WHICH BOARD-RELATED VARIABLES AFFECT FIRM PERFORMANCE

Evidence from European companies

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Examiner: University Lecturer, Roman Stepanov

ABSTRACT

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The European economy has suffered for multiple reasons during the last five years, such as the coronavirus pandemic and the unstable political environment in Europe. The importance of company boards is emphasized during a crisis since the company's strategy faces pressure to adapt to the new situation.

This thesis aims to identify which board-related variables affect firm performance in the European operating environment. Additionally, results are observed over five years starting from a year before the outbreak of the coronavirus pandemic. The thesis gathers the essential variables from agency theory and resource-dependence theory and uses stepwise regression to identify the best models to explain changes in the firm performance measures.

The empirical section of the study implies that variables explaining the changes in performance measures most significantly are the size of the board and the frequency of board meetings over the whole five-year period. These variables are consistently in an inverse relationship with firm performance measures. However, the explanatory value of all models remains notably low, and not all assumptions of linear regression are met.

A temporal review shows that when the crisis begins, some of the variables that were significant before the crisis, such as the average board tenure and the total compensation of board members, no longer explain the variation in firm performance. However, after the crisis has begun, the results produce reasonably consistent models.

TIIVISTELMÄ

Lappeenrannan–Lahden teknillinen yliopisto LUT

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Kauppatieteet

Karoliina Lamminpää

Mitkä hallitukseen liittyvät muuttujat vaikuttavat yritysten suoriutumiseen - Evidenssiä Eurooppalaisista yrityksistä

Kauppatieteiden kandidaatintyö

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Euroopan talous on kärsinyt viimeisenä viitenä vuotena useasta rasitteesta, kuten koronapandemiasta, sekä epävakaasta poliittisesta ympäristöstä Euroopassa. Yritysten hallitusten merkitys korostuu kriiseissä, joissa yrityksen strategia kohtaa painetta mukautua uuteen tilanteeseen.

Tämän kandidaatin tutkielman tavoitteena on selvittää mitkä hallitukseen liittyvät muuttujat vaikuttavat yrityksen suoriutumiseen eurooppalaisessa toimintaympäristössä. Lisäksi havaintojen tuloksia tarkastellaan viiden vuoden tarkastelujaksoissa, jotka alkavat vuosi ennen koronakriisin puhkeamista. Tutkimus kokoaa agenttiteoriasta ja resurssiriippuvuusteoriasta olennaiset muuttujat, ja hyödyntää stepwise analyysiä tunnistaakseen parhaat mallit kuvaamaan yritysten suoriutumiskyvyn muutoksia.

Tutkielman empiirinen osio implikoi, että yrityksen suoriutumisen vaihtelua ennustaisi johdonmukaisesti parhaiten valituista muuttujista hallituksen koko ja hallituksen kokousten tiheys koko tarkastelujakson ajan. Nämä muuttujat ovat johdonmukaisesti käänteisessä riippuvuussuhteessa yrityksen suoriutumisen kanssa. Mallien selitysaste jää kuitenkin analyysissä huomattavan alhaiseksi, eivätkä kaikki lineaarisen regression oletukset täyty.

Ajallinen tarkastelu osoittaa, että kriisivuosien alkaessa osa ennen kriisiä merkitsevistä muuttujista kuten hallituksen jäsenten keskimääräinen toimikausi ja hallituksen kokonaiskompensaatio ei enää selitä yrityksen taloudellisen suoriutumisen vaihtelua. Kriisin alusta eteenpäin tulokset tuottavat kuitenkin kohtuullisen johdonmukaisia malleja.

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1. Introduction

This thesis examines the impact of board composition on firm performance in European companies combining elements of agency theory and resource dependence theory. There has been extensive research on the relationship between the composition of the board of directors and firm performance dealing with these two theories separately and some suggestions to the combined aspect. The discussion in the scientific environment has been livened up in recent years when in 2022 the European Parliament officially approved the EU law on the gender distribution of company boards, which aims to change the legislation on the quota of underrepresented gender in the management of companies. The goal of the reform is to have an underrepresented gender represented on the boards of member states' companies, in percentages of 40% of non-executive members or 33% of all board members by 2026. (European Commission, 2022) The law significantly changes the composition of the board of directors and may increase interest in continuing to develop equality in boards in the future. While the law is gradually implemented in the national law of member states, and companies, it is timely to re-evaluate and develop research on the connections between the composition of the board of directors and firm performance of companies in the European region.

The recovery of the European economy after the pandemic has not been simple. There have been tensions in the European political environment in recent years, which have affected freedom of international trade. Thus, the issue of companies' performance becomes topical since companies are nevertheless an important component in terms of economic recovery in Europe. The successful performance of companies, for which the board is responsible, enables employment and growth in the region. Unfortunately, studies on the impact of board composition on firm performance are highly concentrated in the United States due to the availability and comparability of European data. (Belcredi & Ferrarini, 2013). The purpose of the thesis is to help fill the research gap in the studies conducted in the European continent and offer an insight into which factors in the composition of the board affect the performance of the companies operating at the center of our societies.

1.1 Significant variables from previous literature

Several studies examining the sources of firm performance, appear to have similar significant variables such as the size, independence, and gender distribution of the board of directors. Due to their historical significance, they are interesting variables for the study. Yermack (1996) found in the data collected from 1984 to 1991 of 452 large U.S. industrial corporations, that a small board of directors is positively associated with higher firm value measured by Tobin’s Q. Roffia, Simón-Moya and García (2022) stated that they did not find any connections between board size and performance. These are in contrast to other studies such as the findings of Jackling & Johl (2009) on Indian companies, which found that a larger board of directors improves performance as measured by return on assets and Tobin's Q. It appears that the literature has different views on the relationship between the variable, which increases the need to study the topic further.

Regarding gender distribution, Adams & Ferreira (2009) concluded in their study, that diversity on boards has a positive impact on firm performance only in firms in which governance is otherwise weak measured by its resistance to takeovers. On the other hand, for firms that have strong governance, gender quotas may decrease shareholder value explained by female board members’ tendency to over-monitor. The data in this study was collected in 1996–2003 mostly from Standard and Poor’s. Performance is measured by return on assets and Tobin’s Q variations. Belcredi & Ferrarini (2013) find a strong positive connection between profitability and gender distribution but point out that direct causal relationships should not be derived from the results of the study.

In a study investigating connections between board structures and companies’ financial performance in Indian companies, it was found that the amount of independent directors on boards is positively related to firm performance. The connections were measured by return on assets and Tobins Q. (Jackling & Johl, 2009) Also Belcredi & Ferrarini (2013) found a positive relationship between firm performance and the number of independent directors but point out that the degree of explanation is not great. Roffia, Simón-Moya and García (2022) do not find a connection between independent board members and firm performance examining small and medium-sized enterprises.

1.1 Research questions & objective

The objective of this thesis is to determine which board-related variables explain the changes in firm performance significantly and the main research question therefore is formatted as follows:

WHICH BOARD-RELATED VARIABLES AFFECT FIRM PERFORMANCE?

Expressed in more detail, the main goal of the thesis is to investigate the significance of the selected independent variables in the variation of return on assets, return on equity, and Tobin's Q by forward stepwise regression. In order to expand the understanding of the topic, the study examines the effect of significant variables on performance variables, as well as the temporal variation of the results. Therefore, the sub-questions are as follows:

1. *IS THERE A POSITIVE OR NEGATIVE RELATIONSHIP BETWEEN THE SIGNIFICANT BOARD-RELATED VARIABLES AND FIRM PERFORMANCE?*
2. *ARE THERE DIFFERENCES IN THE OBSERVED CONNECTIONS BETWEEN THE YEARS 2019 AND 2023?*

1.2 Research structure & limitations

The structure of the thesis follows mainly the IMRD formula. It progresses from the introduction to the theoretical framework and literature review, after which the research methodology and the data used are presented in more detail. Together, these create the basis for the presentation of research results, from which conclusions are finally drawn, and opportunities for further research are presented.

