeding 10 years as well as the removal of data points with an infinite *Ratio* value, the group is left with $3,176$ data points. An infinite *Ratio* value only occurs if the value of *BTStdev_PY* converges towards 0, and after the winzorising process there were only two such data points which were removed. With the new data set the average board size decreases to 9.3 (*BS_PY*) board members the average age increases to 52.2 (*AvgAge_PY*). This is reasonable since the additional constraint of the average board tenure (*AvgBT_PY*) exceeding 10 years was added. Furthermore, the average representation of female board members (*FemD_PY*) decreased to 14.2% from 17%. The number of independent directors (*IndD_PY*) is on average 97.3%. Looking at the average financial data *ROAA* is 4.9%, *ROAE* 12.4%, and Tobin's Q 1.4. Total Average Assets (*TotAA*) is 8.27 in logarithmic form, Leverage (*Lev*) 2.70 and Sales (*Sales*)7.49 in logarithmic form.

Table 7: Summary Statistics of Model 3

Statistic	N	Mean	St. Dev.	Min	Max
ROAA	871	0.055	0.071	−0.257	0.274
ROAE	871	0.130	0.197	−0.773	1.883
TQ	871	1.527	1.772	0.051	8.844
BTStdev_PY	871	10.768	3.370	0.629	16.055
BS_PY	871	9.071	2.413	5	16
AvgAge_PY	871	53.721	26.579	0.000	71.571
FemD_PY	871	0.118	0.102	0.000	0.455
AvgBT_PY	871	16.884	2.323	14.045	21.143
IndD_PY	871	0.722	0.106	0.500	0.929
logTotAA	871	8.066	1.509	5.263	12.839
Lev	871	2.508	3.237	−8.164	28.269
logSales	871	7.246	1.293	4.670	11.621
Ratio	871	1.791	1.102	0.644	25.102

For hypothesis 2 and Model 3, the number of data points have been reduced to 871 when the data is filtered on *AvgBT_PY* exceeding 14 years. In Table 7 we can see that the *ROAA* and *ROAE* is on average 5.5% and 13% respectively, while *TQ* is on average 1.53. For the new data set, *BTStdev_PY* is 10.77 on average. *BS_PY* is on average 9.1 people while *AvgAge_PY* has a mean of 53.7 years, which is not surprising since the average board tenure is required to be higher for this data set. The share of female board members (*FemD_PY*) is 11.8% on average while the share of independent board of directors (*IndD_PY*) is 72.2%. Average board tenure (*AvgBT_PY*) has a mean of 16.85 years, which is higher than in Table 6 and is expected since the data is filtered on companies with an exceeding average board tenure of 14 years. The mean value of *Ratio* is 1.79 while the average value for the leverage (*Lev*) is 2.5. Lastly, the average value for total average assets (*TotAA*) in logarithmic form is 8.1 while the average value for sales (*Sales*) in logarithmic form is 7.25.

4.2 Regression Model's Output

Table 8: Multiple Linear Regression Output Model 1

	Dependent variable:		
	ROAA	ROAE	TQ
	(1)	(2)	(3)
BTStdev_PY	0.0002	0.001	0.002
	(0.0003)	(0.001)	(0.006)
BS_PY	−0.0001	0.001	−0.004
	(0.0004)	(0.002)	(0.008)
AvgAge_PY	−0.0001	−0.001*	−0.004**
	(0.0001)	(0.0004)	(0.002)
FemD_PY	0.031***	0.027	0.433***
	(0.007)	(0.030)	(0.140)
AvgBT_PY	0.001***	0.003***	0.021***
	(0.0003)	(0.001)	(0.006)
IndD_PY	−0.025***	−0.008	−0.364**
	(0.007)	(0.031)	(0.144)
logTotAA	−0.024***	−0.088***	−0.497***
	(0.001)	(0.004)	(0.020)
Lev	−0.001***	0.032***	−0.027***
	(0.0002)	(0.001)	(0.003)
logSales	0.030***	0.104***	0.372***
	(0.001)	(0.004)	(0.019)
Constant	0.027	−0.038	2.307***
	(0.023)	(0.094)	(0.439)
Observations	10,633	10,633	10,633
Note:		*p<0.1; **p<0.05; ***p<0.01	

The table shows the regression output from Model 1, where the result from the dependent variables are shown in each column.

