DETERMINANTS OF BOARD SIZE AND COMPOSITION

AN EMPIRICAL STUDY OF DANISH MEDIUM AND LARGE FIRMS

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Executive summary

In this paper, *"The Determinants of Board Size and Composition"*, we give credit to the recently, once again ignited discussion on corporate governance and its most prominent mechanism, the board of directors. Specifically, we follow previous research studying factors that have an effect on board size and board composition. We aim to provide insight into the nature of such factors by analyzing various firm-, board-, and industry-specific parameters that can be associated with the size and the composition of a board of directors based on a set of hypotheses, which have been derived from the prevailing research and theories.

Our empirical analysis focuses on Danish medium and large companies according to the size criteria by the EU Commission (2005). We rely on extensive and up-to-date data provided by the Experian Group (2012) on approx. 700,000 Danish companies and arrive at our final sample if 1,097 firms. We test our hypotheses on this sample by applying different statistical methods and sub-samples to ensure high consistency and reliability of our results

Our study adds value to the existing research in many ways. We examine the association between some unique variables, which generally have not been available to other studies, and board size and composition. Among these variables are measures that can account for the complexity of a firm, such as importing and exporting worldwide dummy variables, the number of segments a company is active in, or the number of foreign subsidiaries. Regarding the latest research on board internationalization, we are able to investigate the effects of foreign ownership on boards.

Among our key insights, we find a positive relationship between board size and certain measures of complexity as well as between the presence of workers and women on board. Moreover, our board composition regressions reveal positive associations between various measures of firm complexity, as well as certain industries with a large female employment base, and female presence on board. Additionally, we find support for the notion that diversity drives diversity, as employee directors are found to be positively associated with female directorship on board. We also find strong evidence of a positive association between employee directors and firm complexity as well as firm size. The latter is also positively associated, as is the presence of a foreign parent company with the presence of foreign board members.

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1 Introduction

In light of recent developments in the corporate landscape, marked by the most severe economic and financial crisis since the Great Depression, managerial missteps, questionable business decisions, or, as some might even argue, immoral and unethical behavior, the field of corporate governance has regained the attention it had in the early years of the 21st century. After Enron, or the likes of WorldCom and Tyco[1], had triggered the greatest debate over the necessity and effectiveness of corporate governance and its mechanisms, roles, and duties for some years after 2003, the discussion has been ignited once again. How can a board of directors be unaware of the company's senior management sending the staff and employees to corporate sponsored sex parties in Hungary, as it was the case with Ergo, one of Germany's largest insurance companies (Iwersen, 2011). Why did nobody notice that Anders Eldrup, Denmark's own DONG Energy CEO, was apparently granting bonuses and golden parachutes to his close allies that were multiple times the size of his own, without being authorized by the board (Christensen & Friis, 2012)? And how can a manipulated CEO's CV go unnoticed for more than an entire quarter after taking the top management position, as it was the case with Yahoo and recently fired Scott Thompson (Tsukayama, 2012; Rushe, 2012)? In all of these instances, the corporate governance mechanisms, especially the board of directors, do not seem to have acted in the shareholders' and stakeholders' interests to protect their rights as prominently outlined in the OECD principles of corporate governance (2004).

For the general public, and sadly enough a lot of times even for the shareholders, the picture of the board of directors is blurry. Little do we know about the most prominent corporate governance instrument called board of directors that goes beyond the required transparency obligations demanded by, in case of publicly traded companies, the respective stock exchanges. It is generally agreed upon that board is the most important internal control device a firm possesses in order to detect and prevent opportunistic actions by the management that could be harmful to the company and, in turn, its shareholders (Fama & Jensen, 1983A; Hermalin & Weisbach, 2003; Rose, 2007). This is based on the fundamental roles a board of directors has, predominantly a monitoring and

[1] In the case of WorldCom, a relatively weak board of directors granted a risk-seeking CEO substantial loan amounts (Beresford et al., 2003), whereas lax corporate governance enforcement by the board of Tyco enabled both CEO and CFO to enrich themselves at the cost of the company (USA TODAY, 2005).

an advisory responsibility, as well as a compensation function (Adams & Ferreira, 2007; Raheja, 2005; Hermalin & Weisbach, 1991).

With these crucial tasks and responsibilities granted to a single governance instrument, the questions related to the people that ultimately constitute the board of directors become important. The board members' track records and backgrounds, or their incentive structures, are just as relevant as insights into the underlying dynamics of board size and composition. A simple question, such as what the appropriate size of a board of directors is, cannot be answered straight away. The general notion is that smaller boards perform more efficiently (e.g. Yermack, 1996) and that larger firms tend to have larger boards (Coles et al., 2008; Klein, 1998). The key aspect is, however, the relationship between board size and composition and various characteristics of a firm. Hermalin and Weisbach (2003) emphasize that both board size and composition are endogenous and bound to evolve with firm characteristics over time. Hence, the following important question arises: What are the determinants of board size and composition, i.e. which characteristics of a firm are associated with them?

This is the perspective this paper takes. We look at size and composition of board of directors and analyze what the potential associations are. Bennedsen (2002) started by studying Danish companies and answered the question of why some firms have a board and others do not. Our thesis strives to take our empirical work a level deeper and give insight into associations with board size and composition. Like Bennedsen's work, this empirical study looks at Danish companies in the medium and large-cap segment, as outlined by the European Commission (2005). We generate insights into the associations between firm size, firm complexity, board diversity and board size.

Another value-adding aspect of this study lies in the data our analysis is based upon. Inspired by the recent works of Rose on women on boards (2008) and worker-elected representation (2011), as well as Nielsen and Huse' paper on female influence on boards of directors (2011) or Gregoric et al.'s (2012) study of board internationalization, this study also aims to highlight firm characteristics associated with board diversity, namely female, employee, and foreign directors on board.

For the purposes of conducting our research, this paper relies on a data set provided by the Experian Group's (2012) Web-Direct database with reliable, daily updated data on approx. 700,000 Danish companies. From this database, we extract a sample of 1,097 medium and large companies. The data set includes variables on several firm-specific aspects, more specifically basic company data, financial data, as well as board data. This substantial amount of data allows us to construct new variables and test our hypotheses derived from existing theory.

Based on our empirical work, we do not find support for the notion that larger firms will have a larger board of directors. The evidence regarding the association between firm complexity and board size is also mixed. Some variables we use to account for firm complexity yield a positive association with board size, while others present a negative association. However, we are able to identify a positive association between board diversity and board size.

Regarding board diversity, we do not observe support for the belief that larger firms are more inclined to promote female board directors. However, despite somewhat mixed evidence, we find significant positive associations between certain measures of firm complexity, selected industries and female board presence. Additionally, diversity seems to be driving diversity, as employee directors on board are positively related to female directorship. Our evidence is very clear regarding employee-elected directors on board, as we observe very significant positive associations with firm size and firm complexity. We also find support for the positive relation between firm size and foreign directors on board.

The structure of the paper is as follows: First, we briefly outline the relevant aspects of corporate governance and examine the prevailing literature related to the determinants of board size and composition. We use this literature to derive a set of hypotheses that serves as a ground for evaluation of our own empirical work. We proceed by outlining our methodology and highlighting key features of our data. After the empirical analysis, which includes an evaluation of our findings in light of our developed hypothesis, we follow up with a discussion of our evidence and previous research, before we conclude our study of the determinants of board size and composition in Danish companies.

2 Literature review

The purpose of this section is to set the relevant theoretical frame for our empirical work. While we start out by highlighting general aspects of corporate governance and how a board of directors fits into the extensive field of corporate governance, we divide the existing literature and research on corporate boards into the, for our purposes, two most relevant areas – corporate boards and their effects on firm performance and the determinants of board structure. We use the latter to derive relevant hypotheses to guide our empirical work.

2.1 Corporate Governance and the board of directors

Corporate governance, in the broadest sense, facilitates shareholder and stakeholder protection and ensures increased transparency regarding the preparation and distribution of information surrounding companies, their activities in the relevant markets and the parties affected by these activities. It is "[…] *part of the larger economic context in which firms operate…*" (OECD, 2004, p. 12). Hence, corporate governance and its rules and regulations, which constitute a so-called corporate governance framework, vary slightly with different countries, as it depends on macroeconomic and regulatory policies and the institutional environment it is applied in. However, the OECD principles of corporate governance (2004) have generally been agreed upon and served as the elementary building block for these corporate governance frameworks across the world. According to these principles, the basis for an efficient framework is suggested to adhere to the following definition:

> *"The corporate governance framework should promote efficient and transparent markets, be consistent with the rule of law and clearly articulate the division of responsibilities among different supervisory, regulatory and enforcement authorities."* (OECD principles of corporate governance, 2004, p. 17)

This broad definition implies various definite responsibilities and rights, such as the protection and facilitation of exercising shareholder rights, equal treatment of all shareholders regardless of their ownership stake, or "*timely and accurate disclosure […] on all material matters regarding the corporation*" (OECD, 2004, p. 22). The most prominent, and arguably the single most important instrument of enforcement of such corporate governance standards, is the board of directors, also called the supervisory

board, which "[…] *is by far the most important internal control device seeking to control and monitor management in order to deter management from opportunistic behavior*" (Rose, 2007, p. 404; Fama & Jensen, 1983B; Hermalin & Weisbach, 2003).

It is important to note that by far not every company has such a board. In fact, only publicly listed companies are required by law and the rules of the respective stock exchanges to promote a structure that includes the governing body at the top of the firm. Companies that are not legally required to have a supervisory board, also called the board of directors, might still benefit from implementing one in light of increased transparency, monitoring, and advising, resulting in e.g. lower capital and transaction costs (OECD, 2004). Bennedsen (2002) bases his argument in his working paper on the same notion as to why a voluntary board establishment makes sense. He highlights two motives – a *governance motive* and a conflict mitigation motive, to which he refers as the *distributive motive*.

The first one is based on the belief that "[…] *boards create firm value by governing the firm and the management*" (Bennedsen, 2002, p. 1) due to their contribution to the sustainable development of a firm, mainly through their monitoring and advisory tasks (Adams & Ferreira, 2007; Raheja, 2005). Most notably, Hermalin and Weisbach (1991) underline this governance motive in their study of board composition and incentive provision to firm performance along with other economic and business literature focused on performance effects and their link to changes in the board structure (e.g. Baysinger & Butler, 1985; Harvard Business Review on Corporate Governance, 2000). In general, this notion is based on the fundamental belief in the separation of ownership and control, in which ownership is dispersed, and hence lacks the strength to pursue its rights facing a powerful management (e.g. Jensen & Meckling, 1976). In this case, it is the board's role to minimize the agency problem, i.e. align the interests, between the management and the owners by providing the right incentives.[2]

The second motive is what Bennedsen (2002) calls the *distributive motive*. In firms with concentrated ownership, the benefit of board establishment is the mitigation of the conflicts between controlling and non-controlling owners, so-called minority shareholders. Conflicts within the ownership structure may arise due to misaligned or differing interests, because

[2] Dispersed ownership is mainly present in large US and UK corporations, as established by Shleifer and Vishny (1997), whereas the typical firm shows concentrated ownership with one or more block holders (e.g. La Porta et al., 1999).

of a deeper involvement with the management or a stronger impact on the firm's decision-making process by the controlling owners.

However, given the obvious advantages a board has, it might seem surprising that only few firms actually make use of it. In the case of Danish companies, which are the focus of this paper and hence the most relevant firms to our work, roughly 26% of all companies have a governing body (Nyhedsbrev for Bestyrelser, 2012). "*The Nordic corporate governance structure lies between the Anglo-Saxon one-tier and the continental European two-tier model*" (Corporate Governance in the Nordic countries, 2009, p. 8; Rose 2007). Despite the extensive decision-making power the board is granted in this setup, with day-to-day tasks delegated to the CEO, a separation between the board and the executive management is necessary.[3] Hence, the CEO cannot be the Chairman of the Board at the same time, resulting in predominantly non-executive boards in Nordic companies (see Hansen, 2003). This applies in the Danish setting to companies with the corporate form of A/S, but not for firms with other corporate forms, i.e. ApS.

Regardless of which system[4] is being used to structure the top of the firm, the roles, responsibilities, and functions of the board and its members generally remain the same. According to the latest update of the recommendations on corporate governance by the Nordic Committee on Corporate Governance (2011) the primary functions of the supervisory board are advising and controlling, or monitoring as it is commonly referred to. This idea is presented in the OECD principles as follows:

> *"The corporate governance framework should ensure the strategic guidance of the company, the effective monitoring of the management by the board, and the board's accountability to the company and the shareholders."* (2004, p. 26)

What type of board structure is optimal insofar that it is able to fulfill its roles efficiently and effectively? Both the OECD principles and the recommendations on corporate governance for the Nordic stock exchanges have highlighted various characteristics perceived to be

[3] These rules apply to listed companies only. The extensive decision-making power of the board is based on the responsibility for the overall management of the company's affairs, including crucial tasks such as strategy, risk management, or financial structure.
[4] Germany generally uses a two-tier system, comprised of an executive and a supervisory board, whereas other countries (e.g. USA) use a one-tier system, where executive and non-executive directors form one board of directors (Commission of the German Corporate Governance Code, 2010).

beneficial to board's performance. As previously mentioned, CEO duality is prohibited in Danish listed companies. For non-listed firms, mainly with the legal constitution ApS (Anpartsselskaber, private limited companies), the implementation of a board of directors is optional and therefore the rules concerning CEO duality are more lenient (this is related to § 114 in the Danish law on joint-stock companies and private limited companies, where publicly traded stock companies' and state-owned companies' chairmen are prohibited from having a director role in the company, see Retsinformation, 2012B).

According to the Nordic Committee on Corporate Governance (2011), at least half of the board's members need to be independent, which in essence means no close or personal ties to the company, and it should be of appropriate size in relation to the organization's complexity while ensuring a certain degree of diversity among the board members regarding their backgrounds, areas of expertise, and experience among many others. "*In Denmark, Norway and Sweden the employees have the right to appoint a limited number of board members"* (Nordic Committee on Corporate Governance, 2011, p. 8). Specifically for Danish companies, employees have the right to ask for two representatives on the board for any company that employs more than 35 people. The share of employee representation on the board can increase up to 50 percent depending on the number of inside members on the board and the firms are obligated to grant at least two spots on the board if the employees request representation (cf. § 140 in the Danish law on joint-stock companies and private limited companies (Retsinformation, 2012B)).

Another point of discussion concerning board diversity is the number of female representatives on the supervisory board. Norwegian legislation introduced a law in 2004 that required all listed companies in Norway had to ensure a 40 percent women ratio on their boards of directors (Dowling, 2010; Sweetman, 2009). The positive results and indications in the study *Women on Board – The Norwegian Experience* by Storvik and Teigen (2010) have sparked further debate on whether quotas for female board representation should generally be implemented or not, and how effectively and efficiently they contribute to the board's and company's success.

This topic, among others, will be discussed during the remainder of this section, in which the focus is turned to the substantial amount of academic literature, as well as empirical and theoretical work. Although previous research in the field of corporate governance has

been very extensive, we argue that most of the work can be categorized by two areas of research on boards of directors – boards and their effects on firm performance and the determinants of board size and composition.

In the following, we devote a chapter to each area, aim to highlight the most relevant research and results, demonstrate how our study adds value to the existing research, and build hypotheses that ultimately guide our empirical work.

2.2 Boards and the effects on firm performance

2.2.1 Board composition

The general consensus is that smaller boards operate more efficiently (e.g. Hermalin & Weisbach, 2003; Yermack, 1996). Jensen (1993) argues that larger boards could be less efficient and less effective due to coordination problems arising because of its size (see also Lipton & Lorsch, 1992). Evidence related to firm value, as measured by Tobin's q, is provided by Yermack (1996) as well as Eisenberg et al. (1998), who demonstrate "that smaller boards are associated with higher firm value" (Coles et al., 2008, p. 330), because smaller groups are more cohesive and hence can fulfill their monitoring role better. Dalton et al. (1999) examined a board's advisory role and conclude that larger boards, often due to the higher fraction of outside directors, provide better advice to the CEO. Harris and Raviv (2008) use their theoretical model to show a potential negative relationship between profits and the number of outside directors, but "*without any implication that large boards are less effective*" (Harris & Raviv, 2008, p. 1800).

In general, "[…] *evidence on the relation between board composition and performance is mixed*" (Coles et al., 2008, p. 333). Board composition can be defined in many different ways, yet most common is the discussion of firm-outsider and firm-insider representation on board, reflecting the issue of board independence.