The study is conducted as a quantitative analysis and chosen variables are reasoned more thoroughly later in the paper. The research is primarily centered around two theories: agency theory and resource-dependence theory. The five cross-sectional datasets used in the research are collected from the Refinitiv database. The group that is investigated is limited to Stoxx Europe 600 -index companies, which consists of mid, and smallcapitalization companies all around Europe (Stoxx, n.d.). The total population sampling method is used as the data collection method. The study is limited to the years 2019-2023, as this brings a unique perspective to the subject due to Covid-19 affecting many aspects of business during that time.

The thesis is limited by the unavailability of primary literature concerning the theoretical framework. Due to this, it has been necessary to rely on the use of secondary sources for some references. The reference method of secondary sources follows the instructions of the Language Center of the University of Helsinki (n.d.).

2 Theoretical framework and literature review

Among the theories related to management, agency theory, and resource-dependence theory have received the most attention when considering the connections of composition of the board of directors and firm performance. Hillman & Daniel (2003) suggest combining these theories since directors are engaged in monitoring the executives usually through remuneration and are in charge of providing resources and advising the executives. In addition to deep diving into these two theories, the theoretical framework provides a deeper understanding of the concepts, theories, and literature related to the topic.

2.1 Board of directors

The board of directors is the brain of the company. It consists of different committees depending on the firm’s specific needs. These committees usually deal with audit and risk, remuneration and people, and technology and investment. Often one of the most important tasks of the board is the fiduciary duty towards the company's shareholders. In practice, the board's duties may include monitoring that the strategic goals are in line with the company's long-term goals. The board is also responsible for hiring and firing the company's CEO, evaluating performance measures, and deciding on the remuneration of top management. (Croci, 2018) Jensen and Murphy (1990) would even place the proper formation of management incentives as one of the most critical tasks of the board.

The board has a responsible role in the decision-making and supervision of the limited company, as stated for example in the Finnish Limited Liability Companies Act (624/2006, Chapter 6, 2&3 §). In addition to the administrative responsibility of the board, the main goal of a limited company is to generate profit for shareholders (Finnish Limited Liability Act, 624/2006, Chapter 13, 29 §), which guides the board's activities. According to Hillman & Daniel (2003) & Lahlou, I. (2018) corporate boards have two important duties that are based on the two theories. Firstly, to supervise that the management acts in accordance with the interests of shareholders and secondly, to provide especially human capital to advise the management in strategic decisions. The board defined by Magnanelli

& Pirolo (2021) is the company's institutional body, which is directly appointed by the shareholders, and which supervises the activities and strategies of the company's management.

The legal text, book, and peer-reviewed journals are not far apart in their definitions. All of them emphasize in their own way the board's obligation to act in accordance with the company's interest in terms of supervision, governance, and the pursuit of profit. The obligations formed are reasonable considering the company's continuity and influence. Monitoring and profitable activities are not only important for individuals but also for several stakeholders (Magnanelli & Pirolo, 2021). Companies are major employers and taxpayers for the regions. Although the assigned duties only concern the company's affairs, the responsibility can also be seen as societal.

2.2 Firm performance

According to Richard, Devinney, Yip, and Johnson, there is a lot of variation in the use and construction of company performance measures, despite their recognized importance. Several indicators are used unsystematically to measure performance, which makes comparability of studies and calculations in the field difficult. Richard and his colleagues have attempted to clarify performance measurement by first dividing it into organizational effectiveness and organizational performance, and the latter into three more categories: financial performance, product market performance, and shareholder return. (Richard, Devinney, Yip, Johnson, 2009)

Out of the three categories, financial performance is a significant category for the thesis. According to Richard et al. (2009), financial performance measures contain profits, return on assets, and return on investment. Several publications researching the topic use the return on assets figure to describe financial performance (Jackling & Johl, 2009; Adams & Ferreira, 2009; Yermack, 1996). However, Tobin's Q is often seen alongside this figure. Tobin's Q is described in Richard et al. (2009) as a hybrid of an accounting figure and a financial measure. The figure is popular among these hybrid measures and is seen to take operational performance risks into account, which are often overlooked in financial performance metrics.

2.3 Agency Theory

One of the most famous articles leading to modern agency theory is Michael Jensen and William Meckling's 1976 article “Theory of the firm: managerial behavior, agency costs, and ownership structure” (Pepper, 2019). Agency theory is a widely known concept in the field of economics about the diverging interests of the principal and the agent. Jensen & Meckling explain the theory so that there are two parties, the principal and the agent. The principal transfers decision-making authority to the agent. If both parties are supposed to maximize their own benefit, a conflict of interest arises. Correcting this conflict causes agency costs, often paid by the principal. The agency theory therefore suggests that supervision and remuneration of the agent play an important role in the fact that the agent acts in accordance with the interest of the principal. (Pepper, 2019 [Jensen & Meckling, 1976]). Often in economics, the agency theory is applied to the relationship between executive management (agent) and shareholders (principal). This application aims to find a way to unify the interests of the management and the shareholders. Agency theory is divided into two main directions, incentives, and supervision.

2.3.1 Incentives

Incentives are means of combining the interests of management and shareholders. They can be used to steer the management's interests away from the pursuit of self-interest and closer to the interests of the shareholders. Hillman & Daniel (2003) mention in their publication that agency theorists have concluded that the effectiveness of board supervision, which leads to better firm performance, depends on board incentives. These incentives include salary, bonuses, stock options, and stock ownership to name a few. According to a publication by Jensen and Murphy (1990) that focuses on CEO compensation, the manner in which compensation is given matters more than the amount of compensation itself, in terms of the firm performance. Jensen (1993) also mentions this in his own publication, stating that when the board members own the shares of the company, they are affected by the consequences of their actions. By strengthening the relationship between performance and remuneration, it is possible to reward well-performing managers fairly and concretely combat bad leadership by tying the manager's remuneration to the company's success. In this way, average managers' salaries will not rise just because well-performing managers would demand fair compensation for their work. (Jensen & Murphy, 1990) Similar ideas are also found in contemporary literature. Kostyuk, Stiglbauer, and Govorun (2016), still present tens of years later the support for performance-related remuneration over fixed remuneration.

Although the scientific discussion often focuses on CEO compensation, there are equally human people on the board whose interests may differ from the interests of the shareholders. Performance-linked remuneration mechanisms can be created by increasing the agent's share of the company, tying salary, bonuses, and options to performance, or setting a penalty for poor performance. (Jensen & Murphy, 1990) Board member's incentives may include meeting fees, fixed annual fees, travel expenses, bonuses, and stock ownership (Kostyuk et al., 2016). A great significant performance-related incentive could be stock ownership. If the board gets benefits from the company's good performance, it has a greater incentive to act effectively for the company at least in theory. In addition, companies often have documented information about this form of remuneration. Publications on the relationship between board remuneration and firm performance are few, and the existing literature produces conflicting results, as acknowledged in Lemma, Mlilo & Gwatidzo (2020).

2.3.2 Board independence

According to Nasdaq, independent directors are those who are not affiliated with the company, its key employees, or major suppliers or customers (Nasdaq, n.d.). According to Ferrarini & Filippelli (2014), there is no clear boundary to independent directors' share ownership, but a significance limit specific to the region can violate independence. Many stock exchanges such as Nasdaq require that the majority of the board of a listed company must consist of independent directors. Bathala & Rao (1995) state that agency literature sees the role of outside directors as monitors that can be used to mitigate or even resolve agency conflicts between management and shareholders. Moreover, Fama and Jensen [1983], who have made a significant contribution to agency theory, suggest in Wu, Sorensen, and Sun (2019) that a board with a majority of independent directors has more control over management's decisions than a board with fewer independent members. The essentiality of independent members on the board seems to be in line with the monitoring aspect of agency theory and therefore firm performance. This view is supported, for example, by Knyazeva, Knyazeva, and Masulis (2013), where it is presented that board independence has a positive relationship with company profitability and intensive-based management remuneration. Jackling & Johl, (2009) and Belcredi & Ferrarini (2013) studies also support the connection between independent members and company performance. Jensen (1993) contributed to the topic by stating that due to the impartiality of the board, the only inside board member should be the CEO. The literature seems to be reasonably unanimous about the importance of independent members to the success of the company.