Table 9: Multiple Linear Regression Output Model 2

	Dependent variable:		
	ROAA	ROAE	TQ
	(1)	(2)	(3)
Ratio	−0.0003	−0.001	0.038
	(0.001)	(0.004)	(0.024)
BS_PY	−0.0002	0.001	−0.005
	(0.001)	(0.002)	(0.014)
AvgAge_PY	−0.0001	−0.0005	−0.006*
	(0.0002)	(0.001)	(0.004)
FemD_PY	0.046***	0.013	−0.319
	(0.013)	(0.046)	(0.276)
AvgBT_PY	0.001**	0.005***	0.014
	(0.0004)	(0.002)	(0.010)
IndD_PY	−0.040***	0.015	−0.485*
	(0.012)	(0.042)	(0.254)
logTotAA	−0.023***	−0.089***	−0.473***
	(0.002)	(0.007)	(0.040)
Lev	−0.001***	0.032***	−0.019**
	(0.0003)	(0.001)	(0.007)
logSales	0.028***	0.103***	0.389***
	(0.002)	(0.006)	(0.037)
Constant	−0.027	−0.245	0.229
	(0.047)	(0.169)	(1.013)
Observations	3,176	3,176	3,176
Note:			*p<0.1; **p<0.05; ***p<0.01

The table shows the regression output from Model 2, where the result from the dependent variables are shown in each column.

Table 10: Multiple Linear Regression Output Model 3

	Dependent variable:		
	ROAA	ROAE	TQ
	(1)	(2)	(3)
Ratio	0.001	0.001	0.117**
	(0.002)	(0.005)	(0.050)
BS_PY	−0.0003	0.001	0.031
	(0.001)	(0.003)	(0.028)
AvgAge_PY	−0.0003	−0.0004	−0.002
	(0.0003)	(0.001)	(0.007)
FemD_PY	0.104***	0.259***	−0.573
	(0.025)	(0.058)	(0.590)
AvgBT_PY	0.001	0.008***	0.034
	(0.001)	(0.002)	(0.024)
IndD_PY	−0.030	−0.077	−1.737***
	(0.023)	(0.053)	(0.544)
logTotAA	−0.026***	−0.111***	−0.364***
	(0.004)	(0.010)	(0.098)
Lev	−0.00001	0.047***	−0.044*
	(0.001)	(0.002)	(0.025)
logSales	0.033***	0.132***	0.337***
	(0.004)	(0.009)	(0.091)
Constant	−0.069	−0.337**	−0.192
	(0.070)	(0.165)	(1.687)
Observations	871	871	871
Note:			*p<0.1; **p<0.05; ***p<0.01

The table shows the regression output from Model 3, where the result from the dependent variables are shown in each column.

Independent Variables Model 1

Having used the Regression Model 1 outlined in Section 3.3, we tested to see if there exists a linear relationship between firm performance in the form of *ROAA*, *ROAE* and *TQ* with board tenure standard deviation (*BTStdev_PY*). This was tested with three different regression models where the dependent variable, measured as firm performance, was changed between the models. As can be seen in Table 8 these three models are summarized in separate columns.

The first column in Table 8 summarizes the regression where *ROAA* is the dependent variable. From the table, one can deduct that there exists a small positive relationship between *ROAA* and *BTStdev_PY*, however, the relationship is not significant. Thus, with regards to hypothesis 1, it can be discarded at the significance level of 5%.

The second column in Table 8 summarizes the regression in which *ROAE* is the dependent variable. With *ROAE* there exists a small positive relationship with *BTStdev_PY*, but it is not significant and thus hypothesis 1 can be discarded at the significance level of 5% here as well.