2.2.2 Board independence

As previously mentioned, the importance for board independence is rooted in the separation of ownership and control. The agency problem, which according to Jensen and Meckling (1976) arises due to dispersed ownership that lacks strength compared to the management of the firm. This agency problem, in theory, is minimized by a greater degree of independence of the primary monitoring mechanism, the board of directors. As Carter et

al. (2003, p. 6) phrase it, "[…] *board independence is critical for boards to function in the best interest of shareholders*". By aligning the interests of the owners and the management, the board ultimately increases firm value (e.g. Baysinger & Butler, 1985; Hermalin & Weisbach, 1991). However, Yermack (1996) as well as Bhagat and Black (1999 and 2001) counter this argument through their finding that the ratio of outside directors on board is unrelated or even negatively correlated with firm value, measured by Tobin's q in their respective studies (see also Agrawal & Knoeber, 1996). Insiders can be an important source of information, especially firm-specific information, and therefore provide valuable advice to the CEO (Raheja, 2005). Rosenstein and Wyatt (1997) as well as Klein (1998) confirm this notion by concluding that insider representation on board appears to increase firm value.

There are several factors that can measure or represent a greater degree of independence of the board. Announcing the addition of outside directors has shown to increase stock prices (Rosenstein & Wyatt, 1990 and 1997). Hermalin and Weisbach (1991) and Bhagat and Black (2001) have evaluated the effect of outside directors on profit without finding significance (see also Baysinger & Butler, 1985). Outside directors play an important role in studies related to firm take-overs. According to Cotter et al. (1997) and Byrd and Hickman (1992) the takeover premium is increased by the presence of outside directors on a board, while combined with board ownership, the probability of a takeover in the first place is decreased (Shivdasani, 1993). Brickley et al. (1994) also find that outside directors assist in adopting anti-takeover devices.

Weisbach (1988) and Borokhovich et al. (1996) show that the presence of outside directors is directly linked to "*discrete tasks, including the hiring and firing of the Chief Executive Officer*" (Coles et al., 2008, p. 330).

2.2.3 Board diversity

Another aspect to consider when discussing board independence is the degree of diversity of the governing body. As Carter et al. (2003) reason, common sense suggests that a more diverse board is also a more independent board. Robinson and Dechant (1997) outline five propositions in their conceptual framework that reason why board diversity, defined as diversity regarding the gender and ethnicity representation on board, and hence board independence benefits a firm's long-term financial outlook. Despite the fact that

Rose (2005) argues that there is no commonly agreed upon "*definition of what board diversity covers*" (p. 405), van der Walt and Ingley (2003) propose an intriguing theoretical definition of board diversity:

> *"The concept of diversity relates to board composition and the varied combination of attributes, characteristics and expertise contributed by individual board members in relation to board process and decision making."* (p. 219)

Carver (2002) extends this view to a more stakeholder oriented approach by using boards in their stewardship role due to moral obligations as a justification for board diversity. *"Although the argument for board diversity is corporate performance, corporate performance is not a direct measure of board effectiveness"* (Huse et al., 2009) as it is driven by many underlying factors besides the diversity of the board.[5] Gregoric et al. (2009) in their study of Nordic firms between 2001-2007 find that diversity along the measures of gender, nationality, and age dispersion has a positive impact on firm performance with respect to firm value return on assets and growth.

For the purpose of this paper, we will highlight the aspects of board diversity that are most relevant to our study, namely gender and racial diversity as well as the presence of worker representation on board.

2.2.3.1 Role of women

An increased amount of attention and research has been devoted to studying the role of women on boards (e.g. Nielsen & Huse, 2010; Vinnicombe et al., 2008; Terjesen et al., 2009). Generally speaking, the presence of women in corporate board rooms remains relatively weak. Daily et al. (1999) undertake a study of US corporate boards and CEO positions between 1987 and 1996 and show that the number of female inside directors is negligibly small with no significant increase over the past decade (see also Brancatto & Patterson, 1999; Burke & Mattis, 2000 for similar notions). To increase female representation, as in the previously mentioned case of Norway, some countries have established formal rules and quotas. An interesting result in Norway is that, despite an increase in the ratio of women on board of up to 40 percent, the majority of the boards of publicly listed companies in Norway are still chaired by men (Storvik & Teigen, 2010).

[5] Refer to Daily et al. (2003) and Zahra and Pearce (1989) for studies on the relationships between the influential factors of firm performance and board diversity.

However, Dalton and Dalton (2010) find that besides an increased participation on corporate boards, women appear to be increasingly represented on key board committees and through this process obtain leadership roles.

The potential benefits of female board presence in relation to firm performance has been at the core of the debate and academic research and independent studies have yielded mixed results (Nielsen & Huse, 2010). Rose (2007) concludes from his theoretical work the hypothesis that "*a higher degree of women represented in corporate boards impacts financial performance positively*" (p. 406). Yet, his empirical work fails to find a significant link between female board representation and firm performance as measured by Tobin's q (2007). In their study based on US data, Erhardt et al. (2003) link a higher degree of women on board to superior firm performance, whereas Adams and Ferreira (2004) find that boards with a higher fraction of women tend to have a less volatile stock price. Catalyst research (2007) makes a strong case for women on corporate boards by finding that companies with more women on their boards outperform competitors with respect to sales (42 percent higher), ROI (66 percent higher), and ROE (53 percent higher).[6] According to Adams and Ferreira (2009), the average effect of gender diversity on firm performance is negative, to a large extent driven by companies with fewer or weaker takeover defense mechanisms. They do, however, add value in poorly governed firms, suggesting that the implementation of quotas may potentially harm firm value of well-governed companies.

The benefits of female presence on corporate boards to a firm extend beyond plain financials and performance metrics. Adams and Ferreira (2004) make a case that women on boards improve corporate governance in the form of interest alignment – by linking greater board diversity to higher performance-based compensation for the management. The same authors support this notion in their article based on their empirical study of S&P 500, S&P MidCaps, and S&P SmallCap firms between 1996 and 2003. Adams and Ferreira (2009) hence conclude that more gender-diverse boards pay closer attention to monitoring.

[6] For a complete overview of women on boards and the effects from a micro- and macroeconomic perspective refer to the *Women in economic decision-making in the EU: Progress report* by the European Commission (2012).

Female representatives on boards also promote new ideas, improve communication (Milliken & Martins, 1996), and encourage other female employees to strive for higher responsibility-laden positions (Bilimoria, 2000; Bilimoria & Wheeler, 2000).

2.2.3.2 Role of employee directors

Employee-elected board members have generated renewed interest and, also because of their largely differing backgrounds, need to be seen as a contributor to board diversity. Gordon and Roe (2004) see the embodiment of worker-elected representatives on board as an important part of a European model of corporate governance. Trade unions on a national scale in Denmark and at a European level have also shown increased interest in the matter (Carley, 2005; Taylor, 2005).

It is generally agreed that the rationale for including employees on boards is the long-term business perspective that employees share due to their dependence on a lasting survival of the firm, and thus can have a positive impact on corporate performance through i.e. sound and sustainable corporate decisions and actions (e.g. Jürgens et al., 2007; Kochan, 2003). Catalyst research (2005 and 2007) as well as Daily et al. (2003) state positive effects of worker-elected board members on firm performance, while other authors show no or even negative effects (e.g. Huse et al., 2009; Rose, 2007). Gorton and Schmid (2000) offer insights on how employee representation affects firm decision-making and financial performance. Their study is one of a few quantitative studies in this area. The paper finds a negative influence on the market to book ratio, return on assets, and return on equity.

Perhaps more important than the effects on corporate performance is the impact that employee-elected representatives have on the board's performance, i.e. efficiency and effectiveness regarding its monitoring and advisory tasks. Windbichler (2005) notes an increased focus on human resources related topics even if the topic seems to lack importance and substance if seen in a broader perspective of such board-level discussions. Bøhren and Strøm (2005) argue along the same line, as they identify worker-elected board members as impeding effective board behavior and often lacking necessary skills to provide valuable input in financial and budget related discussions. Additionally, boards may avoid discussing sensitive control issues in the presence of employee-elected

board members (Rose, 2007). On the contrary, Minow and Monks (2004) suggest that employee representation ensures a higher degree of stakeholder orientation.

A significant part of the research, not just on board independence but on board behavior and boards in general, is devoted to the factors that are associated with the composition of the governing body. As this chapter has outlined so far, the degree of independence varies with the ratio of outside directors on board, CEO duality, or the degree of diversity. Ultimately, these topics relate to the discussion of board structure. This branch of the literature will therefore be highlighted in chapter 2.3 in the discussion on the determinants of board composition.

2.2.3.3 Role of foreigners

Gender diversity is, however, not the only aspect that needs to be considered when assessing board diversity. As previously pointed out, Robinson and Dechant (1997) also state that the ethnic background of board members contributes to board diversity. In his empirical study focused on the banking industry, Orlando (2000) linked racial diversity to firm performance (in this case measured by productivity, ROE and market performance) and shows that greater racial diversity positively impacts firm performance and contributes to the company's competitive advantage.

Additionally, as Oxelheim et al. (2012) outline, foreign directors may bring specific expertise and experience regarding access to foreign product and capital markets as well as crucial resources, benefit a firm's global networking activities and strengthen its legitimacy in an international context (Sanders & Carpenter, 1998; Pearce & Zahra, 1992; Luo, 2005; Oxelheim & Randøy, 2003). However, language barriers and limited familiarity with national governance standards or legislation may seriously restrain the efficiency of the corporate board, as argued by Masulis et al. (2012). Yet, the authors find in their study on US companies that foreign board members upgrade the advisory function of the board because of their international backgrounds and expertise.

2.3 Determinants of board size and composition and relevant hypotheses

As the research on the determinants of board structure is pivotal to our study, the relevant literature we present is used to derive the guiding hypotheses for our empirical work later in this paper. It is important to note that we focus on previous research that is of particular relevance to our data and therefore to our arguments. While the first three chapters of this section are devoted to factors that will influence board size, the remaining three chapters focus on factors associated with board diversity.

A large share of the research on board composition focuses on the monitoring and advising role of the board. Where, as previously mentioned, smaller boards are perceived to be more efficient boards with respect to their monitoring tasks (e.g. Yermack, 1996), fewer authors have focused on the board's advisory role and its relationships to the size and composition of the board. Among the few, Dalton et al. (1999) reason that larger boards offer better advice due to the presence of more outside directors. The question remains which firms experience the need for better or more advice. The answer to this question, as given by the characteristics of these firms, ultimately represents the factors that are associated with board composition. Coles et al. (2008) follow this argument and cite a study by Klein (1998), who "*suggests* [that] *complex firms have greater advisory needs*" (Coles et al., 2008, p. 332). Firm complexity embodies various aspects, such as the scope of operations , capital structure, and firm size.

Hermalin and Weisbach (2003) state that board composition is endogenous. This essentially means that board composition is bound to evolve with firm characteristics over time. In the following sections, we present characteristics that might be associated with both board size and the composition of the board.

2.3.1 Firm size

Conventional wisdom suggests that a bigger firm would tend to have a larger board of directors as these firms are more complex and require more diverse expertise on board. Based on the argument of advisory needs, Klein (1998) emphasizes that the need for good advice increases with the extent to which the firm depends on its environment for resources. Linking this argument to firm size, Booth and Deli (1996) postulate that larger firms most likely depend on more external contracting relationships, and hence require larger boards (Pfeffer, 1972). In line with these expectations, Coles et al. (2008) construct

a variable to proxy for the advisory needs of a firm and find that larger firms tend to have larger boards. Similarly, Linck et al. (2008) show that board size for larger firms fell during the 1990's but started to increase again based on required reforms. Lehn et al. (2004) document a direct positive relationship between firm size and board size, a view that is confirmed by Boone et al. (2007).

Therefore, our first basic hypothesis is as follows:

Hypothesis 1 – Larger firms will have a larger board of directors.

2.3.2 Firm complexity

The remaining aspects of firm complexity, besides firm size, will in this paper be considered together. Especially the scope of operations and the capital structure receive our attention, as our data set allows us to account for these potential associations with board structure.

Boone et al. (2007) define complex firms mainly by geographically dispersed operations as well as complex financial and operating structures in their business, with the scope of operations hypothesis, stating that firms with more complex operations require larger corporate boards. In line with related work by Linck et al. (2008), Coles et al. (2008), and Lehn et al. (2004), they find that more complex firms are in fact associated with larger boards, mainly due to the inclusion of more outside directors based on the need for greater advice (see also Yermack, 1996; Hermalin & Weisbach, 1988). Rose and Shephard (1997) specifically emphasize business and industry segments as determinants of board composition. More diversified firms will act in several segments, and therefore require more advice in the form of a larger board. This view is also shared by Linck et al. (2008), who take into account the number of business segments when modeling firm complexity. Linck et al. (2008, p. 311) state that "[…] *firms with disparate businesses and geographically dispersed operations*" have bigger boards.

Capital structure, or leverage, is often referred to in the context of firm complexity as well. A higher ratio of debt implies a greater need for advice due to the greater dependence on external resources (Pfeffer, 1972; Klein, 1998). Booth and Deli (1999) demonstrate that bankers often hold board positions to provide expert advice on capital markets, whereas Güner et al. (2008) see an amplified access to capital markets as the primary reason to

have bankers on board. These outside experts appear to be added to the existing board rather than to replace current board members. This notion is endorsed by Coles et al. (2008), who say that more leverage leads to a bigger board, and hence use leverage as a proxy for firm complexity.

Firm complexity is also suggested to increase with firm age (Boone et al., 2007).

In line with previous studies, our second hypothesis associates firm complexity with board size:

Hypothesis 2 – More complex firms will have larger boards.

It is important to note that the determinants of board structure outlined so far are firm-specific characteristics. A second string of potential associations, which can impose an effect on board size, are board-specific features, predominantly board diversity.

2.3.3 Board diversity

While the later chapters search for an explanation of the cross-sectional variation in the diversity of company's board, this section investigates how board diversity relates to board size.

As all the literature so far has indicated, the addition of outside directors, which are often needed to provide expert advice, results in larger boards. Of special interest to our study are how the inclusion of women, employee-elected representatives, and foreign representatives relates to board size.

Recently, firms have been under substantial pressure for appointing female directors on board, the extreme case being Norway in which the government required a 40% minimum representation of each gender on board. This institutional pressure for more female directors could consequently also affect other countries. However, previous research has shown that female directors are often considered as "*tokens*", i.e. firms would appoint one female director in order to satisfy the public pressure, but this single director cannot really influence the dynamics of the board decision-making. This is even more so when this additional director is not replacing another director, but is simply added through an increase in the board size. This increase in board size could be associated with a firm's

need to increase board diversity and meet diversity targets (Farrell & Hersch, 2005). This would also cause a dilution of the existing board members' rights.

With respect to the relationship between worker presence and board size, the theory is not as clear as desired. It is, however, possible to imply potential associations. One of the decisive events in this regard happens when workers choose to be represented. Will the employee-representatives be added to the board or replace existing board members? It has been suggested by Bainbridge (1998) as well as Fauver and Fuerst (2006) that workers may constitute an important source of information between the board and the employees, which can aid in the decision-making process. Thus, employee directors take on an important advisory role on the board. Of course the need for this information sharing varies depending on the type of company. As the workers possess some knowledge that is presumably unique to the employee setting, but do not necessarily possess much knowledge important for the other monitoring and advising tasks of the board, one could argue that employees are generally added to the board rather than replacing existing board members. In addition, existing board members would probably rather want to hold on to their power and add employees to the board rather than be replaced by them. Thus, we find it reasonable to expect a positive relation between worker representation and board size.

In the case of foreign directors, Oxelheim et al. (2012) find that their presence in the case of Nordic boards is complementary to board directors with international experience. This can be seen as an indicator that more diversity in terms of foreign directors is positively associated with board size.

Hence, our third hypothesis can be stated as follows:

Hypothesis 3 – Higher board diversity leads to bigger boards.

As already stated, the last three chapters of this section will deal with the associations between firm-specific characteristics and board diversity. Specifically, we focus on the factors that correlate with the presence of females, employee-elected representatives, and foreigners on the board of directors.

2.3.3.1 Female board members

When discussing possible factors associated with the determinants of female board representation, we will distinguish between organizational and board-specific determinants. Our paper adds value to the research in both areas, as we are able to model various firm-specific characteristics as well as board-specific characteristics. However, due to the lack of longitudinal board data, our discussion on board-specific associations is limited.

Hillman et al. (2007) provide insight into which firms tend to have more women on their corporate boards. They find that larger and more visible firms are more likely to pose a greater share of women on boards due to their public exposure and potential societal scrutiny, if they failed to comply with societal standards regarding gender issues. Singh et al. (2001) confirm this notion. In their extensive study of women on boards in UK companies, they show that female board directors are more present in large firms, as measured by the number of employees, and in firms with the highest profits. Van der Walt and Ingley (2003) view a visible commitment to diversity as a key driver for basically all types of companies.

Harrigan (1981) adds another dimension by concluding that women are more likely to appear on corporate boards of firms that are active in service-oriented, labor-intensive, or women's products industries due to a potentially larger pool of women eligible for board positions. In fact, firms in specific industries simply are more dependent on their female employment base, and hence might need this expertise on a board level as well (Hillman et al., 2007). Additionally, Hillman et al. (2007) also hypothesize that a firm's level of diversification, or firm complexity as previously outlined, has a positive effect of female board presence.