2.3.3 Gender diversity

The examination of gender differences in monitoring, attendance, and decision-making confidence has emerged as a significant area of interest in research studies that explore gender representation among company boards. A theory that has become significant regarding the topic is Rosabeth Moss Kanter's [1977] critical mass theory, which states that there is a positive connection between company performance and female representation on the board when the representation has exceeded the critical mass of 30% (Joecks, Pull, Vetter, 2013). A recent study by Joecks, Pull, and Vetter (2013) that tested Kanter's theory found evidence of a critical mass of female representation on boards. The study stated that the critical mass would be between 20-40% of female presentation.

Adams & Ferreira, (2009) investigate in more detail the difference between women and men as board members. In their results, they summarized that a more gender-divided board is stricter in monitoring. They emphasize three findings in particular. Firstly, women tend to have higher attendance rates in board meetings. Secondly, the gender diversity of the board has a positive effect on the attendance activity of male directors, and thirdly, women are more likely to join monitoring committees. These findings seem to support the supervision aspect of agency theory. However, there is a contradiction between their findings and agency theory. Although monitoring seems to be stricter in diverse boards, they find a negative relationship between a more gender-distributed board and company performance. According to Adams & Ferreira, this finding applies to companies that have strict governance measured by their resistance to takeovers.

Adams & Ferreira's (2009) finding of a negative relationship between more gender-distributed boards and company performance could be explained by another research dealing with the subject. Hossain & Oon (2022) suggest in their study that in Germany, where there is stricter governance and higher transparency demands, board meeting frequency has a negative relationship with firm performance, and in Indonesia, where governance is less developed, the relationship is positive. Moreover, the same study found that independent female directors are associated with a higher frequency of board meetings in Germany.

2.3.4 Frequency of board meetings

In previous studies, the relationship between the frequency of board meetings and firm performance seems to have quite unanimous results and thoughts. Vafeas (1999) suggests that an efficient amount of board meetings could decrease agency costs. Additionally, Jensen (1993) finds that board meetings are ineffective since they contain many routine procedures to comply with the company's regulations. Therefore Jensen sees that boards should be relatively less active. Vafeas (1999) continues the topic by stating that board meetings are a quite costly method of supervision compared to insider ownership.

Another notable remark about the subject is that even if some studies have found an inverted relationship between the frequency of board meetings and firm performance (Vafeas, 1999; Hossain & Oon, 2022), which of these variables is the cause, and which one the effect. Jensen (1993) suggests that boards tend to have a requirement to meet more often during a crisis. Vafeas (1999) has also noted this and states that board meeting frequency increases when the share price lowers or when the firm is suffering a difficult era. Also Adams and Ferreira (2008) support this view. Overall the literacy seems to have a mutual view on the subject. It seems that the frequency of board meetings is not the most effective procedure of supervision and it has an inverted relationship with firm performance and value.

2.4 Resource-dependence theory

While agency theorists consider supervision and CEO remuneration to be the most important function of the board, resource dependence theorists value the board's provision of resources (Hillman & Daniel, 2003). Pfeffer's (1972) realization that board can help a company minimize its resource dependence on current resources, and help acquire new ones, has made a significant contribution to today's applications of resource-dependence theory. According to the theory, the board should have members who are able to provide human or other capital to the company, so that its independence from other stakeholders would increase.

Pfeffer and Salancik [1978], explain further in Jiang, Luo, Xia, Hitt, Shen (2023) the concept of resource dependence theory, and outline its essential propositions. This theory suggests that companies are interlinked with other organizations, and they unavoidably depend on them to obtain critical resources. Such reliance may limit a firm's independence and cause uncertainties in its operations and strategies. Therefore, companies are motivated to manage their resource exchanges and power dynamics to avoid or balance dependence constraints. However, the effectiveness of these dependence-managing strategies may be hindered by internal or external obstacles. For the thesis, two variables are studied based on the resource-dependence theory. These are the size of the board and dependent board members.

2.4.1 Board size

Board size is a variable that often appears significant in resource-dependence and agency theory-based firm performance studies. According to Kalsie & Shrivastav (2016), a positive connection between firm performance and the size of the board supports the agency and resource dependence theory and the inverted relationship would lean towards stewardship theory. Many publications are supporting larger boards. These publications propose that expanding the board provides access to a wider range of expertise and resources, as well as greater external connections. (Dalton, Daily, Johnson, Ellstrand, 1999; Zahra & Pearce, 1989; Goodstein, Gautam, & Boeker, 1994). Furthermore, it is proposed that increasing the size of the board can lead to greater diversity in terms of experience, skills, gender, and nationality. (Dalton & Dalton, 2005). The diversity of expertise is highly valuable in enabling the board to advise the management properly. Supporting these views, Jackling & Johl (2009) and Kalsie & Shrivastav (2016) find a positive relationship between firm performance and board size. However, the matter is not clear-cut. For example, Roffia, Simón-Moya, and García (2022) do not find the significance between company performance and board size.

Although a larger board increases resources, as the number of people increases, efficiency may suffer. Yermack (1996) argues that in larger boards communication and decision-making may suffer, and these could outweigh the positive aspects affecting firm value. He also finds an inverted relationship between board size and performance measures. Supporting Yermack's (1996) view, Jensen (1993) suggests that if a board has more than 7-8 members, its effectiveness suffers and it is easier for the CEO to influence the board. Literature seems inconclusive about the subject.

2.4.2 Experience and skills

According to the resource-dependence theory, it is logical to conclude that the availability of resources, and therefore firm performance, depends on the board members' human capital. Hillman & Daniel (2003) present such resources as advice and counsel. Over the years, those who have been on the company's board for longer gain experience that offers company-specific knowledge and skills that cannot be obtained elsewhere. Board tenure could therefore be assumed to have a positive connection with the company's performance. Huang & Gilles (2018) find evidence in their study examining firm performance and board tenure, that the director's on-the-job learning improves the company's value up to a point, after which entrenchment starts to hinder success. In their research, they claim to have found an inverted U-shaped relationship between board tenure and firm value, as well as accounting performance. A slightly similar result is presented in Magnanelli & Pirolo’s (2021) research results, which show a positive connection between tenure diversity and company performance. These results suggest that the board’s experience is useful as long as it does not root the company in its place.

2.4.3 Board diversity

In the modern business environment, diversity is often seen in a positive light, as various issues of equality have been a trend in social discussion for a long time. The diversity of the board can be measured by so many factors that it would be possible to devote an entire study to analyzing them. However, diversity can be seen as an obvious group of variables for the resource-dependence theory, as different skills, preferences, experiences, and characteristics have the opportunity to bring value-creating factors to the company that the competitor does not have. This topic is also related to the signalling theory, according to which companies behave by the norms accepted by society in order to gain a good reputation. Magnanelli & Pirolo (2021) have conducted a large study on the topic, which included more than ten board diversity factors. Gender diversity, diversity of executive and non-executive directors, and tenure diversity emerged as significant factors raising Tobin's Q. At a less significant 0.1 confidence level, diversity of educational background and negatively affecting age diversity were significant. Magnanelli & Pirolo state that the result supports the idea of previous studies that the financial market rewards the diversity of corporate boards by valuing the company highly. The board's general heterogeneity in genetics, education, and experience plays a role in the decision-making process, risk-taking preference, and how risks are faced (Magnanelli & Pirolo, 2021).