The third column in Table 8 summarizes the regression where *TQ* is the dependent variable. Similar to *ROAA* and *ROAE*, there exists a positive relationship between *TQ* and *BTstdev_PY* but is not shown to be significant. Thus, hypothesis 1 can once again be discarded at the significance level of 5%.

To summarize the results from Table 8, we can say that there is no significant relationship between board tenure diversity and firm performance in the forms of *ROAA*, *ROAE* and *TQ*.

Independent Variables Model 2

With the use of linear regression in Model 2 outlined in Section 3.3, the relationship between firm performance (*ROAA*, *ROAE*, and *TQ*) and the variable *Ratio* is tested. Three regression models are presented in separate columns in Table 9.

The first column in Table 9 shows that *Ratio* has a small negative relationship with *ROAA*. However, the relationship is not significant indicating that hypothesis 2 can be discarded at the significance level of 5% for *ROAA*.

The second column in Table 9 shows that the relationship between *Ratio* and *ROAE* is negative. In fact, it is just as small as the relationship between *Ratio* and *ROAA* but similar to that case, it is not deemed to be statistically significant. Thus, hypothesis 2 can be discarded at the significance level of 5% for *ROAE* as well.

Lastly, the third column in Table 9 shows a positive relationship between *Ratio* and

TQ. However, it is also not statistically significant which leads us to reject hypothesis 2 at the significance level of 5% also for Tobin's Q.

Independent Variables Model 3

Using linear regression in Model 3 as outlined in 3.3, the relationship between firm performance (*ROAA*, *ROAE* and *TQ*) and the variable *Ratio* is tested. The results from regression Model 3 is presented in Table 10 where each column represents the three dependent variables.

The first column in Table 10 shows the relationship between *Ratio* and *ROAA* and that there is a small positive relationship between the variables. However, there is no statistical significance in the relationship, which means that hypothesis 2 can be discarded at the 5%-level for *ROAA*.

The second column in Table 10 highlights that there is a small positive relationship between *Ratio* and *ROAE*. However, similar to the case with *ROAA*, the relationship is not statistically significant and thus hypothesis 2 can be discarded at the significance level of 5% for *ROAE* as well.

In the third column in Table 10, the relationship between *Ratio* and *TQ* is highlighted, and it indicates that a positive relationship with a statistical significance of 5% exists. An interpretation of this result is that increasing the value of *Ratio* will increase the value *TQ*. A higher value of *Ratio* is achieved when *AvgAge_PY* is large in relation to *BTStdev_PY*.

Control Variables Model 1

In Table 8, one can study the relationships between the dependent variables and the control variables. Starting by looking at *BS_PY*, it has a negative relationship with *ROAA* and *TQ*, but for *ROAE* it has a positive relationship. In all three cases, there is no statistical significance in either direction.

AvgAge_PY shows a negative relationship with all three dependent variables and for *ROAE* and *TQ* it is statistically significant on the levels 10% and 1% respectively. This implies that increasing the average age of the board members will have a negative impact on both *ROAE* and *TQ*.

FemD_PY shows a positive relationship with all three dependent variables, and for both *ROAA* and *TQ* the relationship is significant on a 1% level implying that increasing the relative female representation in a board has a positive impact on firm performance.

Avg_BT shows a positive relationship with all three dependent variables, and for all three it is also statistically significant at the level of 1%. This is in-line with the findings of Livnat et

al. (2021) with firm performance and average board tenure having a positive relationship.

Ind_PY shows a negative relationship with the dependent variables and is only significant for *ROAA* at a 5%-level. This is an interesting finding as it points towards that having more independent directors yields a worse *ROAA*.

TotAA in logarithmic form shows a negative relationship with all three dependent variables at the significance level of 1%.

Lev shows a significant negative relationship with *ROAA* and *TQ* at the significance level of 1% while showing a positive significant relationship with *ROAE* at the level of 1%. Since these are contradictory findings, one cannot draw any conclusions about these variables and their relationships to firm performance.