Combined and adapted to fit our data, these aspects account for our fourth hypothesis:

Hypothesis 4 – Women on boards are more prevalent in large and complex firms from industries with a larger female employment base.

Substantial evidence exists regarding the impact different board-specific characteristics have on the ratio of women on corporate boards. Gregoric et al. (2012) find a negative relationship between the number of women already on board and newly added female

directors. In other words, a higher number of women on a board significantly reduces the likelihood that more women will be put on the board. Farrel and Hersch (2005) conclude the same result in their study from 1990-1999. Unfortunately, to account for these effects requires longitudinal board data, which our study was not able to gain access to.

However, Gregoric et al. (2012) derive hypotheses from studying publicly listed firms in the Nordic countries that are better suited for our purposes. Generally speaking, they investigate whether "diversity drives diversity" (2009, p. 59). In their study, the authors explicitly examine the relationship between other factors of board diversity, most notably employee-elected, foreign board directors and young directors, and the presence of women on corporate boards. This is an aspect of our work that delivers value to the existing literature, as we are able to consider multiple dimensions of diversity.

Gregoric et al. (2009) find mixed evidence regarding the effects of employee directors and international board members. They find weak evidence that the presence of employee-elected representatives is positively correlated with a greater presence of women on board. They argue that this relation can be both positive or negative, as employee directors are more likely to appoint women to the board, since they choose members from the employee base. The association, however, for foreign board members and women is strong and reversed. Specifically, more international directors are related to a lower ratio of female representation on corporate boards and vice versa. These two dimensions, Gregoric et al. (2012) conclude, seem to behave as substitutes rather than complements.

Due to the lack of longitudinal data in this study, we proceed by focusing on the association between employee directors and women on board with the following hypothesis:

Hypothesis 5 – Employee-elected directors are positively associated with female board representation.

2.3.3.2 Employee-elected board members

Evidence on what the decisive factors for employee representation on corporate boards beyond legal obligations are is relatively weak. We specifically aim to identify firm-specific and board-specific characteristics that relate to the presence of employee directors on Danish boards. Danish companies in this regard are especially interesting, because

employee representation is legally binding only to a certain degree. As stated earlier, employees have a right to be represented if the average number of employees has exceeded 35 over the last three years. The representation is to be at least two members and corresponding to half of the board if there are no other inside members on the board. After the 35-employee threshold, employees have a right to demand more board representation, but companies are not obligated to grant it without being asked for it. This sets an interesting ground to the question which companies and which boards are most likely to induce more worker-elected representatives.

One argument is that larger firms, just as it is the case regarding the gender discussion, are under public scrutiny and may have to comply more with societal standards by granting employee representation voluntarily. An additional thought can be derived from the results a study by Bainbridge (1998) has shown. In this case, firms have voluntarily added employees to the board because their internal structure was too hierarchic and complex, resulting in an intransparent flow of information between the employees and management. Thus, employees can contribute to the firm by providing a source of information for better decision making and specifically add value to firms in information-intensive industries (Fauver & Fuerst, 2006).

Therefore, we hypothesize the following:

Hypothesis 6 – Large and complex firms will have more employee directors above their legal requirements than smaller and simpler firms.

2.3.3.3 Foreign board members

The discussion on the determinants of foreign representation on boards is very straightforward and centers on the degree of internationalization of firms. The intuitive notion is that more international firms will have a more international board. International boards according to Oxelheim et al. (2012) do not only include board directors of a foreign nationality, but should also hold members of the same nationality as the firm, combined with extensive international experience. The authors show that firm internationalization is the key factor in explaining the presence of foreign directors on board. Usually, the level of complexity within a firm also tends to increase with a higher degree of internationalization

(Oxelheim & Wihlborg, 2008). Therefore, it is fair to consider international companies as being complex firms.

Masulis et al. (2012) contributes a third string of firm characteristics often found to stimulate foreign presence on board. Larger firms with greater growth opportunities and a higher share of foreign sales to total sales are more likely to induce foreign board members. The authors also postulate that, in their study on US companies, more independent boards appear to be advantageous to foreign directorship.

Additionally, the presence of foreign ownership will almost inevitably associate with more foreign directors in the board room. The reasoning is straightforward: a large foreign owner can influence the appointments of directors and, in order to maintain control over the decision-making process, will favor foreign directors.

Based on the theoretical and empirical research presented above, we thus present the following hypothesis:

Hypothesis 7 – Large, international, and complex firms with foreign ownership are more likely to have foreign directors on board than other firms.

3 Research methodology

In this section, we will describe our data sample. We describe the source of our data and what alterations we have made to the original data set to arrive at our final sample. We will also explicate the estimators we have chosen to apply and the considerations we have made in relation to them.

3.1 Data source

Our data sample is extracted from the Web-Direct database through the KOB-INTERNET portal provided by Experian Group, a global company which provides data, analyses, and statistical models related to economic data in more than 80 countries (Experian Group, 2012). In order to comprehend the data, several contacts to Experian were made through e-mail and telephone to clarify variables, limitations, etc.

The Web-Direct database contains company information from annual reports collected by Experian Group from the *Danish Business Authority* or "*Erhvervsstyrelsen"*, an agency in the Danish State, on approx. 700,000 Danish companies. The information on a company includes variables on practical information, company type and segment, ownership, financial, key financial ratios as well as board and management information. The data availability varies as some companies do not need to report all information.[7] The data was extracted to a CSV file through the website www.kob.dk provided by Experian Group (2012). The financial data is available historically for five years, but other data, such as board data, is only available in its most recent form and updated on a daily basis. The data set for this paper was extracted February 23.

The variable names available from Experian as well as "Corporate form" titles, industry texts, etc. have been translated from Danish to English using the WordFinder financial dictionary as well as Gyldendals Røde Ordbøger.

3.2 Data adjustments

3.2.1 Company size

Our study focuses on large and medium-sized companies, as data for small firms in WebDirect is often missing. Moreover, many small firms do not have boards. To separate companies into different size criteria, we used the European Commission's (2005) thresholds for large, medium, small, and micro enterprises. To belong to a particular category, a company must satisfy the headcount criteria and EITHER of the turnover or balance sheet criteria, as illustrated in the table. In our data sample, we focus on balance sheet criteria as several companies report only gross profit, not turnover.

Table 1 – European Commission's (2005) company size criteria

Enterprise category	Headcount: Annual Work Unit (AWU)	Annual turnover	OR	Annual balance sheet total
Medium-sized	<250	≤EUR 50m		≤EUR 43m
Small	<50	≤EUR 10m		≤EUR 10m
Micro	<10	≤EUR 2m		≤EUR 2m

[8]

[7] This is e.g. the case for holding companies, corporate forms such as private limited companies (ApS), etc.
[8] Note that the large category is not depicted in the EU Commission's (2005) table but is, of course, a company with exceeds the criteria of the medium-sized enterprise category.

Other authors have used different methods to separate companies into different size categories, e.g. Linck et al. (2008) rank companies according to the market value of their equity and separate them into quintiles, where the first quintile is “small”, quintiles two through four are “medium“, and the last quintile is “large”. We have decided to rely on the EU definition as many of our firms are not listed (and we have no market value information for them). Moreover, given that we study Danish firms, separating according to the EU definition also allows us to compare our results with other European-focused studies.

As we only look at medium- and large-sized companies, only firms with 50 employees and above (as of 23 February, 2012) were considered. This limits the sample from the original approx. 700,000 companies to approx. 8,000.[9]

Please note that in connection with the above size calculations, we use a DKK/EUR exchange rate of 7.4338 for annual turnover and balance sheet total, which is the average of the last three months provided by OANDA (2012).

3.2.2 Corporate form

In this thesis, we want to focus on non-financial Danish companies in the private sector. Financial companies are in fact often omitted from the governance studies or studied separately (in e.g. Hermalin and Weisbach, 1988; Linck et al., 2008) due to the fact that these companies are subject to different regulations, which in turn also affect their composition of the board. This is also true to some extent in Denmark. There are, amongst other, rules that the management of a financial institution is not allowed to serve on the board as well as special requirements regarding the skills of people on these boards (Danske Bank, 2012; Retsinformation, 2011A). There are also efforts towards increasing the requirements to these boards in terms of their composition from both a Danish and an EU standpoint. From the DK side, these activities are led by the Danish Financial Supervisory Authority (FSA) (*Finanstilsynet*), which is under the Danish Ministry of Economic and Business Affairs. Finanstilsynet (2012) is implementing increased corporate governance requirements on boards in financial institutions, which for example will have to evaluate their own effectiveness. In an EU context, the new CRD4 capital requirement directive is expected to increase financial board requirements with respect to board composition and self-evaluation (Franck, 2011). Due to these concerns, we remove the

[9] The sample size will be discussed further in the data quality section.

following financial institutions: "*Insurance joint-stock companies*", "*Banks, savings banks, and cooperative savings banks*", "*Financial leasing*", "*Debt collection and credit reporting*", "*Insurance agencies and insurance broker business*", "*Other credit institutions*", "*Other credit companies*", "*Other financial companies except insurance and pensions*", "*Mortgage banks (realkreditinstitutter)*", "*Not available*" (mostly Faroese companies), "*Other insurance*", and "*Wealth Management*". In addition, we excluded non-industrial organizations, which in our case are "*Unions*", from our sample.

As we are only focusing on Danish companies in this study, we further omit the following corporate forms: "*Branch of foreign joint-stock company*", "*Faroese (small) private limited company "anpartsselskab"*", companies where the corporate form could not be identified (mostly Faroese companies), and "*Foreign company*". The term between the quotation marks is the name of corporate forms in our data set.

We focus on companies in the private sector, and we therefore exclude the corporate form "*State institution/ministry*". In addition, "*Commercial foundations ("Erhvervsdrivende fonde")*", "*Association ("Forening")*", and "*Foundation/independent institution ("Fond/selvejende institution")*" are excluded, as these are not industry-based companies per se and thus not comparable with the rest of the sample.

As will be described in more detail under data quality, our sample is limited by the lack of consolidated data. To deal with this issue, we eliminate companies which appear under both "Company name" and as a "Parent company" of any of the 700,000 Danish companies. This alleviates the problem of double counting and gives us companies with correct financial data in our sample.

3.2.3 Financial performance

As we will be conducting some analyses using financial performance data, in particular using *Return on Assets* (ROA) = $\frac{Net\ income}{Total\ assets}$, we choose to eliminate companies for which ROA data was not available. We choose ROA, because the otherwise popular measure Tobin's q would be inapplicable for most of our unlisted companies. Additionally, several papers use ROA as either a control variable or performance variable (e.g. Boone et al., 2007; Adams & Ferreira, 2009; Gorton & Schmid, 2000). The advantage of ROA is that it is a profitability measure adjusted by size and in our case would be more readily available

than key figures that rely on revenue data. It could be argued that ROA significantly limits our sample size, but we evaluated that it could be an important variable to include as it is the best way to describe financial performance given our dataset. Among the approx. 8,000 companies with 50 employees and above, data for ROA was available for a total of only approx. 2,700 companies.

3.2.4 Final sample

After eliminating companies using the criteria above, we end up with 1,097 companies in our sample – 311 large-sized and 786 medium-sized. The sample size should be more than adequate for the purposes of conducting our research, even though it might seem small considering that it started out as approx. 700,000.

3.3 Data quality

Overall, we evaluate that our data quality is quite high. We have access to a database with a substantial amount of variables available, which have been used to create even more variables for the purposes of our research (will be described further in the following). Further, this database is updated daily and can be assumed to be very reliable as several Danish companies subscribe to and rely on this service, and hence require high degree of accountability. In addition, we have been in contact with the dataset provider and they have assured us of the data quality and explained advantages and disadvantages of our data. We have also achieved a quite satisfactory sample size from a statistical point of view, which adds explanatory power to our analyses.

For a description of the disadvantages of our data set, please consult the following “Data limitations” section. Note that the weaknesses we will outline do not largely limit the conclusions of our study, as we have adjusted the focus of the study, i.e. the definition of the population of firms that we aim to analyze with our sample (i.e. non-financial medium and large Danish firms) to the quality of the data.

3.4 Data limitations

The limitations arising in our data set stem from several sources, which are inherent in the type of data we have gathered.

First off, our primary selection criterion for our rough sample is companies that have 50 employees and above. Unfortunately, we do observe that some companies fail to report

employee data or do not do so on a consolidated basis. We have dealt with the latter by excluding parent companies and, with respect to the former, it is fair to assume that this problem is handled by only considering medium and large companies, which are more likely to report more data than smaller companies.

Secondly, data is not available for all 700,000 companies in the database as companies can choose to opt out if they request to do so to Experian Group. The extent of this should, however, be small as very few companies choose to do this. When extracting the data, it can be seen how many companies have chosen not to be in the database. Overall it must, however, be assumed to have a small effect and not limit our research very seriously.

Thirdly, the data is limited to the information available from annual reports, as mentioned earlier. This limits the potential for research in various ways. We cannot explore internal issues such as the internal workings of the board, education of board members, insiders vs. outsiders, etc. This also entails that ownership information is limited, as most companies are not required to release detailed ownership information. This prevents us from conducting proper analyses of the effect of management ownership, blockholders vs. minority stockholders, etc.

Fourthly, we lack consolidated data. This constrains the possibilities of our financial data and our employee figure data. We have dealt with this by eliminating parent companies from the dataset, but we cannot be completely sure that our dataset has perfect financial data. This remedy should, however, limit our potential bias arising from this source, and we thus evaluate this problem to have a small negative impact.

Fifthly, we only have time series data on the financial information. If we had board data over time, we could evaluate board effectiveness and board efficiency in terms of financial performance and how changes on the board would affect financial performance. The cross-sectional nature of our board data therefore prevents us from making normative analyses in our paper in terms of optimal board size and composition. These issues are, however, not the focus of our study. In other words, in the absence of longitudinal data, we are restricted to evaluating associations as opposed to causality.

Lastly, we are limited insofar as our sample is not random as we have deliberately included companies with data available on selected variables. This has some implications

for the assumptions we can make on our distributions, but as our data set is quite large, it should not seriously bias our results.

3.5 Variables

In order for us to conduct regressions, a number of variables had to be created in addition to the existing ones for the purposes of analyzing the determinants of board size and structure.

3.5.1 Existing variables

As mentioned earlier, the existing data includes variables on practical information such as contact information and location, company type and segment information, ownership information, financial information, key financial ratios as well as board and management information. Most importantly, we have variables for the companies on location, year established, corporate form, industries active in (including Danish DB07 industry codes), main importing and exporting countries of the companies, indication on whether the firms are listed or not, some ownership information (which is, however, quite limited), parent company data, subsidiary data, country and name, accountant and banking connections data, income statement (revenue, EBIT, etc.), and balance sheet data (current assets, debt, etc.) as well as key figures and ratios such as ROA, ROE, gearing, number of employees, etc. Finally, CEO (name) and board information data containing name and type of board member, chairman, vice chairman, board member or worker-elected board representative. Company and board-related data, excl. financial data, are available for one point in time only. The financial data, however, is available for the latest five years.

An exhaustive list of these existing variables can be seen in appendix 1.

3.5.2 Created variables

For the purpose of our empirical analysis, some new variables were created, as described above.

3.5.2.1 Financial variables

We merged the financial data from the individual five years into one Excel worksheet and thus created four lagged variables of our financial data, given the suffix t-1 to t-4. This would allow us to run regressions with the present and past financial data to attempt to explain board structure and board size. In this connection, we also calculated EBITDA,

including lagged variables. Several papers use free cash flow (FCF) as an explanatory variable for a board size regression, e.g. Link et al. (2008) and Coles et al. (2008). As FCF was unavailable for us, we use EBITDA to proxy it. To make it more size neutral, and hence allow for easier comparison across companies, we also created a variable called "*EBITDAOverAssets*", which is equal to EBITDA divided by assets. We also created an average of the ROA over the five most recent years (*ROA_Avg5*) to account for a more holistic effect on board size and structure over time. Other authors such as Coles et al. (2008) use lagged values of ROA to capture effects over time. Presumably poor performance could lead to board changes in later years. In addition, we also calculated the natural log of our company size measures, number of employees and total balance, to make them more suitable for the purpose of serving as explanatory variables, i.e. arrive at less skewed distributions and reduce the influence of outliers (the log of assets is also used by e.g. Fauver & Fuerst, 2006).

3.5.2.2 Industry variables

The Danish DB07 (DB stands for *Danske Branchekoder*) industry classifications is based on the European NACE industry standard classification system. For the purpose of our analysis, we transformed the existing industry classification into the Fama and French (1997) 48 classifications, also termed the *FF algorithm* (Bhojraj et al., 2003). This method is applied only to the primary industry, the existing variable *Industry text 1* and *Industry code 1 (DB07)*. Controlling for industry factors is important as companies operating in different industries can be expected to be subject to different roles for the boards in terms of the monitoring and advising taks, which will ultimately affect the board size and composition (e.g. Coles et al., 2008; Linck et al., 2008).