3 Data and methodology

This section provides detailed information about data collection, variable definitions, and analysis techniques. Firstly, the data is presented in summary format and by industry to provide an overall view of the features it represents. After this, the variables used in the analysis are examined in detail and the analysis methods represented.

3.1 Research data

The research data has been collected from the Refinitiv database using the total population sampling method. The data was compiled from Stoxx Europe 600 index companies, and there were a total of 600 observations. Some of the observations had major shortcomings in the documentation of the desired variables, so these had to be left out of the sample. After removing rejected observations, 593 companies remained. The data was collected in a cross-sectional format from years 2019 to 2023.

Table 1. Summary of collected 2023 data

Variable	Observation	Mean	Standard deviation	Min	Max
ROA	521	0,0611	0,1021	-0,3999	1,9811
ROE	539	0,1756	0,1971	-0,6491	2,9768
Tobin	584	2,0576	2,6159	0,3403	44,3379
BTenure	591	6,3138	2,5622	0,5	17,75
BCompensat~n	588	246000000	5920000000	28258	144000000000
BGender	593	38,5325	10,0066	0	72,7273
BSize	593	11,1147	3,5934	4	28
BIndep	593	65,5117	22,0929	0	100
BMeetings	578	10,0848	5,0397	2	44
BSkills	593	35,8194	17,8720	0	84,6154
BNonExec	593	88,0391	11,5623	33,33333	100
BCultural	389	29,4264	21,5107	0	100
Revenue	595	16200000000	30300000000	-81000000	322000000000
DebtToEquity	583	1,1744	4,7143	0	111,1364

As can be observed from the first column of Table 1 describing the 2023 dataset, the data is unbalanced. The same applies to the 2019-2022 datasets, as seen in Appendix 1. Altogether, data was obtained from 593 companies. However, the number of observations varies depending on data availability. Based on previous studies and theory, the independent variables selected are average board tenure (BTenure), board member compensation (BCompensation), board gender diversity (BGender), board size (BSize), independent board members (IndBoard), number of board meetings (BMeetings), board-specific skills (BSkills), non-executive board members (BNonExec) and board cultural diversity (BCultural). Selected control variables are the total revenue of business activities (Revenue) and total debt percentage of total equity (DebtToEquity). Selected dependent variables are return on assets (ROA), return on equity (ROE), and Tobin's Q (Tobin). All variables describing monetary value are presented in euros.

Figure 1. shows how the observations of the collected data are distributed by industry. The most frequently occurring sectors in the data are industrial companies, the financial sector, and the consumer discretionary sector. The industries with the least occurrence are energy and telecommunications sectors.

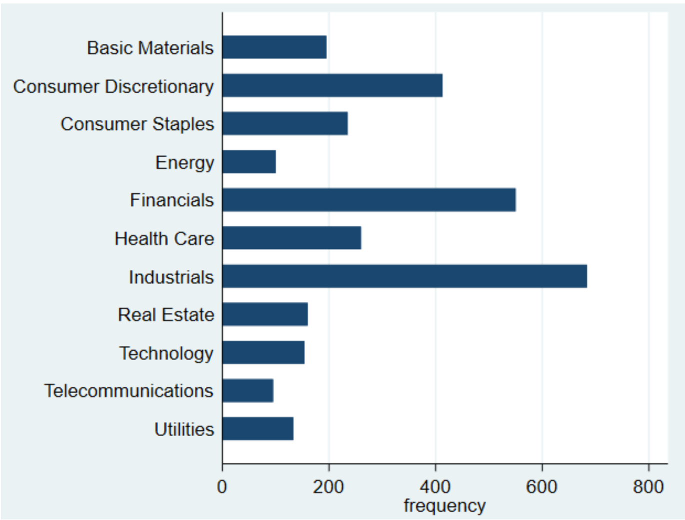

Figure 1. Industry distribution of collected data

As Figure 1. shows, the differences in the representation of industries vary by up to a hundred companies. Industrials, financials, and consumer discretionary dominate the sample. The unevenness of the distribution should be considered when interpreting the research results.

3.2 Variables

As noted by Richard et al. (2009), there is a great deal of variation in measures of firm performance. The same applies to the measurement of independent variables. Due to this, in the thesis, it is considered essential to present the definitions of the variables more precisely, so that the result can be interpreted more comparably based on the given definitions. The majority of the variables are obtained as such from the Refinitiv database, so they are defined according to the database's own calculation methods. Tobin's Q-indicator is not available in the database, therefore it is calculated following the formula used in Nguyen & Faff (2006).

Table 2. Variable definitions

Dependent variables	Abbreviation	Definition
Return on assets	ROA	$\frac{\text{Firm's Net Income}}{\text{Average of Firm's Total Assets}}$
Return on equity	ROE	$\frac{\text{Firm's Net Income}}{\text{Total Equity of Common Shares}}$
Simplified Tobin's Q	Tobin	$\frac{\text{Market Value of Equity + Book Value of Liabilities}}{\text{Book Value of Total Assets}}$
Independent variables		
Average board tenure	Btenure	$\frac{\text{Each Board Member's Tenure}}{\text{Number of Board Members}} \times 100$
Board member compensation	Bcompensation	Total Board Member Compensation
Board gender diversity	Bgender	$\frac{\text{Female Board Members}}{\text{All Board Members}} \times 100$
Board size	Bsize	Number of Board Members at the End of the Fiscal Year
Independent board members	Bindep	$\frac{\text{Sum of Independent Board Members}}{\text{Sum of Board Members}} \times 100$
Board meetings	BMeetings	Board Meetings in a Year
Board spesific skills	BSkills	$\frac{\text{Board Members with Industry Spesific or Financial Skills}}{\text{All Board Members}} \times 100$
Non-executive board members	BNonExec	$\frac{\text{Non-executive Board Members}}{\text{All Board Members}} \times 100$
Board cultural diversity	Bcultural	$\frac{\text{Board Members with Different Cultural Backround}}{\text{All Board Members}} \times 100$
Control variables		
Revenue	Revenue	Total Revenue from Business Activities
Debt to equity	DebtToEquity	$\frac{\text{Total Debt}}{\text{Total Shareholder's Equity}} \times 100$

The definitions of the variables are presented in Table 2. Nine independent variables have been selected based on previous literature and theory. The average tenure of the board is defined as the average of the number of years that each member of the board has been involved in the board’s activities. Board member compensation is the total remuneration given for the duties of the board. It would have been more optimal to measure the portion of the board's salary tied to performance or the board's share ownership, but these were not available in the database, and it would not be efficient to collect them individually from 593 companies. The gender distribution describes the number of women among all board members in percentages. The size of the board is measured at the end of the financial year as the sum of the members. The ratio of independent board members is measured by the number of independent board members among all board members. Board meetings are calculated from the number of meetings held in a year. Board-specific skills are defined as a background specific to the industry or a strong financial background. The share of board members with either or both of those characteristics is reported as a percentage of all board members. Non-executive board members formula follows the same logic as well as board cultural diversity. The cultural diversity of the board describes the members of the board who have a different cultural background than that which prevails in the location of the company's headquarters.

Based on previous research, three variables were chosen to describe the company's performance. The first of these, return on assets, is a popular accounting metric used to assess a firm’s profitability. It is defined as the net operating profit divided by the total assets listed on the company’s balance sheet at the beginning of the year. Return on equity measures value created for owners. It is defined as the ratio of net profit to the book value of shareholder’s equity. (Richard et al., 2009) Tobin’s Q is formally defined as the market value of a company’s assets divided by their replacement cost. However, due to the difficult estimation of replacement costs, the figure has been replaced by the simplification used in Nguyen & Faff’s (2006) publication, in which it is measured as the sum of market value of equity and book value of total liabilities divided by the book value of total assets. In addition, revenue from business activities and the total debt percentage of total equity are taken as control variables for the stepwise analysis. The debt-to-equity formula is total debt divided by the value of total shareholder’s equity including minority interest and hybrid debt multiplied by 100. Control variables try to capture the correlation between independent variables in the models, which could be due to the size of the company. All independent variables are studied as linear because as Appendix 4. shows, there is no clear shape between dependent and independent variables.