Sales in logarithmic form shows a positive significant relationship with all three dependent variables at a significance level of 1% implying that increasing sales has a positive impact on firm performance.

Control Variables Model 2

From Table 9 the relationship between the dependent and control variables are visible. The first control variable is *BS_PY* and its relationships with *ROAA* and *TQ* are both negative while the relationship is positive with *ROAE*. However, none of the relationships are statistically significant and thus no relationship between the variables can be confirmed.

AvgAge_PY shows a negative relationship with all three dependent variables, and for *TQ* it is statistically significant on a 10% level which indicates that a decrease in the average age in a board will increase Tobin's Q. However, this is not significant according to our significance threshold of 5%.

FemD_PY shows a positive relationship with both *ROAA* and *ROAE* while it shows a negative relationship for *TQ*. For *ROAA* the relationship is statistically significant at a 1%-level indicating that *ROAA* increases if there is an increase in the proportion of female board members.

AvgBT_PY shows a positive and statistically significant relationship with all three dependent variables. For *ROAA* and *ROAE* the relationship is significant at 5% and 1% respectively. For *TQ* the relationship is significant at the 10%-level, which is above our significance threshold. This indicates that the higher the average board tenure is, the higher the *ROAA* and *ROAE* which is in-line with the findings of Livnat et al. (2021). Furthermore, one should remember that this is for firms where the average board tenure is a minimum of 10 years indicating that this trend continues.

Ind_PY shows a negative relationship with *ROAA* and *TQ* where the relationships are statistically significant at 1% and 10% respectively. However, since our acceptable significance level is 5%, the results for *TQ* are considered to be non-significant. For *ROAE* the relationship is positive but not significant. The significant relationship with *ROAA* is interesting as it points to that a lower proportion of independent directors increases the firm performance for firms where the average board tenure is above 10 years. This is usually where previous literature, such as Huang and Hilary (2018), indicate that the probability of entrenchment increases and that it is negative for firm performance. If one is to make the assumption that the probability of entrenchment increases with the time a board member stays on the Board, our data suggests that this does not necessarily lead to decreased firm performance. In fact, it suggests the opposite. However, this is a cause where correlation could be high but causation very small.

TotAA in logarithmic form shows a negative significant relationship with all three dependent variables on a 1%-level. This indicates that reducing the total average assets in logarithmic form will increase firm performance.

Lev shows different results for the three dependent variables. For *ROAA* there is a negative relationship on the significance level of 1%. In the case of *TQ* there is also a negative relationship but at the significance level of 5%. Lastly, for *ROAE* there is a positive relationship at the significance level of 1%.

Sales in logarithmic form shows a positive relationship with all three dependent variables on a significance level of 1%.

Control Variables Model 3

From Table 10 the relationships between the control variables and the dependent variables are presented. For the first control variable *BS_PY*, the relationship with *ROAA* is slightly negative, while it is slightly positive for *ROAE* and *TQ*. However, none of them are statistically significant.

AvgAge_PY shows a negative relationship with all three dependent variables. However, none of the variables are statistically significant, indicating that no conclusion regarding a significant relationship can be drawn.

FemD_PY shows a positive relationship with *ROAA* and *ROAE* but a negative relationship with *TQ*. For *ROAA* and *ROAE* the relationship is significant at a 1%-level, whereas the relationship with *TQ* is not significant at all. This would indicate that an increase in the proportion of female directors on a board would increase firm performance for *ROAA* and *ROAE*.

AvgBT_PY shows a positive relationship with all three dependent variables. However, the only variable showing a relationship that is statistically significant is *ROAE*, and it does

so on the significance level of 1%. The constant which indicates a positive linear relationship between *ROAE* and *AvgBT_PY* is 0.008 which is very small. Thus, a conclusion can be that there exists an extremely small significant relationship between *ROAE* and *AvgBT_PY*.