The transformation was done at our discretion, as the Fama and French codes (1997) are based on the Standard Industry Classification (SIC) system, which is not directly transferable to DB07 (NACE). To ensure consistency, all codes were looked up and checked using guidelines on the DB07 system (Danmarks Statistik, 2012) as well as online look-ups for the SIC system (NAICS Association 2012). For an overview of the Fama and French (1997) system and the codes we have transformed, please refer to appendix 2. Of the 48 classifications, we only had 42 industry classifications in our case as some industries had either been excluded or were simply not present in Denmark. The reference

group would be *Sector42* or *Whlsl*, the FF code for wholesale. This was chosen arbitrarily as the industry variables would be used almost exclusively to control for the industry-related effects.

Please note in this context that the SIC system, on which the FF algorithm is based, is being replaced by the North American Classification System (NAICS) codes, because the SIC system is relatively old and lacks certain industry categories which are being introduced through new technology. This was experienced in our case when we tried to identify e.g. a suitable FF category for wind turbines as it was non-existent in the SIC and FF system. The FF algorithm is, however, very popular for academic purposes and easy to operationalize due to its few categories (Bhojraj et al., 2003).

In relation to the industry codes, we also calculated the total number of industry segments the company was active in (*NoSegments*). This variable was defined as the number of different industry codes the company was assigned. Please note that we use segments and industries active in as meaning roughly the same thing. Basically, the variable "*NoSegments*" measures how diversified the company is (Coles et al., 2008). The variable has been used in other papers to factor in the effect of complexity and scope (e.g. Boone et al., 2007; Linck et al., 2008).

3.5.2.3 Corporate form variables

To account for the effect of different corporate forms, such as joint-stock companies (A/S), private limited companies (ApS), etc., we created a dummy variable (*OtherCorpForm*) to account for other corporate forms than joint-stock companies, which is our reference group (approx. 90% of our dataset). As mentioned above, joint-stock companies are subject to different rules with respect to boards than other types of companies and it thus seems appropriate to make this distinction.

3.5.2.4 Internationalization variables

We created the variables "*ImportWW_dummy*" and "*ExportWW_dummy*" to signify whether the company was exporting or importing on a worldwide basis. We defined worldwide as exporting or importing, respectively, to at least three different regions. We then counted these regions manually and created these two dummies. Presumably, these two variables would proxy for the company's internationalization, scale, and complexity.

To account for the effect of having a foreign parent company on board size and board structure, we created a dummy variable for all companies with a foreign parent company (*FrgnParent_dummy*). This was defined as any parent company that does not have the "DNK" code.

To factor in the effect of having foreign subsidiaries, we constructed a count variable for the number of subsidiaries which do not have DNK in their country code (*NoFrgnSubs*). Viewed this way, the nature of this variable is similar to Sullivan's (1994) attempts to measure *Degree of Internationalization (DOI)*, where he, among others, creates the measure of *Overseas Subsidiaries as a Percentage of Total Subsidiaries (OSTS)* as a proxy for the *structural* internationalization of a company. In this case, structural relates to how many of a firm's resources are located abroad. We also constructed this variable and named it *OSTS*.

3.5.2.5 Size variables

To differentiate between medium and large companies, we created a dummy for large companies (*LargeComp_dummy*). The differentiation between medium and large has been explained above.

To account for the scope of operations, we included a variable on the total number of subsidiaries for each company (*NoSubsidiaries*).

3.5.2.6 Board variables

The board variables include some of our most important variables, as many of them will serve as the dependent variables in our regressions.

For the overall board, we constructed a count variable for number of people on the board (*BoardSize*) and a dummy if the firm had a board, i.e. BoardSize > 0 (*Board_dummy*). Board size is defined as the total of chairman, vice chairman, board members, and worker-elected representatives.

As CEO duality is not illegal in Denmark (mentioned in literature review) unless you are a listed or state-owned company, we built a dummy variable to account for whether the CEO is also the chairman of the board (*CEODual_dummy*). This dummy will allow us to account

for any effects on board size and composition relating to CEO duality. We do, however, have less than five instances where this occurs in our sample.

With respect to diversity on board, we have constructed variables on female, worker-elected representatives, and foreigners on the board.

With regards to female representatives, we created the following relevant variables: "*NoFemaleBoardMB*" by manually counting the number of women on board; "*Women_dummy*" taking the value 1 if women are present on the board, and 0 otherwise; "*NoFemaleWE*", number of female worker-elected representatives; *"TotWomenBoard"* and "*WomenRatio",* a total and a ratio of women on the board (the total includes women no matter whether they are foreigners, workers, or just ordinary board members); and *WomenChairOrViceChair_dummy,* a dummy if a woman is either chairman or vice chairman, and 0 otherwise. We counted the women by evaluating their names, we discussed cases of doubt and employed Google image search to determine. This method is naturally suspect to error, but it was evaluated that the method is fairly precise. These constructed variables would all serve as our proxies for female representation on the board. The *WomenRatio* in this paper is identical to the *ratio women directors* in Huse et al. (2009).

To model the importance of the absolute and relative impact of employee-elected representatives on the board, we created variables for the total number of worker directors (*NoWorkElecReps*), a dummy if there were any workers on board (*Worker_dummy*), and the ratio they account for of the total board size (*WorkElectRatio*). The use of the WorkElectRatio is used in the same way as the *ratio employee directors* in Huse et al. (2009).

Another diversity factor is foreign influence on Danish boards. To measure this, we counted the number of foreigners on the board (*NoForeignBoardMB*), a dummy if any foreigners are on the board (*Foreign_board*), number of foreign worker-elected representatives (*NoForeignWE*), a total and a ratio of foreign members on the board (*TotForeignBoard* and *ForeignRatio*) including a dummy if a foreigner was chairman, vice chairman, or both (*FrgnChairOrViceChair_dummy*). For the *TotForeignBoard* measure foreigners who are worker-elected representatives or women also count. To evaluate

whether a person was foreign or Danish, we looked at the name to evaluate if it was Danish or not. Borderline cases were checked with a Google search to check for foreign references. This check was done for a substantial part of the names to ensure reliability of the data.

3.5.2.7 Miscellaneous variables

We also created a series of variables that were available in our dataset, which could presumably have an effect of our results.

The age of the company (2012 - year of establishment, *CompAge*) has been used in other papers to factor in the effect of complexity and scope, e.g. Boone et al. (2007) and Linck et al. (2008). As done in the latter paper, we also create a squared value of company age (*CompAgeSquared*) to account for non-linear marginal effects of company age.

We also created variables for number of bank connections (*NoBankCon*) and accounting connections (*NoAcc*). These variables could be assumed to be related to company complexity, size, and scope.

3.6 Statistical methods applied

3.6.1 Statistical software

For the purposes of creating descriptive statistics, as well as conducting different types of regressions, STATA 12 statistical software was used. STATA 12 is a statistical tool with a relatively high amount of flexibility, which we found adequate for the purposes of creating variables and running regressions for our research. Prior to using STATA 12, we have also used Microsoft Excel 2010 extensively to exclude data as well as create variables for the regressions.

3.6.2 Linear methods

Our primary method to conduct regressions is through the use of *ordinary least squares (OLS),* which we will describe in this section, particularly with respect to its assumptions and how any violations were mitigated. We conduct initial regressions with OLS and then move into non-linear methods if the distribution could be approximated more accurately this way.

3.6.2.1 OLS and linear regression – method and assumptions

To use our OLS estimation model for inference, we rely on the assumptions of the *classical linear regression model* to deliver the best linear unbiased estimators of the parameters of the explanatory variable coefficients and the variance. If we assume the disturbance terms are normally distributed, we get the *classical normal linear regression model (CNLRM)*, which is usually at least approximately true in large samples. Hence, we are able to derive probability distributions for the parameters we want to estimate (Gujarati & Porter, 2009).

We will briefly outline the nine assumptions of CLRM (see Gujarati & Porter, 2009):

1) The regression model is linear in the parameters
2) Fixed *X* values or *X* values independent of the error term, i.e. zero covariance between the u_i and each of the *X* variables
3) Zero mean value of disturbance u_i
4) Homoscedasticity or constant variance of u_i
5) No autocorrelation, or serial correlation between the disturbances
6) The number of observations *n* must be greater than the number of parameters to be estimated
7) There must be variation of the *X* variables
8) No exact collinearity between the *X* variables
9) There is no specification bias.

3.6.2.2 Weaknesses of OLS and their mitigation

The weaknesses arise when the above assumptions fail to hold. In our paper, we will mostly concern ourselves with potential violations of assumptions 4), 5), and 9) as the others are not very likely to be violated. Some of the most serious of these violations relate to the problem of endogeneity, meaning a correlation between the parameter or variable and the error term, which arises e.g. from autocorrelation or omitted variables, i.e. misspecification (Gujarati & Porter, 2009).

When assumption 4) is violated, we have heteroskedasticity in our data. This gives rise to high variances and covariances, minimizing the significance of the coefficients and thus leading us to accept the “zero null hypothesis” too often (Gujarati & Porter, 2009). This has

not been evaluated as a big concern and we have mitigated this issue by using heteroskedasticity-corrected robust standard errors in our regressions (through the STATA function .*vce*)

A violation of assumption 5) leads to OLS estimators being no longer efficient (minimum variance), in which case the variance is underestimated and, as a consequence, we cannot use the usual t- and F-tests of significance any longer. In our data, the autocorrelation will most likely arise from model misspecification, which we will describe further in the following (Gujarati & Porter, 2009).

Assumption 9) can be violated in different ways; omitting a relevant variable (underfitting the model), including an unnecessary or irrelevant variable (overfitting a model), using the wrong functional form, errors of measurement, incorrect specification of the stochastic error term, or assuming that the error term is normally distributed (Gujarati & Porter, 2009).

Overfitting a model is not as serious an issue as the OLS estimators of the parameters are still unbiased and inconsistent. However, their variances tend to be larger than in the true model (Gujarati & Porter, 2009). We are mitigating this bias by evaluating the result of including and excluding different variables when running different models in STATA.

Omitting a relevant variable is, on the other hand, more of a problem as it can bias our results as well as cause inconsistency due to the so-called endogeneity problem. This problem relates to the violation of the assumption 2) on zero covariance between the u_i and each of the X variables. Simply put, if our explanatory variables are correlated with some unobserved or omitted variables that also influence our dependent variable, then the estimated coefficients for X will be biased. Due to data limitations (i.e. no panel data available for board variables, lack of data on some of the directors' characteristics, such as experience, etc.), we cannot address this problem efficiently. We have, however, partly mitigated the problem by including as many control variables as possible (Gujarati & Porter, 2009).

3.6.3 Non-linear methods

Standard CNRLM OLS assumes normally distributed data, which is not necessarily the case for our data due to the specifics in the distribution of our dependent variables. When trying to model board size and board composition, we are in fact faced with a limited

number of discrete values (a maximum of 19), which are non-negative. Alternatively, some of our dependent variables are measured by a dummy, i.e. taking only two values (0 or 1). We therefore considered 2 non-linear methods which could fit our data more accurately. They can be classified as *limited dependent variable models (LDV)*, because the notable feature of these models is that the dependent variable only takes a very limited range of values (Woolridge, 2009).

The two LDV models we look into are probit and Poisson. Probit models are used for binary responses, while Poisson is suited for a count response (Woolridge, 2009). We will describe each of the models in turn. Bear in mind that we use them because they may describe the distribution of our dependent board size and composition variables more accurately.

3.6.3.1 Binary – probit –method and assumptions

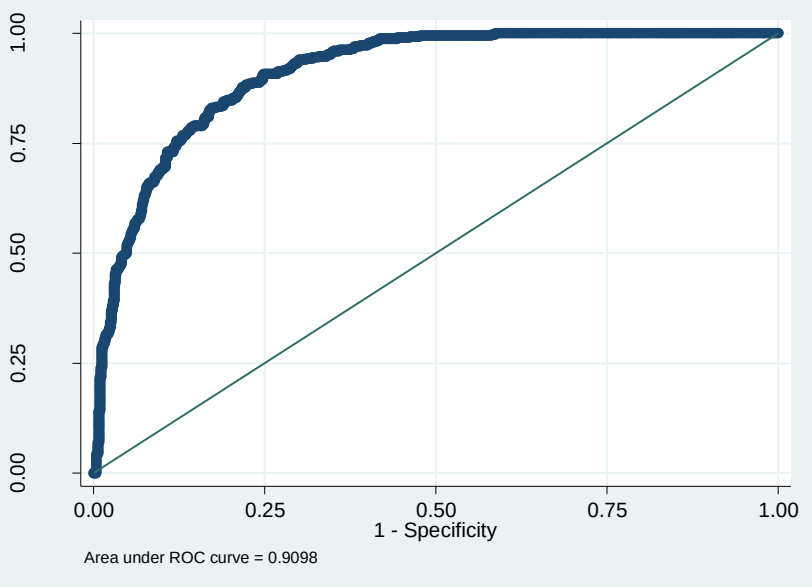
Using a probit model can overcome some of the limitations of the *linear probability model (LPM*) and is therefore more appropriate when our dependent variable is a dummy variable taking only two values, i.e. 0 or 1. In this case, the variable has a Bernoulli distribution, for which the expected value (mean) is actually the probability that our dependent variable (Y) takes the value 1. In the regression context, we know that the population regression function is the expected value of Y given X. Therefore, for a binary variable, the predicted value from the population regression is the probability of Y=1, given X. The coefficient of the regressor X therefore indicates the change (in percentage points) in the probability that Y=1 associated with the change in X. Using OLS estimates in a binary case would yield unbiased estimates, but the estimates of the standard errors would be biased, while the estimated expected value of or dependent variable could be below 0 or above 1 – not very meaningful for a probability estimate. To address this problem, we therefore introduce non-linear models, i.e. probit or logit models.

Please note that we use probit and not logit, as probit has certain advantages in an economic context. The normality assumption for the disturbance term in the *latent variable model* and specification problems can be more easily dealt with (for more, see Woolridge, 2009; Nagler, 1994).

The estimation procedure with respect to the parameters will be *Maximum likelihood (MLE)*, not OLS. This method is based on the distribution of Y given X, which ensures that potential heteroskedasticity is automatically accounted for. In addition, we will now get a Wald statistic from STATA instead of the usual F-statistic for linear models to test if explanatory variables together give us significance. The Wald statistic follows an asymptotic chi-square distribution and the P-value is provided in STATA. The disadvantage of the probit model in relation to OLS is that the coefficients are harder to interpret, as they relate to the *latent variable*. Moreover, because in this model the effect of X on Y (i.e. the relationship between selected variables and the probability of having at least one woman on board, for example) is non-linear, this effect varies with the value of X. We have two possibilities in this regard. First, we can estimate the partial or marginal effects at the average value of the independent variables (X). This is also called the *partial effect at the average (PEA)*. An alternative approach involves averaging the individual partial effects across the sample, leading to the *average partial effect (APE).* In our thesis, we will rely report the PEA, which we will refer to as marginal effects. Thereby, we do not have to concern ourselves with the issue that the probit model implies diminishing magnitudes of partial effects. In addition, note that the signs of the coefficients will not vary from OLS to probit (Wooldridge, 2009; Nagler, 1994).

In relation to the above, we have used the marginal effects function "*mfx*" in STATA to yield us the marginal effects at the mean. In other words, the STATA function gives us the partial effect (dy/dx) of increasing one independent variable one unit, while holding all independent variable at their mean values. This is important to bear in mind when interpreting the results in our analysis section.

Figure 1 – example of a ROC curve



To evaluate model fit for our probit regressions, we use Receiver Operating Characteristic (ROC) curves (figure 1). They y-axis of a ROC curve shows Sensitivity, which is the probability of correctly predicting a 1 (for a binary dependent variable). The x-axis is 1-Specificity, where Specificity is the probability of correctly predicting a 0. The depicted 45° line signifies how a model with no covariates is making the tradeoff between Sensitivity and 1-Specificity. The curved line above the 45° line is the ROC curve, which shows how well the model fares. Any given point on this line indicates how the probability of predicting the value 1 is traded off against the probability of predicting a 0 correctly. In other words, this is the tradeoff between Type I and Type II errors. The farther the ROC curve is from the 45° line, the better the model predicts both 1s and 0s. This information is summarized in the area under the ROC curve statistic (this is given underneath the graph in STATA's output using the "*lroc*" command). The optimal area is 1, which would be the situation where the model correctly predicts everything. The worst value is 0.5, implying a random guess (Golder, 2009).