3.3 Estimation method

To select an appropriate estimation method for the empirical section of the thesis, the suitability of the data to the possible estimation methods is tested. In studies determining a connection between multiple independent variables and a dependent variable, the multiple regression model is a popular option. Another popular method is the stepwise regression variable selection method. According to Teo (2013), the assumptions of multiple linear regression are linearity, normal distribution of errors, homoscedasticity, and independence of errors. In addition, an assumption that might affect the beta coefficients of the regression is multicollinearity between independent variables (Radboud University, n.d.).

Testing linearity determines if the linear estimation method is indeed the best method to use in estimation instead of a nonlinear model (Teo, 2013). Linearity between independent and dependent variables seems reasonable based on Appendix 4. two-way scatterplots. The pictures represent scatterplots on top of which is seen the linear relationship between independent and dependent variable.

The normality of residuals -assumption is considered if the intention is to do hypothesis testing or provide either confidence or prediction intervals. Violation of the normal distribution of errors may lead to misleading information on the three previously mentioned estimates. (Chatterjee & Simonoff, 2013) Shapiro-Wilk test in Appendix 6. indicates that the errors would not be normally distributed in the sample. The p-values of the test are below the limit value of 0,05, which determines that the assumption of the normal distribution is in all cases rejected (Stata, n.d.).

The assumption of homoscedasticity is considering if the conditional variance of the dependent variable is the same in the population regardless of the combination of independent variables (Teo, 2013). The homoscedasticity of the multiple regression models is tested using the Breusch-Pagan method as seen in Appendix 5. According to Hill, Griffiths, and Lim (2018) the null hypothesis of homoscedasticity is rejected when the Breusch-Pagan test's p-value is below 0,05. Therefore, all models are heteroscedastic.

The last assumption of no multicollinearity between independent variables is tested using a correlation matrix and variance inflation factor -test. Multicollinearity is defined as a linear relationship between independent variables. It may cause reliability issues to the beta-values of the parameters. (Aylin, 2010) As seen in Appendix 2., the correlations are between -0,49 – 0,3284. The highest correlation is between the percentage of non-executive directors and the board's skills and seems to be in an inverted correlation. Since some variable correlations show quite high numbers, the investigation is continued by the variance inflation factor -test. VIF-values are between 1,01-1,49. These values do not show a high multicollinearity since they are under the value 5. (Radboud University, n.d.). Yet, when the real world behind the statistics is considered, multicollinearity might be a problem. Looking at the correlation matrix, board size correlates with many variables. Thus, it is safer to use stepwise regression which according to Tripathi (2019) prevents the problem of multicollinearity.

In the empirical phase of the thesis, the aim is to find the variables that best predict the company's performance from the options selected based on theory. This is implemented with forward stepwise regression. In forward stepwise regression, the computer program, in this case Stata, calculates one linear regression model for each independent variable. After this, the program selects the variable with the best p-value in the model. The process is carried out again so that the variables selected from previous iterations are always included in the model. The iteration is stopped at the desired limit value. (Eye & Schuster, 1998) This limit value can be, for example, a p-value of 0.05, which is often used as a limit for the significance of a variable. After the iteration is completed, the remaining significant variables represent the model that best predicts the dependent variable from the given alternatives. The model description is:

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_n x_n + \varepsilon \qquad (1)$$

In which:

Y = Response variable, β_0 = Y-intercept, β = Coefficient, x = Independent variable, ε = Random error component

In the context of the thesis, the response variable represents the company's performance and the independent variables are the factors explaining the performance. The error term represents the unexplained variability of the firm performance measures. The coefficients represent the slope of the variable in the coordinate system.

The selected stepwise model represents the same assumption violations as the multicollinearity model would have had. The variance inflation factor has been reduced. The heteroscedasticity problem is considered by using robust standard errors, which is a method usually used in cases of heteroscedasticity (Stata, n.d.).

4 Findings

In order to get an overall picture of the research results, a compilation of tables is provided in the following Figure 2.

2023	ROA	ROE	Tobin's Q
BSize	-0,0046***		-0,1539***
	(0,0017)		(0,0397)
DebtToEquity	-0,0112***		
	(0,0042)		
BMeetings	-0,0025***	-0,0057***	-0,0755***
	(0,0008)	(0,0020)	(0,0215)
Number of observations	332	339	364
R-squared	0,0503	0,0135	0,0525

2022	ROA	ROE	Tobin's Q
Bsize		-0,0087***	-0,1358***
		(0,0033)	(0,0311)
BSkills	0,0006**		
	(0,0002)		
DebtToEquity	-0,0089**	0,0524**	
	(0,0040)	(0,0254)	
BMeetings	-0,0035***	-0,0110***	-0,0843***
	(0,0010)	(0,0027)	(0,0232)
Number of observations	352	371	383
R-squared	0.0374	0.0862	0.0568

2021	ROA	ROE	Tobin's Q
BSize	-0,0036**	0,0062	-0,2307***
	(0,0014)	(0,0073)	(0,0553)
DebtToEquity	-0,0094***	-0,2987**	
	(0,0034)	(0,1281)	
BNonExec	-0,0015**		
	(0,0007)		
BMeetings	-0,0024**		-0,0674***
	(0,0009)		(0,0144)
Number of observations	341	358	357
R-squared	0.0993	0.5318	0.0613

2020	ROA	ROE	Tobin's Q
BSize	-0,0047***		-0,2002***
	(0,0013)		(0,0396)
DebtToEquity	-0,0085***	-0,0668***	
	(0,0016)	(0,0070)	
BMeetings	-0,0030**		-0,0761***
	(0,0012)		(0,0239)
Number of observations	321	336	339
R-squared	0.1426	0.0247	0.0999

2019	ROA	ROE	Tobin's Q
BSize	-0,0030***	-0,0062***	-0,1353***
	(0,0008)	(0,0016)	(0,0233)
DebtToEquity	-0,0064***		-0,1575***
	(0,0022)		(0,0481)
BNonExec	-0,0009***	-0,0029**	
	(0002)	(0,0013)	
BTenure	0,0046***	0,0070**	
	(0,0015)	(0,0032)	
Bcompensation			-1,44e-08***
			(5,01e-09)
BMeetings	-0,0016**		-0,0434***
	(0,0008)		(0,0165)
Number of observations	317	331	333
R-squared	0.1649	0.0851	0.1770

*** = p-value < 0,01, ** = p-value < 0,05

Figure 2. Compilation of robust standard error-corrected annual forward stepwise regression analyses

As is evident, the majority of the models have a notably low R-squared value. The R-squared value indicates how well the data fits the regression model. It represents the amount of variance of the dependent variable that can be explained by the independent variable. (Taylor, n.d.) The highest value can be observed in the results of the 2021 return on equity model, which however has only one significant control variable as an explanatory variable. Values range between 0,0247 and 0,5318, thus models are not predicting very well the dependent variables. Overall, the variables that seem to be repeatedly significant through the years are the size of the board, debt-to-equity ratio, and frequency of board meetings. Debt-to-equity ratio and revenue are ignored in interpreting the results since these are only added to avoid omitted variable bias.

The first stepwise regression analysis formed from 2023 data in Table 3. produces results, that implicate an inverse relationship between the frequency of board meetings and variables measuring firm performance. This finding might support Hossain & Oon's (2022) study which concluded that in countries where corporate governance is stricter and more demanding, the benefits of monitoring and advising are achieved with fewer board meetings considering that the data is from Europe. However, Vafeas (1999) and Jensen (1993) suggest interpreting the inverted relationship as the board's reaction to the reduced performance measures. They suggest that boards meet more often in times of crisis which the pandemic was. Data also supports the view of Yermack's (1996) publication which proved evidence of larger boards to be ineffective and suggested that larger boards tend to ignore CEOs' poor performance, unlike smaller boards. Jensen (1993) also states that larger boards tend to be ineffective and easily influenced by the CEO. The inverse relationship between the board's size and firm performance is significant only with return on assets and Tobin´s Q as performance measures.