IndD_PY has a negative relationship with all three dependent variables. However, for *ROAA* and *ROAE* the relationship is not significant, but it is for *TQ*. The level of significance for *TQ* is 1%, which indicates that firm performance increases if the number of independent directors decreases. An interpretation of this result could be that even though the probability of entrenchment increases when having fewer independent directors, the firm performance may increase.

TotAA in logarithmic form shows a negative relationship with all three dependent variables on the significance level of 1%.

Lev shows a negative relationship with *ROAA* and *TQ* but a positive relationship with *ROAE*. For all three cases, the relationship is statistically significant on the 1%-level.

Sales in logarithmic form shows a positive relationship with all three dependent variables on a statistically significant level of 1%.

4.3 Robustness Test of Model 1

As was mentioned in Section 3.6, the evaluation of VIF-scores in Model 1 suggested that the variable *AvgAge_PY* might be multicollinear, which could affect the reliability of the model. However, as discussed, there is a trade-off between having a model that includes relevant control variables for what we want to test, and having a model that is meeting the requirements of a statistical model, such as not being a multicollinear model. That being said, we argued that since *AvgAge_PY* is a control variable, the VIF-score would not affect the outcome of the model. In order to check the robustness of the model, a new regression model similar to Model 1, but excludes the control variable *AvgAge_PY*, has been conducted (called Model 4). The results of the model (see Table 13 in Appendix) suggest that with regards to the dependent variables and the independent variables, there is no change in terms the significance of the variables' relationships. *BTStdev_PY* is still positively related to *ROAA*, *ROAE* and *TQ*. But similarly to Model 1 with *AvgAge_PY*, it is not statistically significant. With regards to the control variables, the results follow the same trend as for Model 1. Thus, one can conclude that the robustness of Model 1 holds as a removal of a potentially multicollinear variable yields the same conclusion. For that reason, Model 1 can be considered to be legit model for this study.

5 Discussion

We wanted to examine whether having a high board tenure diversity would lead to increased financial performance, more specifically, if high board tenure diversity increases *ROAA*, *ROAE* and *TQ*. The findings of the regressions in Section 4.2 show that there was no significant linear relationship relating board tenure standard deviation (*BTStdev_PY*) with firm performance (*ROAA*, *ROAE* and *TQ*). The results therefore fail to find any definite general relationship between board tenure diversity and firm performance. One potential reason for the results could be explained by Li and Wahid (2018). They argue that board tenure diversity increases the Board's ability to monitor the CEO and that the diversity, in theory, should make the Board more willing to replace the CEO in case of poor firm performance. However, they also mention that there is support for an opposite reaction due to the lack of consensus on the Board. More perspectives may lead to more indecisiveness and disagreement on which action to take, which can make more tenure diverse boards less effective. This might explain why there is no concluding evidence in Model 1 whether board tenure diversity increases or decreases firm performance. For some firms, it may lead to better firm performance where decisive action can still be taken while in other organizations, it may lead to ineffectiveness.

One could also argue that the positive performance of the S&P1500 index during the period from when the data is collected has been good and thus favoured more risk taking. Ji et al. (2021) found that tenured diverse boards tend to make less risky investment decisions while the opposite is generally true for lower tenure diversity. However, the S&P1500 has seen a compounded annual return since 2013 of roughly 13.65%, meaning the economic environment has been relatively good during the period of our data (Financial Times, n.d.). During periods where the economic environment is good, more risk-taking may be favoured over risk-aversion. This could be a part of the explanation why a positive relationship between board tenure diversity and firm performance was not found.

Nonetheless, we do want to point to some other interesting findings from Model 1, one of them being that there is a significant negative relationship between independent directors (*IndD*) and firm performance for *ROAA* and *TQ*. This supports the findings of Fernandes (2008), outlined in Section 2.2, that independent directors are not necessarily good for firm performance. In addition, we see that the positive effect from increased gender diversity (*FemD*) on the board is greater than the negative effect from independent directors. This could be argued to support Liu et al.'s (2014) results that the Board's gender diversity is more important for firm performance than the number of independent female directors is, mentioned in Section 2.2. Even if we have not made any distinction between the genders of the independent directors, Liu et al.'s

results seem to hold for a generalized set of independent directors.