3.6.3.2 Weaknesses of probit and their mitigation

The probit model is quite flexible, which limits its weaknesses substantially. The main weakness of the model is its complexity, which causes e.g. the interpretation of coefficients to be tougher, as explained above (Wooldridge, 2009).

The probit model is, however, also prone to issues arising from endogenous explanatory variables, as we have seen with OLS. In addition, the normality assumption of *e* might be violated in the latent variable model, which would entail that the response probability will not have the probit form. Another potential specification problem is heteroskedasticity in *e* of the latent variable model. This would result in the response probability depending on the variance (Wooldridge, 2009). We do not evaluate that the above two mentioned issues will have a substantial impact on our results, given that we try to estimate our results using different models and even different methods in some cases.

3.6.3.3 Count variables – Poisson

A Poisson regression model is useful when dealing with a count variable, which can take nonnegative integer values, especially relatively few values including 0. A linear model will not be optimal if this type of distribution is present in the dependent variable. A count variable cannot be normally distributed. Instead, the nominal distribution for count data is the Poisson distribution, which relies on the exponential function. Our board size variable, in addition to the count variables for women, worker-elected, and foreigners on board as well as some of our subsample data sets, which have fewer observations than the original dataset, each seem ideal for this type of regression due to their characteristics (Woolridge, 2009).

The Poisson distribution makes the strong assumption that the variance is equal to the mean, which is quite restrictive and will be violated in many applications. The distribution does, however, have a robustness property, which entails that whether or not the Poisson distribution is present, we still get consistent, asymptotically normal estimators of the coefficients. If we assume the Poisson distribution is not quite correct, the analysis is called *quasi-maximum likelihood estimation (QMLE)*. The assumption that the variance equals the mean must, however, still not be violated (Woolridge, 2009).

An advantage of the Poisson model vis-à-vis the probit is that its coefficients are easier to interpret. For practical purposes, we can interpret the dependent variable as log(y) in a linear regression, i.e. 100 times the coefficient is approx. the percentage change in the E(y|**x**), given a 1-unit increase in the respective explanatory variable (Wooldridge, 2009).

3.6.3.4 Weaknesses of Poisson and their mitigation

As mentioned above, the Poisson distribution makes the strong assumption that the variance is equal to the mean, which we cannot rely on is the case in our data. We will therefore use the "*vce(robust)"* function in STATA to obtain robust standard errors to control for small violations of this distribution assumption (UCLA, 2011).

One also has to be aware that specification problems, such as omitted variables or wrong functional form, can give rise to *overdispersion* if the variance is greater than the mean for all X. This can be adjusted for if the variance is proportional to the mean (Wooldridge, 2009). Overall, these limitations were not evaluated to have a substantial effect on the Poisson regression's ability to serve the purpose of robustness test for our results from normal OLS estimation.

3.7 Robustness tests

To check the results arrived at during our main regressions, we have conducted several robustness tests. The purpose of this is to solidify our conclusions and uncover where the weaknesses of our conclusions might lie.

One of the primary methods in this regard has been to use different variables that proxy the same type of measure, e.g. we have many measures of complexity as well as performance. This way, we can see if the findings hold using different measures which are significant and go in the same direction as the other measures.

Furthermore, we have tried different functional forms to test for second-order effects, e.g. squared terms for company age to see if it yields significant results. Related to this, we also used lagged terms for the performance variable ROA to capture any potential dynamic effects. As these methods did not provide any interesting results, they are not reported in the analysis. With respect to functional form we did, however, opt to use the log values of our size measures, employees and total balance, as mentioned above.

In addition, we have relied on regressions on subsamples to see if the results only hold for certain types of companies. This has resulted in a few interesting results in terms of changing significances and changing predictions of directions. These will be discussed in our analysis section.

As indicated in our sections on different statistical methods, we have also used different statistical methods on the same data with the same dependent and explanatory variables to see if the results remain relatively unchanged. An example of this is using normal OLS as well as Poisson on the same dataset. This method has also been applied on the subsamples to see if the results change. Continuing on the normal OLS and Poisson example, a subsample might have a less normally distributed dataset due, e.g., to fewer observations, and thus a Poisson distribution could be the more appropriate method.

4 Descriptive statistics

In this section, we will show and comment on descriptive statistics for the key variables for our later regressions. We start with company-specific general variables, then move in to complexity and financial variables, and following that to board-specific variables. This is followed by summary statistics where dependent variables are combined with explanatory variables to see if any associations are suggested. Finally, we have a correlation table which helps us become aware of potentially important variables as well as variables, which in a regression, can give rise to multicollinearity issues when used together.

4.1 Industry – Fama and French (1997) industry codes

Table 2 – industry classification distribution

Industry classifications			***Cont***		
FamaFrench1	N	Percent	FamaFrench1	N	Percent
Aero	2	0.18%	Hshld	15	1.37%
Agric	1	0.09%	LabEq	14	1.28%
Autos	8	0.73%	Mach	68	6.20%
Beer	2	0.18%	Meals	15	1.37%
BldMt	35	3.19%	Mines	3	0.27%
Books	15	1.37%	Misc	15	1.37%
Boxes	2	0.18%	Paper	14	1.28%
BusSv	132	12.03%	PerSv	4	0.36%
Chems	14	1.28%	RlEst	10	0.91%
Chips	3	0.27%	Rtail	76	6.93%
Clths	1	0.09%	Rubbr	15	1.37%
Cnstr	48	4.38%	Ships	3	0.27%
Comps	2	0.18%	Smoke	1	0.09%
Drugs	10	0.91%	Soda	2	0.18%
ElcEq	27	2.46%	Steel	19	1.73%
Enrgy	7	0.64%	Telcm	11	1.00%
FabPr	57	5.20%	Toys	1	0.09%
Food	62	5.65%	Trans	77	7.02%
Fun	23	2.10%	Txtls	5	0.46%
Guns	1	0.09%	Util	22	2.01%
Hlth	2	0.18%	Whlsl	253	23.06%
Total	**1,097**	**100%**			

As illustrated in table 2, we have quite some variation in the industries represented. There is, however, a very substantial presence from companies active in Wholesale (23.06%), Business Services (12.03%), and Retail (6.93%), which combined account for more than 40% of all companies. As noted before, companies within Wholesale will serve as the reference group, as we are accounting for industry-specific effects using dummy variables.

Some categories are only represented by one company and other categories still are not represented at all (*Medical Equipment*, *Precious Metals* and *Coal*). The banking, insurance, and trading industries have been deliberately removed.

Table 3 – Distribution of companies in terms of the number of segments they are active in

Number of segments		
NoSegments	N	Percent
1	573	52.23%
2	328	29.90%
3	131	11.94%
4	53	4.83%
5	9	0.82%
6	2	0.18%
7	1	0.09%
Total	**1,097**	**100%**

In relation to a firm's main industry classification, we observe that 52.23% of the companies in the sample are only active within one industry segment, e.g. a company which is only a wholesaler and does not have any retail. Almost 30% are active in two segments, whereas 11.94% engage themselves in three segments. Overall, the conventional wisdom is confirmed that the number of companies decreases in the number of segments increasing. It is, however, not uncommon for a firm to be active in two segments. If the companies active in one or two segments are combined, we observe a 80-20 split in our sample.

As highlighted in our section on variables previously, we believe this variable to be a sound proxy for the complexity of a firm and the scope of operations.

4.2 Corporate form

Table 4 – Distribution of companies by corporate form

Corporate form		
Type	N	Percent
Joint-stock company	974	88.79%
(Small) private limited company ("Anpartsselskab")	86	7.84%
Limited liability cooperative (amba)	15	1.37%
Limited liability partnership ("Kommanditaktieselskab")	10	0.91%
Partnership ("Interessentskab")	7	0.64%
Limited partnership ("Kommanditselskab")	3	0.27%
Company with limited liability ("Selskab med begrænset ansvar")	1	0.09%
Owner n/a (newly established not found)	1	0.09%
Total	**1,097**	**100%**

With respect to corporate form, we observe that approx. 89% of the companies in our sample are joint-stock companies (A/S). Hence, this category will serve as our reference group when controlling for corporate form effects via a dummy variable. It is important to note that the majority of these joint-stock companies are not publicly traded. In fact, only 20 firms in our entire sample are publicly traded. The second largest category is (small) private limited companies (ApS), which represents approx. 8% of the sample. For the purpose of the mentioned dummy variable, all other corporate forms except for joint-stock companies are grouped together as “other corporate form”, and hence compared jointly with joint-stock companies.

4.3 Scope of operations of the firm

Table 5 – Distribution of the companies by how many subsidiaries they have

Number of subsidiaries		
NoSubsidiaries	N	Percent
0	770	70.19%
1	103	9.39%
2	65	5.93%
3	55	5.01%
4	22	2.01%
5	20	1.82%
6	18	1.64%
7	10	0.91%
8	8	0.73%
9	6	0.55%
10	1	0.09%
11	4	0.36%
12	4	0.36%
13	1	0.09%
14	1	0.09%
16	2	0.18%
19	1	0.09%
20	1	0.09%
22	1	0.09%
24	1	0.09%
25	1	0.09%
30	1	0.09%
48	1	0.09%
Total	**1,097**	**100%**

Table 6 – Distribution of the companies by how many foreign subsidiaries they have

Number of foreign subsidiaries		
NoFrgnSubs	N	Percent
0	774	70.56%
1	99	9.02%
2	65	5.93%
3	55	5.01%
4	24	2.19%
5	20	1.82%
6	17	1.55%
7	10	0.91%
8	8	0.73%
9	6	0.55%
11	4	0.36%
12	5	0.46%
13	1	0.09%
14	1	0.09%
16	1	0.09%
19	1	0.09%
20	1	0.09%
22	1	0.09%
24	1	0.09%
25	1	0.09%
30	1	0.09%
48	1	0.09%
Total	**1,097**	**100%**

One of our measures to account for the scope of operations or firm complexity is the number of subsidiaries for each company, along with the number of industry segments active in. The distinction between the two tables illustrated is that the first one shows the general distribution of companies with regards to the number of subsidiaries (table 5), whereas the second table (table 6) specifically focuses on the number of foreign subsidiaries. As can be seen from both tables, approx. 70% of firms in our sample do not have subsidiaries of any kind. This high number is related to the fact that we eliminated a series of parent companies in our data set due to the lack of consolidated data. However, it is not surprising that the number of companies decreases in the number of subsidiaries.

4.4 Internationalization

Table 7 – Distribution of companies by foreign subsidiaries proportion

Foreign subs. proportion		
OSTS	N	Percent
0	774	70.56%
0.6	1	0.09%
0.67	2	0.18%
0.75	1	0.09%
1	319	29.08%
Total	**1,097**	**100%**

At a first glance, the two previous tables seemed to be very similar. There appears to be a close relationship between the number of Danish and foreign subsidiaries. A comparison of the two tables via the *OSTS* variable confirms this intuition. The OSTS variable indicates what proportion of subsidiaries are foreign. Please note that some of the 0 values represent companies that either do not have any subsidiaries at all (the vast majority of these companies) or only have domestic subsidiaries (only a few companies). As the majority of companies with subsidiaries have foreign subsidiaries, it seems that subsidiaries are mainly set up when a company is expanding abroad.

We expect these internationalization factors to be an additional proxy for the complexity and scope of the company's operations.

4.5 Financials variables and company age

Table 8 – Financial variables and the company age variable

Variable	Unit	All films				
		Median	Average	Std.dev.	Min	Max
CompAge	Years	32	41.2	34.6	2	237
Empl	Count	126	240.9	637.9	50	16700
EBITDA	DKKt	18117	69707	743208	-736014	23500000
TotBal	DKKt	180408	554590	1831384	74392	30300000
ROA	%	5.04	5.54	14.23	-190.22	94.93
ROE_I	%	13.17	5.23	89.69	-999.99	471.20
Gearing	%	1.57	5.04	39.86	0.00	999.99

The variables listed in table 8 represent the continuous variables of our sample, except for *CompAge* and *Empl*. With respect to company age and the total number of employees, it is intuitive that there is substantial variation inherent in the data. The *Empl* variable is highly affected by our chosen cut-off value of 50 employees and above. A typical company in our sample has an average of approx. 241 employees, with a median of 126 employees. The notion of substantial variation is confirmed by the large standard deviation of almost

638 employees. This is also the case for company age, where a standard deviation of 34.6 years is very substantial, considering that the average company in our sample is 41.2 years old (median of 32 years).

Similar to the number of employees, the total balance statistics is also affected by the chosen cut-off value at EUR 10m. The average company in the sample has a total balance sheet figure of approx. DKK 545m, yet with substantial skew as the median is relatively small with a little over DKK 180m. A similar skew is also observed with the EBITDA variable, where mean and median diverge substantially.

With respect to the three financial ratios, *ROA*, *ROE_I,* and *Gearing*, we observe substantial variation and a problem with outliers. Especially troublesome are the extreme outliers taking on values of -999.99% and 999.99% (presumably the data is capped at these values), which will bias our regression results. In addition, it appears that there is heavy skew in the Gearing and ROE_I ratios as the median and average are far apart. Interestingly, with ROE_I we observe that the median is above the average indicating that we have a lot of companies with very poor financial performance in terms of ROE_I (very negative values). With gearing, we see the contrary. A median well below the average indicates that we have some companies in our dataset which are very highly levered.

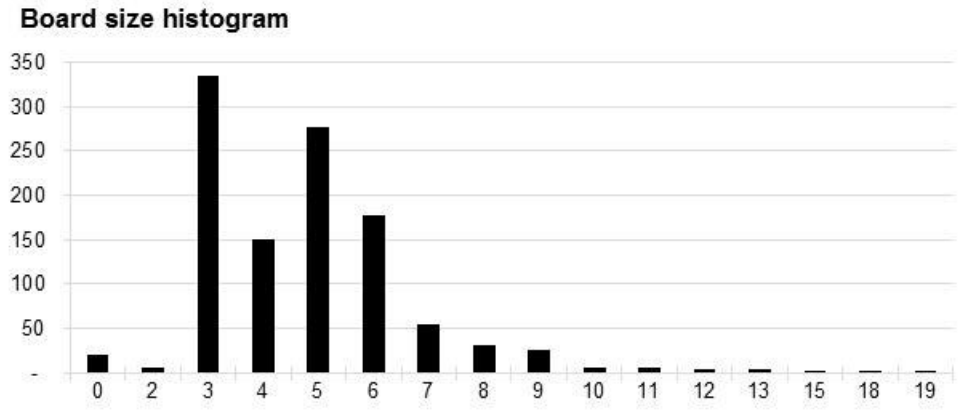
4.6 Board size

Table 9 – Distribution of the companies by number of board members

Number of board members		
BoardSize	N	Percent
0	20	1.82%
2	6	0.55%
3	334	30.45%
4	150	13.67%
5	276	25.16%
6	177	16.13%
7	55	5.01%
8	31	2.83%
9	26	2.37%
10	5	0.46%
11	5	0.46%
12	4	0.36%
13	4	0.36%
15	1	0.09%
18	2	0.18%
19	1	0.09%
Total	**1,097**	**100%**

With respect to the number of people represented on the board, we see substantial variation in the data ranging from values of 0 (board non-existent) to 19. There appears to be a cluster around the values of 3 to 6 with more than half of companies represented in this region. Most of the 20 companies without a board are private limited partnerships (ApS), along with two partnerships (I/S) and one joint-stock company (A/S). The latter must be a mistake in the reporting of the data as all joint-stock companies are legally required to have a board. It is not surprising we do not observe more companies without boards as we only look at medium-sized and large enterprises with specific data information available.

Figure 2 – Histogram depicting the distribution of companies by board size



It is noteworthy that the most common board size value is 3, represented by approx. one third of the sample, as this is the minimum board size required by law for a joint-stock company (A/S). An explanation could be that these companies simply do not need a board composed of more than three board members to maintain the functions of the board.
Additionally, the shape of the distribution of board size is interesting and highly relevant for the regression models later on, which use the variable for board size as the dependent variable. It appears reasonable to regard the shape as a normal distribution. Hence, the necessity to use a log function of the variable, which would smoothen the distribution even more to enhance the normal distribution characteristics, is not given. Therefore, we opted to use the normal board size variable instead of the log board size as the dependent variable in our regression models. Further, it might not be necessary to apply a Poisson model to this type of dependent count variable, given the relatively normally distributed data, even though it will be done for robustness purposes.