Table 3. Robust error-corrected forward stepwise regression 2023

2023			
	ROA	ROE	Tobin's Q
BSize	-0,0046***		-0,1539***
	(0,0017)		(0,0397)
DebtToEquity	-0,0112***		
	(0,0042)		
BMeetings	-0,0025***	-0,0057***	-0,0755***
	(0,0008)	(0,0020)	(0,0215)
Number of observations	332	339	364
R-squared	0,0503	0,0135	0,0525

*** = p-value < 0,01, ** = p-value < 0,05

Stepwise regression conducted with 2022 data in Table 4 seems to provide similar results with the first regression and low R-squared values. The inverse relationship between board meetings and firm performance remains in Table 4., further supporting either Hossain & Oon's (2022) results or Vafeas' (1999) and Jensen's (1993) view. The inverse relationship between a board's size and firm performance is valid only when firm performance is measured by return on equity or Tobin's Q. Still the relationship supports Yermack's (1996) results and Jensen's (1993) view. The board's industry-specific or financial skills percentage appears to have a positive relationship with return on assets. Thus, it could be interpreted that having more expertise on the board has a positive effect on return on assets, which would support resource dependency theory. This result is only seen in Table 4. out of all results, therefore it is not reliable to draw hasty conclusions based on this observation. However, it is essential to mention that in 2022 the effects of COVID-19 were slowly unravelling, and directors' competence and industry-specific expertise might have been essential to rebuilding the strategy in a constant state of uncertainty. The importance of the board of directors is emphasized in times of crisis, thus the topic should be studied further in the future.

Table 4. Robust error-corrected forward stepwise regression 2022

	2022		
	ROA	ROE	Tobin's Q
Bsize		-0,0087***	-0,1358***
		(0,0033)	(0,0311)
BSkills	0,0006**		
	(0,0002)		
DebtToEquity	-0,0089**	0,0524**	
	(0,0040)	(0,0254)	
BMeetings	-0,0035***	-0,0110***	-0,0843***
	(0,0010)	(0,0027)	(0,0232)
Number of observations	352	371	383
R-squared	0.0374	0.0862	0.0568

*** = p-value < 0,01, ** = p-value < 0,05

The third year's stepwise regression in Table 5. supports consistently Yermack's (1996) results and Jensen's (1993) publication. Also the frequency of board meetings continues to support Hossain & Oon's (2022) or Vafeas' (1999) and Jensen's (1993) studies. The model with return on assets as a dependent variable has picked a new significant independent variable for its model. The percentage of non-executive board members seems to be in an inverted relationship with return on assets. This observation would suggest that adding non-executive directors to the board would decrease the return on assets. Executives as board members provide experience from the field i.e. human capital but will not increase the supervisory aspect nor objective perspective to compensation. This result therefore supports resource-dependence theory rather than agency theory. The size of the board on the other hand is against resource-dependence, if it is perceived that more people provide more resources. Yermack (1996) suggests that CEO compensation is more sensitive to performance in companies with small boards, thus it could be perceived that the size variable would indicate more in favour of agency theory or stewardship theory as suggested by Kalsie & Shrivastav (2016).

Table 5. Robust error-corrected forward stepwise regression 2021

2021			
	ROA	ROE	Tobin's Q
BSize	-0,0036**	0,0062	-0,2307***
	(0,0014)	(0,0073)	(0,0553)
DebtToEquity	-0,0094***	-0,2987**	
	(0,0034)	(0,1281)	
BNonExec	-0,0015**		
	(0,0007)		
BMeetings	-0,0024**		-0,0674***
	(0,0009)		(0,0144)
Number of observations	341	358	357
R-squared	0.0993	0.5318	0.0613

*** = p-value < 0,01, ** = p-value < 0,05

Similarly, as in previous tables, in Table 6. the size of the board and the frequency of board meetings are significant and in inverse relationship with firm performance measures. These observations support the work of Yermack (1996) and Jensen (1993), and either Hossain & Oon's (2022) or Vafeas' (1999) and Jensen's (1993) studies.

Table 6. Robust error-corrected forward stepwise regression 2020

2020			
	ROA	ROE	Tobin's Q
BSize	-0,0047***		-0,2002***
	(0,0013)		(0,0396)
DebtToEquity	-0,0085***	-0,0668***	
	(0,0016)	(0,0070)	
BMeetings	-0,0030**		-0,0761***
	(0,0012)		(0,0239)
Number of observations	321	336	339
R-squared	0.1426	0.0247	0.0999

*** = p-value < 0,01, ** = p-value < 0,05

The last stepwise regression analysis in Table 7. is notably different compared to the previous tables. The data collected from 2019 is not significantly impacted by the pandemic or the unstable political environment, which could explain the change in results. As seen in Table 7. R-squared values are slightly higher in models measuring return on assets and Tobin's Q. The R-squared is also relatively high in models measuring return on equity if the models containing only one significant variable, which is also the control variable, are ignored. The analysis contains similar elements compared to previous tables. The board's size and frequency of meetings are still intact proving an inverse relationship with firm performance, however, the percentage of non-executives appears to have a similar inverse relationship with return on assets that was inspected in Table 5.

Table 7. Robust error-corrected forward stepwise regression 2019

2019			
	ROA	ROE	Tobin's Q
BSize	-0,0030***	-0,0062***	-0,1353***
	(0,0008)	(0,0016)	(0,0233)
DebtToEquity	-0,0064***		-0,1575***
	(0,0022)		(0,0481)
BNonExec	-0,0009***	-0,0029**	
	(0002)	(0,0013)	
BTenure	0,0046***	0,0070**	
	(0,0015)	(0,0032)	
Bcompensation			-1,44e-08***
			(5,01e-09)
BMeetings	-0,0016**		-0,0434***
	(0,0008)		(0,0165)
Number of observations	317	331	333
R-squared	0.1649	0.0851	0.1770

*** = p-value < 0,01, ** = p-value < 0,05

New significant variables in Table 7. appear to be the average tenure of the board and total compensation given to the members of the board. Board tenure seems to have a positive relationship with return on assets and return on equity. This would imply that experience is an essential factor in performance at least when the business environment is somewhat stable. The publication by Huang & Gilles (2018) found an inverted U-shaped relationship between board tenure and firm performance, and Magnanelli & Pirolo (2021) a positive relationship between tenure diversity and company performance. Both of these studies indicate that experience has its place on the board. It could be interpreted that in a stable environment board tenure is a positive factor since it gets the firm through on a daily basis securely.

Another significant variable that did not appear in previous tables is the total compensation given to the board members. It seems that between the amount of compensation given and Tobin’s Q evaluation measure is a negative relationship. Without knowing what the total compensation consists of in each company it is challenging to make any statements about good or bad compensation methods. However, this evidence implies that the more the board is compensated, the lower the market values the company. It can be concluded that markets don't appreciate overcompensated boards of directors.

5 Conclusions and limitations

The objective of this thesis was to determine which board-related variables predict firm performance most accurately in the European context. It is evident that there is consistently an inverse relationship between the size of the board and the performance measures return on assets and Tobin's Q. This observation would suggest that slightly smaller boards would be more effective in the European context. However, this thesis does not contain any evidence of the optimal size of the board. One possible future research topic would be to study the optimal board size in the European corporate governance environment. Another variable showing consistent significant values was the frequency of board meetings, which appears to have an inverse relationship with return on assets and Tobin's Q. This finding suggests that the benefits of monitoring and advising are achieved with fewer board meetings in an environment where corporate governance is strictly regulated.