Important to note is also the positive relationship between average board tenure and firm performance for all three types of dependent variables. This is in-line with Livnat et al. (2021) as they found that longer board tenure implied better firm performance. We also argue that this is in-line with Huang and Hilary's (2018) findings to some extent since they found a positive relationship up to an average board tenure of 10 years.

In our second hypothesis, we tried to make sense of the paradox created by Huang and Hilary's findings of decreasing firm performance when exceeding a specific average board tenure and the contradicting findings of both Bonini et al. (2022) and Livnat et al. (2021) who all suggest that longer board tenures increase firm performance. Using data only from the firms that were above the threshold suggested by Huang and Hilary of 10 years in Model 2 and incorporating a ratio of average board tenure and board tenure standard deviation, we theorized that the lower the ratio is – meaning, the greater the tenure diversity in relation to the average board tenure – the better the firm performance. But we found no such evidence, i.e., the results were not significant of a negative relationship between the ratio and firm performance. Therefore, using Huang and Hilary's suggested empirical optimal average board tenure as a threshold, we could not align the different studies using board tenure diversity as its link.

There have been other studies made on the subject however, with one of them being Beckvid and Erikson (2021) who made a similar study on the Swedish market. They found another optimal average board tenure of roughly 14 years instead. In Model 3 we used that threshold instead and found a positive relationship between the ratio and Tobin's Q on the significance level of 0.05. This was a completely contradicting result to our hypothesis in which we theorized of a negative relationship. But according to our data and model, there is support for that a higher average board tenure in relation to a lower board tenure standard deviation increases firm performance measured in Tobin's Q.

To try to understand our findings, we first note that Tobin's Q is a measure constructed using the shareholders' perceived valuation of the company, i.e, the metric incorporates firms' market values, which is set by the people and institutions buying and selling shares in the companies. Bonini et al. (2022) looked at long-tenured independent directors – long-term being defined as a tenure exceeding 15 years – and found evidence of a negative reaction when a director with that trait died. This indicates that the general perception of having such directors serving on the Board is positive. Even if we do not distinguish between dependent and independent directors on an individual level, we still argue that shareholders might perceive long-tenured directors as something good, even if that may not be true.

We should note that we are here focusing on firms with an average board tenure above

14 years, which provides us with a sample of relatively few firms and that may have an impact on our results – it gives room for some observations to influence the model to an extent that may affect its robustness. In-line with this reasoning is the observation that the average value of Tobin's Q for the sample used in Model 3 is larger than for Model 1 and 2, but the standard deviation is also larger, which indicates that there may be some firms with abnormally high Tobin's Q in the data set used in Model 3 that cause our results.

Adding to the general discussion of board tenure diversity, we want to add a quick note on how we measure board tenure diversity. We decided to use the standard deviation of the tenures to do this, however, another way one could measure the composition of the board with respect to board tenure is to look at the maximum difference of tenures in the board, i.e., use the tenure difference between the longest and shortest serving member on the board. The reasoning in the hypothesis development may hold as long as there is just one individual director who has served a shorter time than the others, and vice versa. More specifically, if the Board has a high average board tenure, it may be enough to just have one short-tenured member to change the firm performance. The best measure for this may not be standard deviation, but rather the maximum difference in board tenure or something else. It would be interesting to test these results with such a metric as well.

Continuing on the subject of the metric used, the ratio in the second hypothesis may have played a role in the results we saw. The ratio works in the following way, when the average board tenure is high in relation to board tenure diversity, the ratio will also be high and vice versa. However, this may create an issue when the average board tenure becomes large since the board tenure diversity may not increase with the same rate. Thus, as the average board tenures become very high, their corresponding tenure diversity may also be high relative to other firms, but the tenure diversity's effect on the ratio might be less and therefore not show a comparable output for all average board tenures. This might have been a flaw in the way we tested our second hypothesis.