4.7 Board composition

Table 10 – Diversity variables summary statistics

Diversity variable	All films				
	Median	Average	Std.dev.	Min	Max
WomenRatio	0	0.11	0.16	0	0.78
WorkElectR~o	0	0.14	0.18	0	1.00
ForeignRatio	0	0.24	0.32	0	1.00

(this table will be referred to in the subsections below)

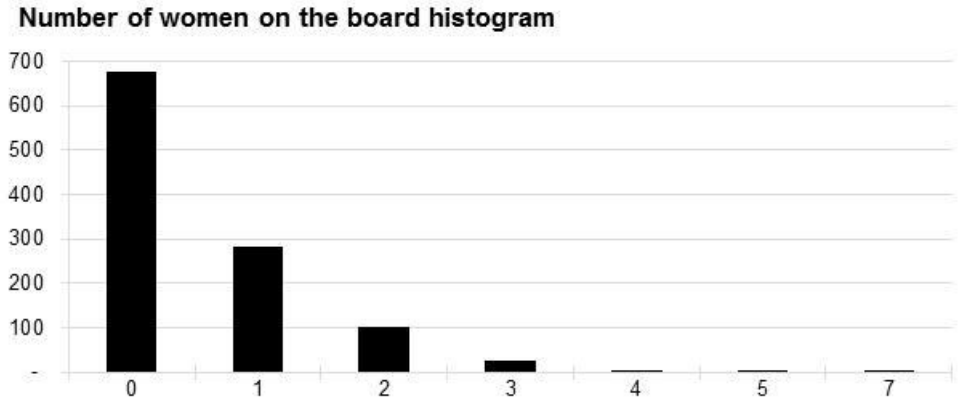
4.7.1 Women on the board

Table 11 – Distribution of the companies by number of females on board

Number of females on board		
TotWomenBoard	N	Percent
0	676	61.62%
1	284	25.89%
2	102	9.30%
3	27	2.46%
4	5	0.46%
5	2	0.18%
7	1	0.09%
Total	**1,097**	**100%**

In our sample, the total number of women represents 11% of total board members, as indicated in the table 10 on board composition. Note that all figures for the three variables on women, worker-elected, and foreign representation are calculated as ratios of total board size. A value of 1 would therefore indicate that the entire board is composed of e.g. women. The reason for the low average of 11% arises primarily due to the fact that 61.62% of boards do not have female representatives at all. This is demonstrated in table 10. In addition, we see that approx. one fourth of the companies in the sample have one woman present. Overall, it appears that women on boards, especially in larger numbers, is very uncommon. This is also demonstrated by the fact that the median women board ratio is 0 and the mean is 11%. (table 10). As illustrated in the histogram (figure 3), the distribution does not look very normally distributed but can probably be approximated much better by a Poisson distribution.

Figure 3 – Histogram depicting the distribution of companies by number of women on board



4.7.2 Worker-elected representatives

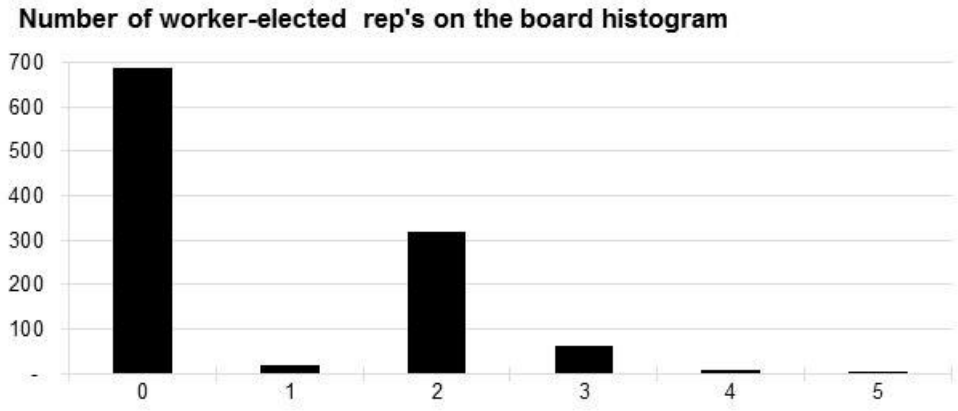
Table 12 – Distribution of companies by number of workers on board

Number of workers on board		
NoWorkElecReps	N	Percent
0	686	62.53%
1	19	1.73%
2	320	29.17%
3	64	5.83%
4	7	0.64%
5	1	0.09%
Total	**1,097**	**100%**

With respect to worker representation on boards, we observe that 62.53% of the Danish boards in our sample do not have employee directors currently instated. Not coincidentally, of the companies which put worker-elected representatives on the board, it is very uncommon to have only one employee director. Only 1.73% of firms opt for one employee-elected representative. The law states that employees, when represented, have the right to at least two board seats. Therefore, it is actually strange that we even observe some companies with only one worker-elected representative. Overall, it appears that there is a tendency for companies to maintain a minimum of worker-elected representatives because few companies exceed the legally required minimum of two such board members and opt for three and even more employee directors. A noteworthy fact, however, is that table 10 shows a worker-elected ratio of 1.0 as a maximum value. This simply means that in our sample, we are able to observe rare cases in which an entire corporate board is composed of employee-elected directors. The distribution is not very normal, as can be seen in the histogram (figure 4). It resembles a bit more a Poisson distribution, but the fact that the

one worker-elected representative observations have so few observations (de facto censored by legal requirement as stated above) makes it harder to approximate the distribution through Poisson.

Figure 4 – Histogram depicting the distribution of companies by number of worker directors



4.7.3 Foreigners on the board

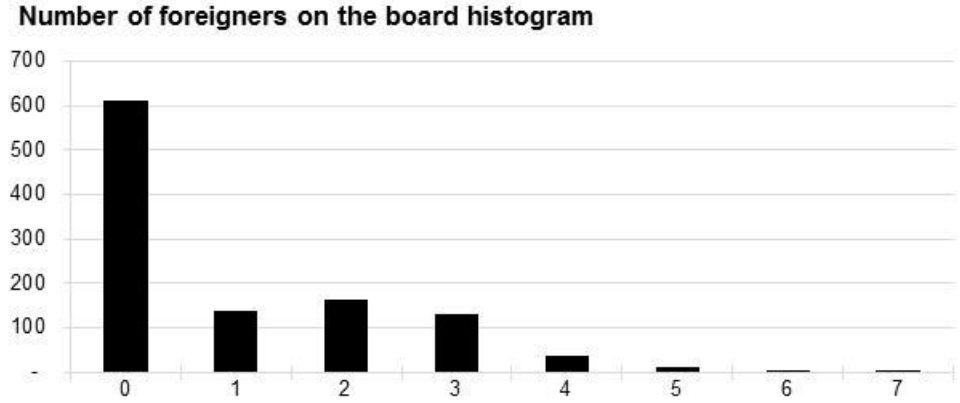
Table 13 – Distribution of companies by number of foreigners on board

Number of foreigners on board

TotForeignBoard	N	Percent
0	610	55.61%
1	138	12.58%
2	162	14.77%
3	131	11.94%
4	36	3.28%
5	12	1.09%
6	5	0.46%
7	3	0.27%
Total	**1,097**	**100%**

As with the other diversity variables, it appears more than 55% of the companies in the sample do not have foreigners on the board. There is, however, more variation with respect to foreigners on board, as can be seen from the higher standard deviation. In addition, it appears that more companies have more foreigners on board, relatively, than either worker-elected representatives or women representatives judging by the higher average value. As evident in the histogram (figure 5), the distribution is not very normal given the large amount of 0-observations. It can better be approximated by a Poisson distribution.

Figure 5 – Histogram depicting the distribution of companies by number of foreigners on board



4.8 Summary statistics of dependent variables conditional on explanatory variables

To get an initial idea on potential relationships between important variables in our data, we constructed a few tables where we depict dependent variables along different values of selected categorical and ordinal variables.

4.8.1 Board size

Here we investigate board size as a dependent variable and the following tables will thus depict median, average, standard deviation, minimum, and maximum of board size for different values of the categorical or ordinal variable.

Table 14 – Summary statistics on board size by number of business segments the companies are active in

Board size by…	All films				
NoSegments	Median	Average	Std.dev.	Min	Max
1	4	4.69	2.21	0	19
2	5	4.72	1.72	0	13
3	5	4.85	1.90	0	13
4	5	5.11	1.73	3	11
5	5	4.44	2.46	0	9
6	5	5.00	1.41	4	6
7	5	5.00	.	5	5

In table 14, we look for an indication of a relationship between number of industry segments a company is active in, a measure of complexity, and the board size. Surprisingly, we do not see much variation or median across different values for *NoSegments*.

Table 15 – Summary statistics on board size the companies' Fama and French (1997) codes

Board size by..	All films					Board size by	All films - *continued*				
FamaFrench1	Median	Average	Std.dev.	Min	Max	FamaFrench1	Median	Average	Std.dev.	Min	Max
Aero	5	5.00	0.00	5	5	Hshld	5	5.00	1.36	3	7
Agric	0	0.00	.	0	0	LabEq	5	4.93	1.69	2	8
Autos	5	4.75	1.16	3	7	Mach	5	4.72	1.36	0	7
Beer	5.5	5.50	0.71	5	6	Meals	4	4.67	2.26	3	10
BldMt	5	4.69	1.16	3	7	Mines	3	4.00	1.73	3	6
Books	5	4.93	2.91	0	11	Misc	4	4.33	1.29	3	7
Boxes	8	8.00	7.07	3	13	Paper	5	5.07	1.27	3	7
BusSv	5	4.98	2.70	0	18	PerSv	4	4.00	1.15	3	5
Chems	5	5.50	2.18	3	9	RlEst	3	3.00	2.00	0	6
Chips	6	5.67	0.58	5	6	Rtail	4	4.92	2.27	0	13
Clths	4	4.00	.	4	4	Rubbr	5	5.00	1.25	3	7
Cnstr	5	4.94	1.66	3	10	Ships	7	6.67	1.53	5	8
Comps	3	3.00	4.24	0	6	Smoke	6	6.00	.	6	6
Drugs	4.5	4.50	1.27	3	6	Soda	5	5.00	0.00	5	5
ElcEq	5	5.00	1.78	3	9	Steel	6	5.42	1.07	3	7
Enrgy	5	5.00	2.24	3	9	Telcm	3	4.36	1.63	3	7
FabPr	5	4.93	1.57	0	9	Toys	6	6.00	.	6	6
Food	5	4.87	2.08	0	12	Trans	4	4.83	2.00	3	12
Fun	4	4.26	1.54	3	9	Txtls	6	6.00	1.87	4	9
Guns	3	3.00	.	3	3	Util	6	5.95	3.14	0	13
Hlth	3.5	3.50	0.71	3	4	Whlsl	4	4.25	1.87	0	19

In table 15, we show key statistics for board size across different industry segments using the Fama and French (1997) industry codes. Looking at the averages, we do observe some variation in the board size across industries. The standard deviations across the different industries appear to be varying widely. This is partially due to the few observations that are available in certain categories, which inflates the standard deviation. Overall the above arguments suggest that we are right in our approach to control for industry types in our regressions.

Table 16– Summary statistics on board size by the companies' corporate form

Board size by…	All films				
Corporate form type	Median	Average	Std.dev.	Min	Max
(Small) private limited company ("Anpartsselskab")	4	3.51	2.12	0	8
Company with limited liability ("Selskab med begrænset ansvar")	19	19.00	.	19	19
Joint-stock company	5	4.75	1.77	0	18
Limited liability cooperative (amba)	8	8.27	1.87	7	13
Limited liability partnership ("Kommanditaktieselskab")	5	7.30	5.29	3	18
Limited partnership ("Kommanditselskab")	3	3.00	0.00	3	3
Owner n/a (newly established not found)	6	6.00	.	6	6
Partnership ("Interessentskab")	4	5.00	4.51	0	12

With table 16, we want to investigate the variation in board size across different corporate form types. As illustrated, there appears to be a substantial amount of variation in the board size average. Again, we have several categories with only a few observations, while joint-stock companies represent 974 observations and private limited companies 86 observations out of the total sample of 1,097. We do, however, also see substantial difference between these two corporate form types. Overall, this table shows that we are right in using a dummy variable for other corporate form types than joint-stock companies to control for the effect of corporate form.

Table 17 – Summary statistics on board size by the number of subsidiaries the companies have

Board size by…	All films				
NoFrgnSubs	Median	Average	Std.dev.	Min	Max
0	5	4.62	2.05	0	18
1	4	4.61	1.70	0	12
2	5	5.23	2.57	0	19
3	5	4.80	1.69	0	9
4	5	5.21	1.28	4	9
5	5	5.15	1.09	3	7
6	5	5.41	1.77	2	9
7	5.5	4.80	1.62	3	7
8	6	5.63	1.30	3	7
9	5	4.83	1.17	3	6
11	4.5	5.00	3.16	2	9
12	6	5.80	1.48	4	8
13	9	9.00	.	9	9
14	6	6.00	.	6	6
16	6	6.00	.	6	6
19	8	8.00	.	8	8
20	9	9.00	.	9	9
22	9	9.00	.	9	9
24	3	3.00	.	3	3
25	9	9.00	.	9	9
30	5	5.00	.	5	5
48	9	9.00	.	9	9

In table 17, we relate board size to the number of subsidiaries to see if any relationship is suggested. The average board size of companies in the range 0-12 foreign subsidiaries does not appear to be very different, although the standard deviations do vary somewhat. There is only a handful of companies with more than 12 subsidiaries (note the non-existent standard deviation) and some of these appear to have a larger board.

4.8.2 Women on the board

Next, we turn to the diversity variables. First, number of women on the board:

Table 18 – Summary statistics on number of women on board by number of segments

TotWomenBoard by…	All films				
NoSegments	Median	Average	Std.dev.	Min	Max
1	0	0.49	0.80	0	5
2	0	0.60	0.90	0	7
3	0	0.66	0.89	0	4
4	0	0.64	0.86	0	3
5	0	0.56	0.73	0	2
6	0	0.00	0.00	0	0
7	1	1.00	.	1	1

From table 18 we can infer that the total number of women on board does not vary much across number of segments in terms of average number of women on board.

Table 19 – Summary statistics on number of females on board by Fama and French (1997) industry codes

TotWomenBoard by…	All films					TotWomenBoard by…	All films - *continued*				
FamaFrench1	Median	Average	Std.dev.	Min	Max	FamaFrench1	Median	Average	Std.dev.	Min	Max
Aero	0	0.00	0.00	0	0	Hshld	0	0.87	1.06	0	3
Agric	0	0.00	.	0	0	LabEq	0	0.43	0.51	0	1
Autos	0	0.25	0.71	0	2	Mach	0	0.37	0.62	0	3
Beer	0.5	0.50	0.71	0	1	Meals	1	1.33	1.50	0	5
BldMt	0	0.46	0.66	0	2	Mines	0	0.00	0.00	0	0
Books	0	0.80	1.15	0	3	Misc	0	0.33	0.62	0	2
Boxes	1	1.00	1.41	0	2	Paper	0	0.36	0.50	0	1
BusSv	0	0.60	0.86	0	4	PerSv	0.5	0.50	0.58	0	1
Chems	0.5	0.79	0.97	0	3	RlEst	0	0.20	0.63	0	2
Chips	0	0.33	0.58	0	1	Rtail	1	1.13	1.34	0	7
Clths	2	2.00	.	2	2	Rubbr	0	0.27	0.46	0	1
Cnstr	0	0.46	0.74	0	3	Ships	1	0.67	0.58	0	1
Comps	0.5	0.50	0.71	0	1	Smoke	0	0.00	.	0	0
Drugs	0	0.60	0.84	0	2	Soda	0	0.00	0.00	0	0
ElcEq	0	0.41	0.64	0	2	Steel	0	0.47	0.77	0	3
Enrgy	1	1.00	0.82	0	2	Telcm	0	0.27	0.47	0	1
FabPr	0	0.32	0.57	0	2	Toys	1	1.00	.	1	1
Food	0	0.53	0.69	0	2	Trans	0	0.62	0.89	0	4
Fun	0	0.39	0.78	0	3	Txtls	0	0.40	0.89	0	2
Guns	1	1.00	.	1	1	Util	1	0.95	0.90	0	3
Hlth	1	1.00	1.41	0	2	Whlsl	0	0.46	0.73	0	4

From table 19 we see that the average amount of women on the board is quite different across industries. This suggests an interesting relationship, which might be connected to our hypothesis that number of women on the board is related to industry type.

Table 20 – Summary statistics on number of women on board by corporate form

TotWomenBoard by…	All films				
Corporate form type	Median	Average	Std.dev.	Min	Max
(Small) private limited company ("Anpartsselskab")	0	0.59	0.79	0	3
Company with limited liability ("Selskab med begrænset ansvar")	2	2.00	.	2	2
Joint-stock company	0	0.52	0.79	0	5
Limited liability cooperative (amba)	3	2.53	1.88	0	7
Limited liability partnership ("Kommanditaktieselskab")	1	0.50	0.53	0	1
Limited partnership ("Kommanditselskab")	1	0.67	0.58	0	1
Owner n/a (newly established not found)	0	0.00	.	0	0
Partnership ("Interessentskab")	0	0.86	1.21	0	3

In table 20, we observe a substantial amount of variation in the average number of women across different corporate form types for other companies than joint-stock companies or private limited companies (the majority of our sample). Therefore, it appears reasonable to control for corporate form in this case.