The agency theory has a supervision aspect and the incentive aspect. Only one of these aspects was consistently presented in the results. The total compensation was not apparent in any other year than 2019. According to the results, the total compensation is in an inverse relationship with Tobin's Q, and in most cases, it is not significant. This is a surprising result since agency theory is quite commonly used as a base for economic studies. Thus, the variable used in the study is not optimal, since the theory mostly focuses on performance-based incentives. The supervision aspect was apparent in the results. The frequency of board meetings is usually in an inverse relationship with firm performance, and this study is no exception. The agency literature contains a lot of speculation about the best practices for supervising management. The results either show that board meeting frequency is not an efficient supervision method at least in a crisis environment, or the fact that boards tend to meet more often during difficult times such as the pandemic. The appearance of the percentage of non-executives in an inverse relationship with return on assets and return on equity would suggest that adding non-executive directors to the board would decrease these performance measures. Non-executive directors provide supervisory aspects to the board. This would suggest against the agency theory. It surprising that largely studied supervision variables were rarely significant or were against the agency theory.

Resource dependence theory focuses on getting an advantage against competitors based on unique resources. The size of the board made an appearance in all regressions. It is in an inverse relationship with ROA and Tobin's Q. This is also a surprising result if it is viewed in the resource dependence aspect. More human capital provides less performance. There could be efficiency reasoning behind this result. The other variables selected to present resources are not consistent, but in some years there are appearances of board tenure and board skills. Additionally, these relationships are positive and support the importance of experience and skills as resources for better firm performance. The results are not consistent but still mentionable. These results support the theory inconsistently, but in a lens of resource dependency, the size of the board does not support the agenda. There were signs of this result in previous studies.

The models that predicted the firm performance with the highest accuracy usually contained the size of the board and the frequency of board meetings. The models that best explain the return on assets and Tobin's Q were obtained from 2019 data and for ROE from 2022 data excluding the models having only one significant variable which is also control variable. However, the models that only included the control variable debt-to-equity ratio turned out to be the best explanatory models, and board-related variables only seem to reduce the degree of explanation.

Another interest of the thesis was to track if and how the models changed during the five-year review period. An interesting observation is, that there are fewer significant independent variables after the year 2019. It is logical that when companies suffer losses as a result of the global crisis, the results change slightly. The board can be required to have different abilities, but with such a few years included in the research, it is not reliable to draw conclusions on the matter. Other than for 2019 data, the datasets produced reasonably consistent results. It could also be stated that researching the topic of the thesis in a stable economic environment or over a longer period could be more meaningful in order to get a more comprehensive and reliable picture of the results.

5.1 Limitations

There are limitations in the selected estimation method. Stepwise regression provides only one model which may not be the optimal model, since there might be equally good models that it does not consider. As the results of stepwise regressions present, none of the models based on combining agency theory and resource dependency theory explain the variation in firm performance measures very accurately. Collected data was dominated by industrial, finance, and consumer discretionary companies. The data included information from the early years of the coronavirus pandemic to the latest financial statements, and the study is affected by the economic crisis environment. When interpreting results it is important to consider that the data does not perfectly meet for example the normality assumptions. This study only focuses on agency theory and resource dependence theory, although there are multiple other theories concerning this matter. The data is collected only from five years since the years were studied individually. The variables selected for the study are limited to Refinitiv and affect for example the interpretation of the incentive aspect of agency theory.

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Appendix 1. Summaries of collected 2019-2022 data

2022					
Variable	Observation	Mean	Standard dev	Min	Max
ROA	540	0,0630	0,1068	-0,6665	1,8989
ROE	576	0,1779	0,2356	-2,4185	2,8660
Tobin	596	1,9296	2,3268	0,3876	41,8009
BTenure	589	6,2817	2,6739	0,0978261	18,3
BCompensat~n	581	1551135	1717778	300	16600000
BGender	592	36,5763	10,6934	0	66,6667
BSize	592	10,9645	3,5799	4	22
BIndep	592	64,1923	22,4264	0	100
BMeetings	566	10,3198	5,0497	2	48
BSkills	592	35,6447	18,5659	0	85,7143
BNonExec	592	87,5907	11,6223	36,36364	100
BCultural	403	32,5614	24,4645	0	100
Revenue	599	16400000000	32700000000	-2390000000	356000000000
DebtToEquity	596	1,0112	1,3644	0	14,25122

2021					
Variable	Observation	Mean	Standard dev	Min	Max
ROA	542	0,0628	0,0905	-0,5317	1,3940
ROE	576	0,1439	0,5386	-11,3042	1,9291
Tobin	580	2,5923	4,7670	0,3083	81,0751
BTenure	580	6,2847	2,5969	0,2884615	17,3
BCompensat~n	573	1683357	6324415	18377	148000000
BGender	585	35,0359	10,9901	0	75,0000
BSize	584	11,0069	3,6549	3	26
BIndep	585	63,5226	23,2098	0	100
BMeetings	545	11,2165	5,6080	3	43
BSkills	585	35,6730	19,6763	0	100,0000
BNonExec	585	86,1597	13,0035	0	100
BCultural	391	34,1481	25,1203	0	100
Revenue	597	13900000000	25500000000	14600000	250000000000
DebtToEquity	592	1,3131	8,1347	0	195,8086

2020					
Variable	Observation	Mean	Standard dev	Min	Max
ROA	541	0,0471	0,0842	-0,5038	0,8674
ROE	574	0,1560	0,8833	-2,1419	20,4600
Tobin	582	2,3996	3,6875	0,2466	61,1010
BTenure	569	6,3177	2,5160	1	16,3
BCompensat~n	563	1580742	2096380	46578	31600000
BGender	579	33,1919	10,9638	0	75,0000
BSize	579	10,9050	3,6480	3	22
BIndep	579	63,7715	22,6800	0	100
BMeetings	527	9,4023	4,3691	2	38
BSkills	579	35,7456	19,7816	0	100,0000
BNonExec	579	85,1920	12,8292	33,33333	100
BCultural	377	34,2256	24,3494	0	100
Revenue	594	12100000000	21300000000	25800000	223000000000
DebtToEquity	592	1,1997	2,2339	0	35,16231

2019					
Variable	Observation	Mean	Standard dev	Min	Max
ROA	533	0,0640	0,1125	-0,4040	2,2126
ROE	565	0,1832	0,4118	-1,8854	6,6415
Tobin	577	2,3405	3,7547	0,2954	57,2633
BTenure	555	6,3030	2,5758	0,7857143	15,96154
BCompensat~n	541	1726404	4594270	34000	73400000
BGender	562	31,3358	11,4600	0	63,6364
BSize	562	11,0694	3,8553	3	30
BIndep	562	63,0678	23,2827	0	100
BMeetings	505	9,2911	4,4575	1	43
BSkills	562	38,1083	20,2084	0	90,9091
BNonExec	562	84,3157	13,5277	40	100
BCultural	373	33,6329	24,5329	0	100
Revenue	593	14000000000	27400000000	5534602	308000000000
DebtToEquity	585	0,9965	1,1786	0	11,32111