6 Conclusion

In this paper, we have studied whether board tenure diversity has an impact on firm performance. We have found no evidence that board tenure diversity has any effect on Return On Average Assets, Return On Average Equity and Tobin's Q. We also looked specifically at the companies with an average board tenure above the optimal value found empirically by Huang and Hilary (2018) in an attempt to align their evidence of decreasing firm performance above that threshold with the results of Livnat et al. (2021) and Bonini et al. (2022). We failed to align those

findings using Huang and Hilary's empirical threshold of 10 years. However, when doing the same test with an optimal average board tenure of 14 years, suggested by Beckvid and Erikson (2021), we found a positive relationship between Tobin's Q and the ratio between having high average board tenure in relation to low board tenure diversity. This was against our hypothesis. Moreover, our findings suggest that board tenure diversity has no effect on firm performance in general, but when looking at firms with a high average board tenure, board tenure diversity has a significant negative impact on firm performance.

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Appendix

Table 11: Summary of Models

	Belongs to	Independent Variable	Unique Factor
Model 1	Hypothesis 1	*BTStdev_PY*	Standard Model 1
Model 2	Hypothesis 2	*Ratio*	*AvgAge_PY* > 10
Model 3	Hypothesis 2	*Ratio*	*AvgAge_PY* > 14
Model 4	Hypothesis 1	*BTStdev_PY*	Model 1 with *AvgAge_PY* removed

Table 12: Summary of Financial Ratios

Variable	Formula
Average Assets	$AverageAssets = \frac{Total\ Assets\ (IB)+Total\ Assets\ (OB)}{2}$
Average Equity	$Average\ Equity = \frac{Total\ Equity\ (IB)+Total\ Equity\ (OB)}{2}$
Market Value (MV)	$MV = Price/Share * Total\ Shares\ Outstanding$
Return on Average Assets (ROAA)	$ROAA = \frac{Net\ Income}{Average\ Assets}$
Return on Average Equity (ROAE)	$ROAE = \frac{Net\ Income}{Average\ Equity}$
Tobin's Q (TQ)	$TQ = \frac{Market\ Value}{Average\ Book\ Value\ of\ Assets}$
Average Board Tenure (AvgBT)	$AvgBT = \frac{\sum Individual\ Board\ Tenures}{Board\ Size}$
Board Tenure Diversity (BTStdev)	BTStdev = $\sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \mu)^2}$ *
Ratio	$Ratio = \frac{Average\ Board\ Tenure}{BTStdev}$

* $n = Board\ size,\ x_i = Individual\ Board\ Tenure,\ \mu = Average\ Board\ Tenure$

Table 13: Multiple Linear Regression Output Model 4

	Dependent variable:		
	ROAA	ROAE	TQ
	(1)	(2)	(3)
BTStdev_PY	0.0002	0.001	0.003
	(0.0003)	(0.001)	(0.006)
BS_PY	−0.0001	0.001	−0.004
	(0.0004)	(0.002)	(0.008)
FemD_PY	0.031***	0.028	0.443***
	(0.007)	(0.030)	(0.140)
AvgBT_PY	0.001***	0.003**	0.019***
	(0.0003)	(0.001)	(0.005)
IndD_PY	−0.026***	−0.010	−0.379***
	(0.007)	(0.031)	(0.144)
logTotAA	−0.024***	−0.088***	−0.498***
	(0.001)	(0.004)	(0.020)
Lev	−0.001***	0.032***	−0.027***
	(0.0002)	(0.001)	(0.003)
logSales	0.030***	0.104***	0.371***
	(0.001)	(0.004)	(0.019)
Constant	0.027	−0.035	2.326***
	(0.023)	(0.094)	(0.440)
Observations	10,633	10,633	10,633
Note:		*p<0.1; **p<0.05; ***p<0.01	