Table 21 – Summary statistics on number of women on board by number of foreign subsidiaries

TotWomenBoard by…	All films				
NoFrgnSubs	Median	Average	Std.dev.	Min	Max
0	0	0.58	0.88	0	7
1	0	0.34	0.61	0	2
2	0	0.60	0.84	0	3
3	0	0.42	0.74	0	3
4	0	0.54	0.72	0	2
5	0	0.50	0.69	0	2
6	1	0.88	0.93	0	3
7	0	0.50	0.71	0	2
8	0	0.25	0.46	0	1
9	0	0.67	1.03	0	2
11	0	0.25	0.50	0	1
12	1	0.80	0.84	0	2
13	0	0.00	.	0	0
14	0	0.00	.	0	0
16	0	0.00	.	0	0
19	0	0.00	.	0	0
20	2	2.00	.	2	2
22	1	1.00	.	1	1
24	0	0.00	.	0	0
25	2	2.00	.	2	2
30	0	0.00	.	0	0
48	1	1.00	.	1	1

With respect to number of foreign subsidiaries and number of women on board, there is variation in the average but a clear trend is not evident.

4.8.3 Worker-elected representatives

Table 22 – Summary statistics on number of worker directors by number of segments

NoWorkElecReps by…	All films				
NoSegments	Median	Average	Std.dev.	Min	Max
1	0	0.72	1.06	0	4
2	0	0.81	1.09	0	5
3	0	0.93	1.12	0	4
4	2	1.30	1.17	0	4
5	0	1.00	1.22	0	3
6	1	1.00	1.41	0	2
7	2	2.00	.	2	2

From table 22, there is an indication that average number of worker-elected representatives on the board appears to increase in the number of industry segments the company is active in.

Table 23 – Summary statistics on number of worker directors by Fama and French (1997) industry codes

NoWorkElecReps by…	All films						All films - *continued*				
FamaFrench1	Median	Average	Std.dev.	Min	Max	FamaFrench1	Median	Average	Std.dev.	Min	Max
Aero	2	2.00	0.00	2	2	Hshld	2	1.33	1.18	0	3
Agric	0	0.00	.	0	0	LabEq	2	1.50	1.22	0	3
Autos	2	1.38	1.19	0	3	Mach	2	1.15	1.03	0	3
Beer	2	2.00	0.00	2	2	Meals	0	0.53	1.13	0	3
BldMt	0	0.89	1.08	0	3	Mines	0	0.33	0.58	0	1
Books	2	1.47	1.36	0	4	Misc	0	0.73	1.10	0	3
Boxes	2	2.00	2.83	0	4	Paper	2	1.50	1.02	0	3
BusSv	0	0.82	1.14	0	4	PerSv	0	0.50	1.00	0	2
Chems	2	1.36	1.28	0	3	RlEst	0	0.20	0.63	0	2
Chips	2	1.33	1.15	0	2	Rtail	0	0.38	0.83	0	3
Clths	0	0.00	.	0	0	Rubbr	2	1.53	0.99	0	3
Cnstr	0	0.88	1.14	0	3	Ships	2	2.33	0.58	2	3
Comps	1	1.00	1.41	0	2	Smoke	2	2.00	.	2	2
Drugs	0	0.80	1.03	0	2	Soda	0	0.00	0.00	0	0
ElcEq	2	1.26	1.13	0	3	Steel	2	1.53	0.96	0	3
Enrgy	2	1.29	1.25	0	3	Telcm	0	0.36	0.81	0	2
FabPr	2	1.14	1.08	0	3	Toys	2	2.00	.	2	2
Food	0	0.85	1.13	0	4	Trans	0	0.55	1.03	0	4
Fun	0	0.39	0.89	0	3	Txtls	2	1.40	1.34	0	3
Guns	0	0.00	.	0	0	Util	0	0.68	1.29	0	3
Hlth	0	0.00	0.00	0	0	Whlsl	0	0.52	0.93	0	5

In table 23, we see a substantial amount of variation in the average number of worker-elected representatives across different industries. It thus appears valid to include this in the regression.

Table 24 – Summary statistics on number of worker directors by corporate form

NoWorkElecReps by…	All films				
Corporate form type	Median	Average	Std.dev.	Min	Max
(Small) private limited company ("Anpartsselskab")	0	0.52	0.89	0	3
Company with limited liability ("Selskab med begrænset ansvar")	0	0.00	.	0	0
Joint-stock company	0	0.84	1.11	0	5
Limited liability cooperative (amba)	0	0.67	0.82	0	2
Limited liability partnership ("Kommanditaktieselskab")	0	0.30	0.95	0	3
Limited partnership ("Kommanditselskab")	0	0.00	0.00	0	0
Owner n/a (newly established not found)	2	2.00	.	2	2
Partnership ("Interessentskab")	0	0.29	0.76	0	2

From table 24, we see a substantial amount of variation in number of worker-elected representatives across corporate form types, surprisingly also between the two largest categories, joint-stock companies and private limited companies. Thus, it seems appropriate to take industry into account in the regressions.

Table 25 – Summary statistics on number of worker directors by number of foreign subsidiaries

NoWorkElecReps by…	All films				
NoFrgnSubs	Median	Average	Std.dev.	Min	Max
0	0	0.73	1.06	0	5
1	0	0.70	1.01	0	3
2	0	1.08	1.22	0	4
3	0	0.87	1.07	0	3
4	0	0.75	1.03	0	3
5	1	1.05	1.10	0	3
6	2	1.41	1.18	0	3
7	1.5	1.20	1.14	0	3
8	2	2.00	0.93	0	3
9	1	1.00	1.10	0	2
11	2	1.75	1.26	0	3
12	2	1.60	0.89	0	2
13	3	3.00	.	3	3
14	2	2.00	.	2	2
16	2	2.00	.	2	2
19	2	2.00	.	2	2
20	3	3.00	.	3	3
22	3	3.00	.	3	3
24	0	0.00	.	0	0
25	3	3.00	.	3	3
30	0	0.00	.	0	0
48	3	3.00	.	3	3

In table 25, we see a weak tendency that the average number of worker-elected representatives increases in number of foreign subsidiaries.

4.8.4 Foreigners on the board

Table 26 – Summary statistics on number of foreign directors by number of segments

TotForeignBoard by…	All films				
NoSegments	Median	Average	Std.dev.	Min	Max
1	0	1.05	1.40	0	7
2	0	0.97	1.35	0	7
3	0	0.86	1.25	0	5
4	1	1.23	1.28	0	4
5	0	0.33	0.71	0	2
6	1	1.00	1.41	0	2
7	1	1.00	.	1	1

Table 26 does not suggest that there is much variation in the average number of foreigners on the board when a company is active in more industry segments.

Table 27 – Summary statistics on number of foreign directors by Fama & French (1997) industry code

TotForeignBoard by…	All films						All films - *continued*				
FamaFrench1	Median	Average	Std.dev.	Min	Max	FamaFrench1	Median	Average	Std.dev.	Min	Max
Aero	2	2.00	0.00	2	2	Hshld	0	0.80	1.15	0	3
Agric	0	0.00	.	0	0	LabEq	0	0.86	1.29	0	3
Autos	0	0.63	0.92	0	2	Mach	0	1.00	1.29	0	4
Beer	1.5	1.50	0.71	1	2	Meals	0	0.60	1.06	0	3
BldMt	0	1.17	1.69	0	6	Mines	0	0.67	1.15	0	2
Books	0	1.27	1.49	0	4	Misc	0	0.73	1.28	0	4
Boxes	3.5	3.50	4.95	0	7	Paper	0	1.14	1.51	0	4
BusSv	0	0.89	1.20	0	6	PerSv	1	1.25	1.50	0	3
Chems	0	0.93	1.69	0	5	RlEst	0.5	1.00	1.25	0	3
Chips	1	1.67	2.08	0	4	Rtail	0	0.38	0.92	0	4
Clths	0	0.00	.	0	0	Rubbr	2	1.80	1.47	0	4
Cnstr	0	0.52	1.05	0	4	Ships	1	0.67	0.58	0	1
Comps	1.5	1.50	2.12	0	3	Smoke	0	0.00	.	0	0
Drugs	1	1.40	1.51	0	4	Soda	3	3.00	1.41	2	4
ElcEq	1	1.07	1.33	0	5	Steel	1	1.21	1.32	0	4
Enrgy	2	1.71	1.38	0	4	Telcm	2	2.09	2.30	0	7
FabPr	0	0.77	1.20	0	4	Toys	0	0.00	.	0	0
Food	0.5	1.24	1.62	0	6	Trans	0	0.84	1.36	0	6
Fun	1	1.04	1.22	0	4	Txtls	0	0.20	0.45	0	1
Guns	3	3.00	.	3	3	Util	0	0.64	1.18	0	4
Hlth	1.5	1.50	2.12	0	3	Whlsl	1	1.28	1.38	0	7

From table 27 it appears that the average number of foreigners on the board tends to vary across industries. It thus also seems valid to control for industry type in a regression with foreigners on board as a dependent variable.

Table 28 – Summary statistics on number of foreign directors by corporate form

TotForeignBoard by…	All films				
Corporate form type	Median	Average	Std.dev.	Min	Max
(Small) private limited company ("Anpartsselskab")	1	1.40	1.47	0	7
Company with limited liability ("Selskab med begrænset ansvar")	7	7.00	.	7	7
Joint-stock company	0	0.99	1.34	0	7
Limited liability cooperative (amba)	0	0.13	0.35	0	1
Limited liability partnership ("Kommanditaktieselskab")	0	0.30	0.95	0	3
Limited partnership ("Kommanditselskab")	0	0.00	0.00	0	0
Owner n/a (newly established not found)	1	1.00	.	1	1
Partnership ("Interessentskab")	0	0.71	1.89	0	5

In table 28, it is evident that the average number of foreigners on the board seems to vary across corporate form types and that it is thus valid to control for this in a regression.

Table 29 – Summary statistics on number of foreign directors by number of foreign subsidiaries

TotForeignBoard by…	All films				
NoFrgnSubs	Median	Average	Std.dev.	Min	Max
0	0	0.98	1.34	0	7
1	1	0.99	1.21	0	5
2	1	1.35	1.66	0	7
3	0	1.02	1.52	0	6
4	0	0.75	1.22	0	5
5	0	0.60	1.19	0	4
6	2	1.53	1.50	0	4
7	0	1.00	1.41	0	3
8	1	1.25	1.39	0	3
9	0	0.67	1.21	0	3
11	2	1.75	1.26	0	3
12	0	1.00	1.41	0	3
13	0	0.00	.	0	0
14	2	2.00	.	2	2
16	3	3.00	.	3	3
19	3	3.00	.	3	3
20	5	5.00	.	5	5
22	0	0.00	.	0	0
24	2	2.00	.	2	2
25	0	0.00	.	0	0
30	1	1.00	.	1	1
48	0	0.00	.	0	0

Table 29 suggests a tendency that the average number of foreigners on the board increases in the number of foreign subsidiaries the company has. This is interesting as it may indicate that, when new foreign subsidiaries are added, a firm needs foreigners with international expertise.

4.9 Correlation statistics

To get an initial impression of the strength of relationships between our variables, we created table 30 for bivariate analysis (located a few pages ahead), which shows the correlation between our primary variables of interest. Note that we deliberately included more variables than used in later regressions to uncover potential issues with omitted variables. In addition, these correlations are useful when trying to avoid multicollinearity issues in our data as they indicate whether some variables are measuring the same type of effect, e.g. two variables might proxy for firm size and have a high correlation between each other, which means that including both in the same regression can cause multicollinearity.

4.9.1 Board size

First, we investigate which variables tend to have a high correlation with board size, a primary dependent variable in our following regressions. Here we see a moderate correlation with the firm size measures total balance sheet and number of employees (approx. 0.09-0.10). Further, we note the relatively low correlations with the different performance variables such as EBITDA, ROA, and ROE_I. The complexity variables have varying correlations with board size. Whether the company is listed or not has some correlation with board size (approx. 0.10). Company age surprisingly has a correlation of approx. 0.19, while e.g. number of industry segments a company is active in only has a correlation of approx. 0.04. Number of foreign subsidiaries also appears important (correlation approx. 0.15). Whether the company has a foreign parent or not also has a substantial correlation with board size (approx. -0.13). With respect to the board diversity variables, they all evidence a high correlation with board size, particularly the worker-elected ratio with a correlation of 0.4452. Overall, we have correlation in some of the key underlying variables we suggested in our hypotheses section (cf. hypotheses 1-3), which gives us some potentially interesting regressions for board size.

4.9.2 Board composition

Second, we turn to board composition and check for notable correlations for dependent variables on board diversity. We focus in this section on the dummy variables for our three board diversity elements, as these dummies will be used as our primary dependent variables for our board composition regressions.

With respect to *Women_dummy*, whether any female board members are present on the board or not, we see: a notable correlation with the size of the board (0.3157); some correlation with the size variables, total balance (0.1032) and number of employees (0.0803); some correlation with the performance measure ROE (0.0802); some correlation with the complexity measure company age (0.1449); and some correlation with the board diversity variables *WorkElectRatio* (0.1870) and *ForiegnRatio* (-0.0790). As several of these correlations relate to size, complexity as well as board diversity in terms of employee-elected and foreigners on board, this bodes well for our hypotheses relating to women on board (cf. hypotheses 4-5).

With regards to *Worker_dummy*, whether any worker-elected representatives are present on the board or not, we observe: very high correlation with board size (0.5074); some correlation with especially employees as a size variable (0.1276) vs. *TotBal* (0.0605), which makes sense given that we are looking at worker representatives; substantial correlation with complexity variables such as our exporting worldwide dummy (0.2388) and company age (0.2798) as well number of foreign subsidiaries (0.1523); and some correlation with board diversity variables, *WomenRatio* (0.0701) and *ForeignRatio* (0.0790). The correlations on size and complexity can be linked to our hypotheses on employee-elected representatives (hypothesis 5-6), and thus it looks as if we may derive some interesting results from this regression.

With respect to *Foreign_dummy*, whether any foreigners are present on the board or not, we note: low correlation with board size (-0.0443), especially compared with the other board diversity variables; low correlation with size measures, max. 0.0592, which is with total balance; low correlation for most complexity measures; a very high correlation with dummy for having a foreign parent (0.4743), which is not that surprising; and little correlation with board diversity variables, *WomenRatio* (-0.0319) and *WorkElecRatio* (0.0778). These correlations look less promising for our hypothesis on foreigners on board (hypothesis 7), at least for size and complexity. The effect of foreign ownership, and to some extent female presence, appears promising though.

4.9.3 Correlation among explanatory variables

Not surprisingly, several of the variables, which proxy for the same factor, have high correlations with each other. It is important to identify these at this stage in order to use them carefully in our regressions.

First, we note that our two size measures, total balance sheet value and number of employees, are highly correlated with each other (correlation 0.4761), as well as with EBITDA. Second, we observe that the performance measures all have some degree of correlation with each other. As an example, average ROA over the last five years, has correlations with the other performance measures of 0.2725-0.7151 (EBITDA-EBITDA/total assets). Gearing is highly correlated with ROE, which seems intuitive granted the reasoning that higher leverage should increase the return going to equity holders as the equity becomes more risky. Third, we notice some relations with the complexity variables. With respect to the internationality variable, we see that the dummies for exporting and importing worldwide are highly correlated (correlation 0.4513), dummy for foreign parent is highly correlated with foreigners on board related variables, and number of foreign subsidiaries is highly correlated with number of subsidiaries (0.9979) and to a much lesser extent with the import (0.1517) and export (0.2608) dummies. Another complexity measure, company age, is highly correlated with number of industry segments a company is active in (0.2064) as well as with number of bank connections a company has (0.1556) and worker-related board variables (0.2728-0.2798). The other variables of interest for our regressions do not exhibit worrying correlations that we have to account for to deal with multicollinearity concerns.

This section has demonstrated some of the potential relationships between dependent and explanatory variables, and has indicated which explanatory variables we have to be careful with in order to mitigate multicollinearity concerns with respect to our regressions. These regression models will be analyzed in the following chapters.