Appendix 2. Correlation matrix from 2023 data

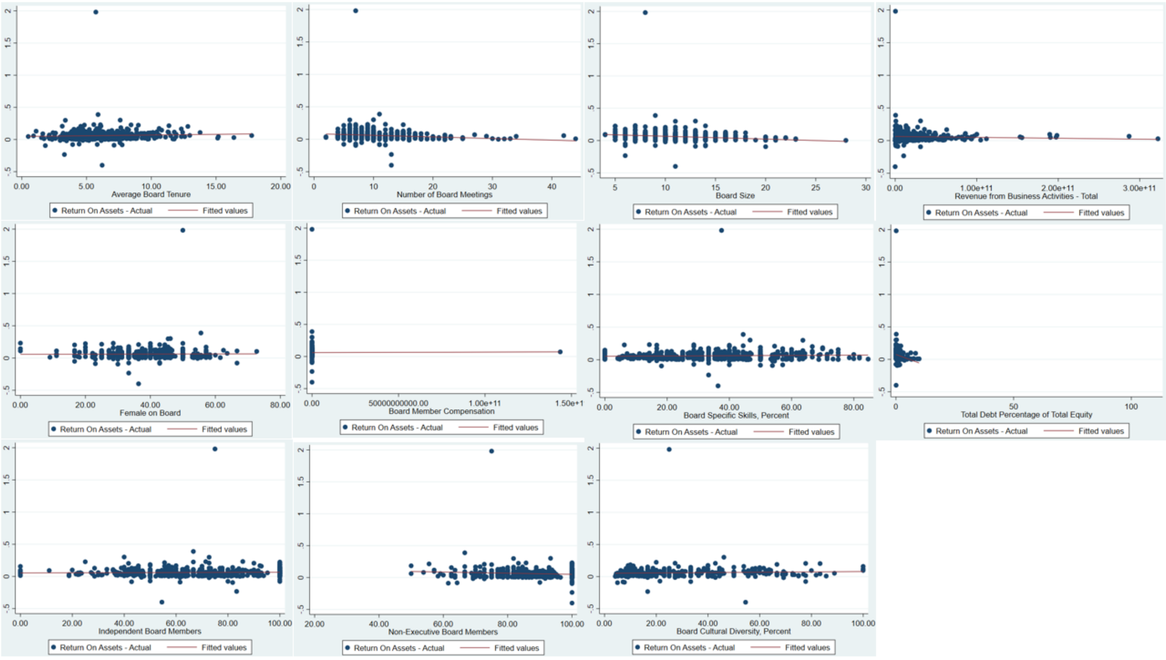
	BTenure	BMeetings	BSize	BGender	BCompensation	BSkills	BIndep	BNonExec	BCultural	Revenue	DebtToEquity
BTenure	1.0000										
BMeetings	-0.0932	1.0000									
BSize	-0.0419	0.0284	1.0000								
BGender	-0.1679	0.0818	0.0612	1.0000							
BCompensation	-0.0173	-0.0322	-0.0257	0.0075	1.0000						
BSkills	-0.0523	-0.0622	-0.2434	0.0448	0.0853	1.0000					
BIndep	-0.2188	0.0499	-0.2411	-0.0163	0.0359	0.0501	1.0000				
BNonExec	-0.0757	0.0160	0.0747	-0.0103	-0.0364	-0.4971	0.1973	1.0000			
BCultural	-0.0361	-0.0131	-0.3071	-0.1000	-0.0478	0.1652	0.2130	0.0738	1.0000		
Revenue	0.0154	0.0014	0.3284	0.0408	-0.0262	-0.0525	0.0017	0.0456	0.0891	1.0000	
DebtToEquity	0.0006	0.0270	-0.0291	0.0222	-0.0093	-0.0067	0.0497	0.0546	-0.0093	-0.0248	1.0000

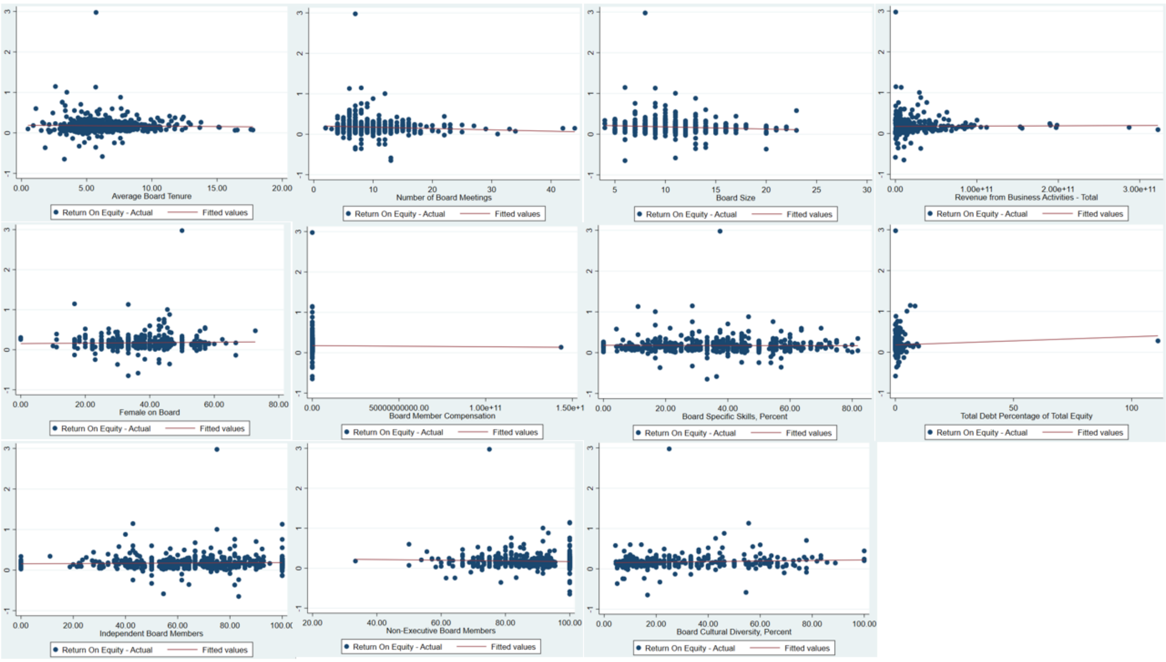
Appendix 3. Variance inflation tests from 2023 data

Variance inflation test (multiple regression)	2023 ROA	ROE	Tobin
BTenure	1,08	1,10	1,11
BMeetings	1,08	1,01	1,02
BSize	1,48	1,44	1,45
BGender	1,08	1,06	1,05
BCompensation	1,02	1,02	1,02
BSkills	1,48	1,49	1,49
BIndep	1,26	1,22	1,22
BNonExec	1,48	1,44	1,46
BCultural	1,26	1,22	1,23
Revenue	1,19	1,22	1,21
DebtToEquity	1,12	1,01	1,01

Variance inflation test (stepwise regression)	2023 ROA	ROE	Tobin
BTenure			
BMeetings	1,07	1,00	1,00
BSize	1,01		1,00
BGender			
BCompensation			
BSkills			
BIndep			
BNonExec			
BCultural			
Revenue			
DebtToEquity	1,08		

Appendix 4. Two-way scatter plots from 2023 data






Average Board Tenure
Tobin
Fitted values
Number of Board Meetings
Board Size
Revenue from Business Activities - Total
Female on Board
Board Member Compensation
Board Specific Skills, Percent
Total Debt Percentage of Total Equity
Independent Board Members
Non-Executive Board Members
Board Cultural Diversity, Percent

Appendix 5. Breusch-Pagan tests

Breusch-Pagan test (multiple regression)	p-value ROA	ROE	Tobin
2023	0,0000	0,0000	0,0000
2022	0,0000	0,0000	0,0000
2021	0,0000	0,0000	0,0000
2020	0,0000	0,0000	0,0000
2019	0,0000	0,0000	0,0000

Breusch-Pagan test (stepwise)	p-value ROA	ROE	Tobin
2023	0,0000	0,0000	0,0000
2022	0,0000	0,0000	0,0000
2021	0,0000	0,0000	0,0000
2020	0,0000	0,0135	0,0000
2019	0,0000	0,0000	0,0000

Appendix 6. Shapiro-Wilk tests

Shapiro-Wilk residual test (multiple linear regression)	p-value ROA	ROE	Tobin
2023	0,0000	0,0000	0,0000
2022	0,0000	0,0000	0,0000
2021	0,0000	0,0000	0,0000
2020	0,0000	0,0000	0,0000
2019	0,0000	0,0000	0,0000

Shapiro-Wilk residual test (stewise regression)	p-value ROA	ROE	Tobin
2023	0,0000	0,0000	0,0000
2022	0,0000	0,0000	0,0000
2021	0,0000	0,0000	0,0000
2020	0,0000	0,0000	0,0000
2019	0,0000	0,0000	0,0000