Table 30 – Correlation table with the most important variables

Correlation	BoardS~e	TotBal	Empl	EBITDA	EBITDA~s	ROA	ROA_t1	ROA_t2	ROA_Avg5	ROE_I	Gearing	Import~y	Export~y	Listed~y	OtherC~y	CompAge	NoSegm~s	NoSubs~s	NoFrgn~s	FrgnPa~y	NoBank~n	NoAcc	CEODua~y	Board_~y	WomenR~o	WorkEl~o	Foreig~o	Women_~y	Worker~y	Frgn_d~y	LargeC~y
BoardSize	1																														
TotBal	0.0962*	1																													
Empl	0.0909*	0.4761*	1																												
EBITDA	-0.011	0.4828*	0.1323*	1																											
EBITDAOver~s	0.0082	0.0442*	0.0005	0.3062*	1																										
ROA	0.0187	0.0504*	0.0091	0.2460*	0.9354*	1																									
ROA_t1	-0.0026	0.0405	0.0211	0.1772*	0.5488*	0.5703*	1																								
ROA_t2	-0.0113	0.0742*	0.0152	0.2669*	0.4916*	0.4882*	0.6736*	1																							
ROA_Avg5	-0.0113	0.0554*	0.0097	0.2725*	0.7151*	0.7286*	0.7808*	0.8531*	1																						
ROE_I	0.043	0.0343	0.0214	0.0741*	0.5138*	0.5687*	0.3441*	0.2413*	0.4027*	1																					
Gearing	-0.0333	-0.0059	-0.0092	-0.008	-0.0479*	-0.039	-0.0191	-0.0187	-0.0341	-0.3333*	1																				
ImportWW_d~y	0.0224	-0.0029	0.0533*	-0.0128	0.0690*	0.1042*	0.0427	0.0301	0.0738*	0.0750*	-0.0463*	1																			
ExportWW_d~y	0.0819*	-0.0126	-0.0063	-0.0113	0.0455*	0.0670*	0.0492*	0.0124	0.0486*	0.0243	-0.0473*	0.4513*	1																		
Listed_dummy	0.1027*	0.0589*	-0.006	-0.0107	-0.1188*	-0.1082*	-0.1105*	-0.0456*	-0.0922*	-0.0343	-0.0118	0.0467*	0.0372	1																	
OtherCorpF~y	-0.0213	0.0628*	-0.0102	-0.0075	0.0058	0.0291	0.0623*	0.0226	0.0327	0.0434	0.0363	-0.0524*	-0.0635*	-0.0432	1																
CompAge	0.1885*	-0.0124	0.0435*	-0.0051	0.0147	0.0367	0.0154	0.0458*	0.0590*	0.0249	-0.0551*	0.1350*	0.1354*	0.0651*	-0.0671*	1															
NoSegments	0.0373	0.0749*	0.1502*	0.0036	-0.0266	-0.016	-0.0112	-0.0275	-0.0172	-0.0241	-0.0345	0.0041	0.0135	0.0026	-0.0117	0.2064*	1														
NoSubsidia~s	0.1461*	0.1646*	0.0781*	0.005	-0.0648*	-0.025	-0.0065	-0.0298	-0.0434	0.0188	-0.0299	0.1502*	0.2592*	0.0851*	-0.0238	0.0715*	0.0172	1													
NoFrgnSubs	0.1455*	0.1394*	0.0612*	-0.0016	-0.0640*	-0.024	-0.0071	-0.0309	-0.0436*	0.0189	-0.0298	0.1517*	0.2608*	0.0865*	-0.0223	0.0732*	0.0137	0.9979*	1												
FrgnParent~y	-0.1349*	-0.0036	0.0067	-0.0174	0.0016	0.0181	-0.0028	-0.0315	-0.0146	0.0486*	-0.0327	-0.0145	-0.0115	-0.0671*	0.0567*	-0.0013	0.0276	-0.0427	-0.0404	1											
NoBankCon	0.1190*	-0.0321	0.0622*	-0.0540*	0.0334	0.0512*	0.0301	0.0273	0.0544*	0.0025	-0.0595*	0.1232*	0.1449*	0.0591*	-0.0945*	0.1556*	0.0942*	0.0586*	0.0592*	-0.0741*	1										
NoAcc	0.0201	0.0910*	0.0149	0.0112	0.0207	0.0191	0.0353	0.0045	0.0203	-0.0905*	0.2117*	-0.0414	-0.0647*	0.0623*	0.0244	0.0134	-0.0492*	0.0109	0.0114	-0.0483*	0.0047	1									
CEODual_du~y	0.0079	0.1415*	0.1053*	0.0219	0.03	0.0258	0.0196	-0.0299	0.0047	0.0383	-0.0029	-0.0092	0.0185	-0.0074	0.1702*	-0.0174	0.0334	-0.0223	-0.0222	0.0381	-0.0091	-0.0053	1								
Board_dummy	0.3207*	0.0117	0.013	0.0063	0.0083	-0.012	-0.0261	-0.034	-0.0211	-0.0158	0.0081	0.0207	0.0723*	0.0166	-0.3619*	0.0636*	0.0188	0.0368	0.0365	-0.0376	0.1036*	0.0119	0.0082	1							
WomenRatio	0.1439*	0.0877*	0.0224	0.0068	0.0113	0.0421	0.0195	0.0131	0.0175	0.0705*	-0.0419	-0.0326	-0.0528*	-0.0271	0.1135*	0.1281*	0.0662*	-0.017	-0.0203	-0.0006	0.0026	0.024	0.0239	0.0929*	1						
WorkElectR~o	0.4452*	0.0552*	0.1274*	-0.0076	0.0289	0.0363	-0.0117	-0.0004	0.0118	0.034	-0.0482*	0.1650*	0.2436*	0.0638*	-0.0901*	0.2728*	0.1221*	0.1416*	0.1420*	0.0815*	0.0758*	-0.0334	0.0572*	0.1022*	0.0754*	1					
ForeignRatio	-0.1726*	0.0567*	-0.0041	0.0464*	-0.0022	-0.004	-0.0576*	-0.0471*	-0.0492*	-0.0062	0.0289	-0.0243	-0.0086	-0.0018	0.0308	-0.0880*	-0.0569*	-0.0124	-0.0123	0.5004*	-0.0837*	0.0118	0.0026	0.1012*	-0.0640*	-0.0911*	1				
Women_dummy	0.3157*	0.1032*	0.0803*	0.0052	0.0143	0.0459*	0.0167	0.0176	0.0169	0.0802*	-0.0459*	0.0037	0.0004	-0.0022	0.0820*	0.1449*	0.0768*	0.0201	0.0197	-0.0011	0.0416	0.0569*	0.0456*	0.1075*	0.8634*	0.1870*	-0.0790*	1			
Worker_dummy	0.5074*	0.0605*	0.1276*	-0.0063	0.0425	0.0498*	-0.0004	0.0011	0.019	0.044	-0.0521*	0.1538*	0.2388*	0.0786*	-0.0781*	0.2798*	0.1197*	0.1522*	0.1523*	0.0627*	0.0830*	-0.0316	0.0469*	0.1055*	0.0701*	0.9690*	-0.0921*	0.1985*	1		
Frgn_dummy	-0.0443*	0.0592*	0.0365	0.0371	-0.0008	0.0046	-0.0453*	-0.0315	-0.0403	-0.0003	-0.0059	0.0343	0.0489*	0.029	0.0023	-0.0121	0.0027	0.0214	0.0205	0.4743*	-0.0558*	-0.0077	-0.0236	0.1218*	-0.0319	0.0778*	0.8308*	-0.0223	0.0817*	1	
LargeComp_~y	0.1450*	0.3489*	0.2632*	0.1121*	-0.0530*	-0.032	-0.0305	-0.0265	-0.0495*	-0.0182	0.0680*	0.0356	0.0085	0.0753*	0.0457*	0.0799*	0.0492*	0.2301*	0.2265*	0.0833*	0.0207	0.042	0.0626*	-0.0352	0.0367	0.1810*	0.0691*	0.1025*	0.1900*	0.1096*	1

Note: Correlations above 0.05 have been given an *.

5 Analysis

In line with our theoretical work, we divide our empirical analysis into two major sections. Whereas chapter 5.1 deals with the factors associated with board size, chapter 5.2 looks at parameters in relation to board composition. As the structure for both sections is essentially the same, the initial results from our main regressions are evaluated with respect to our set of hypotheses and tested for robustness by means of alternative appropriate methods.

5.1 The determinants of board size

This first section of our analysis focuses on board size. The main aim of the analysis, in which multivariate results are presented, is to identify primarily firm and industry-specific factors that correlate with the size of the board of directors. The structure of the section is as follows: First, we give an overview of our results from the standard OLS regressions with a summarizing table of our three main models. The results for each model are then discussed in light of our previously developed hypotheses. We repeat this process for our three models using Poisson regressions to test our initial results for robustness and highlight key insights. Afterwards, we emphasize important findings from further OLS and corresponding Poisson regressions on sub-samples of our dataset. This means that the regressions essentially remain unchanged, yet the underlying data varies according to different criteria (e.g. to compare the results for medium and large companies or for the different corporate forms).

To give a general overview, we summarize the relevant independent variables used in our models in table 31. We outline the names of the various measures used in the analysis, state which variables or factors these measures are supposed to proxy, and a prediction of the direction. The last column in table 31 essentially represents our hypotheses in a very condensed format.

Table 31 – Important variables in board size regression

Short name	Long name	Measure of	Expected direction of association (+/-)*
Firm specific			
Empl	Employees	Firm size	**+**
EBITDAOverAssets	EBITDA divided by total asssets	Performance/FCF	**+/-**
ROA_Avg5	Avg. ROA over 5 the most recent years	Performance	**+/-**
ROE_I	Most recent ROE figure	Performance	**+/-**
Gearing	Gearing (total debt divided by equity)	Complexity	**+**
ImportWW_dummy	Importing worldwide	Complexity	**+**
ExportWW_dummy	Exporting worlwide	Complexity	**+**
Listed_dummy	Listed on a stock exhange	Complexity	**+**
CompAge	Company age (time since founded)	Complexity	**+**
NoSegments	Number of segments active in	Complexity	**+**
NoFrgnSubs	Number of foreign subsidiaries	Complexity	**+**
FrgnParent_dummy	Foreign parent owns company	Foreign influence	**+/-**
OtherCorpForm_dummy	Other corporate form than joint-stock comp.	Company type	**+/-**
Board specific			
WomenRatio	Ratio of women to total board members	Diversity	**+**
WorkElectRatio	Ratio of worker-elected representatives to total board members	Diversity/worker influence	**+**

Note: *Indicates the prediction by our hypotheses. "+/-" indicates that our hypotheses have no definite prediction

We present the distribution of our dependent variable – board size – in the figure 1 below. As the histogram shows, the distribution is very similar to a normal distribution. Thus, we abstain from using the log function of board size (*LnBoardSize*), which usually is used in cases where the distribution of a variable needs to be smoothened to fulfill the OLS assumption of normally distributed standard errors.

Figure 6 – Histogram depicting the companies by board size

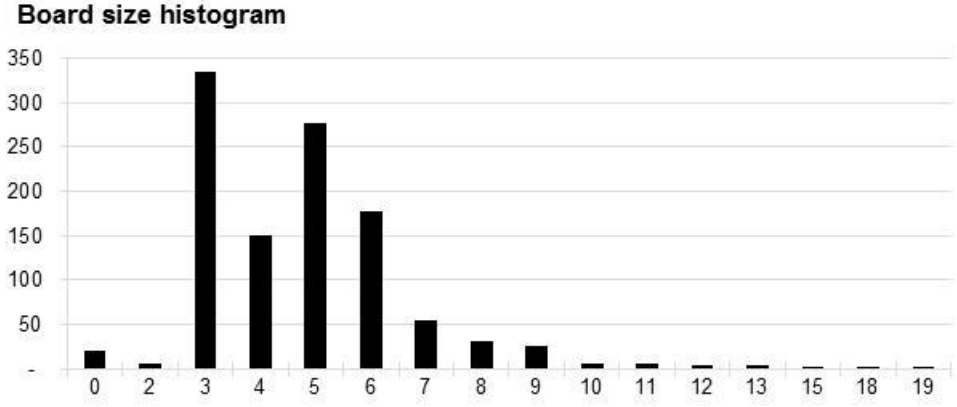


Table 32 – Main board size regression using normal OLS

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – OLS Coeff. [SE]	Model 2 – OLS Coeff. [SE]	Model 3 – OLS Coeff. [SE]
Firm specific			
LnEmpl	0.3119786*** [0.0698193]	0.03288237 [0.066398]	0.03154291 [0.0683278]
EBITDAOverAssets			0.00076394 [0.003109]
ROA_Avg5	-0.00355979 [0.0043401]	-0.00225817 [0.0037186]	
Gearing	-0.00180758*** [0.0005827]	-0.00123341** [0.0005179]	-0.00116413** [0.0005126]
ImportWW_dummy			-0.16011569 [0.1008265]
ExportWW_dummy	0.13757808 [0.1198972]	-0.0404351 [0.1063479]	
Listed_dummy	1.4211011*** [0.3791922]	1.1059903*** [0.3373395]	1.0728529*** [0.3245273]
CompAge	0.00985494*** [0.0015663]	0.00413443*** [0.0014882]	0.00433436*** [0.001528]
NoSegments			-0.09299432* [0.0532771]
NoFrgnSubs			0.05252201*** [0.0168382]
FrgnParent_dummy	-0.56467221*** [0.1241569]	-0.72827094*** [0.1098932]	-0.7076398*** [0.1092883]
OtherCorpForm_dummy	0.9530891*** [0.3020673]	0.93055883*** [0.309395]	0.91277454*** [0.3075851]
Board specific			
WomenRatio		0.49478705 [0.3464903]	0.53358752 [0.3491631]
WorkElectRatio		4.7470593*** [0.4004228]	4.7358624*** [0.4052749]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	1077	1077	1077
R^2	0.1459	0.2954	0.3033

Note: * p<0.1; ** p<0.05; *** p<0.01

5.1.1 Overview of results and general remarks

Table 32 summarizes the standard OLS regressions results for our three models. While the first model only contains firm-specific variables, model 2 and 3 include also selected board-specific variables. Model 3 is a variation of model 2, i.e. we use alternative proxies for selected explanatory variables. All models contain industry dummy variables to account for the potential industry-specific effects on board size. We use robust standard errors to account for heteroskedasticity. Further, since our aim is to analyze the size of the corporate board (and not a firm's decision on whether to have a board or not), we exclude 20 observations – firms that did not have a board of directors in place at the time of our analysis. Hence, the sample size for the final OLS regressions is 1,077 Danish firms.

5.1.1.1 Model 1

We start by presenting our baseline model – model 1 – that includes firm-specific variables and industry dummies. In this first step, board-specific variables are excluded from the analysis as these variables are likely correlated with the firm-specific variables, reducing the significance of our estimates.

As evidenced in model 1, the number of employees appears to have explanatory power of board size, as it is significant even at the 1%-level. Additionally, the coefficient suggests a positive relation with board size. Because the employee variable is in log (*LnEmpl*), the interpretation of the coefficient is a semi-elasticity. This means that a one percent change in the employee base is associated with a 0.31 person increase in board size. In this model, the log of the number of employees is used to proxy the size of a firm instead of total assets (in our case total balance), as some other papers do. Generally speaking, we find that the number of employees is a better proxy than total assets with greater significance given our specific data set.[10]

Whereas the average ROA of the past five years, a measure of firm performance, is insignificant at all levels, the strong and clear results for the various measures of leverage and firm complexity tell a more compelling story. We incorporate gearing as a proxy for a firm's capital structure related degree of leverage, as the general notion

[10] This conclusion is based on a comparison of the different regression models using total assets and total number of employees as measures of firm size, alternatively. Due to space requirements and relevance, the results of these regressions are not shown in this thesis.

is that a higher debt ratio fuels the need for a larger board based on increased advising needs (e.g. Coles et al., 2008). Our results imply that gearing is very significant (1%-level) for the size of a corporate board. What, however, is a surprising result is the direction of the coefficient. The magnitude is small – a one unit change in gearing is associated with -0.0018 unit decrease in board size. Leaving aside endogeneity concerns associated with our empirical setting, the negative association between leverage and board size contradicts the existing empirical evidence.

The results also show mixed significance for the three measures of firm complexity. As our data allows us to specifically account for the aspect of geographic dispersion or degree of internationalization of a firm, we start out by using a dummy variable for a firm's export rather than import activities to account for complexity effects. The underlying intuition is that exporting requires more coordination than importing. However, it appears to have no significant association with the size of the board. Company age is a classic measure of firm complexity, and hence we include it in our first model as well. The expectation here is that older firms tend to be more complex. The explanatory power of this variable is subject to controversy in the literature, e.g. Linck et al. (2008) see a better connection between complexity and firm maturity, which is said to be different from company age. However, we experience significance at the 1%-level in relation to board size for our sample, with an increase of 0.0098 board members for a one year change in company age.

The dummy variable *Listed_dummy*'s coefficient indicates the difference in board size between listed and non-listed firms (reference category). This is an important effect to control for as listed companies are subject to stricter legal obligations and rules regarding their corporate boards and respective board tasks (e.g. disclosure, flow of information, etc.). It is not surprising that the variable is significantly associated with the board size. The coefficient itself suggests that, on average in our sample, a listed company will have a board that is roughly 1.42 people larger than the board of a non-listed firm.

We justify the inclusion of a dummy variable for the presence of a foreign owner by the distinct implications we expect from having a foreign parent company with respect to the board of the Danish firm. As mentioned earlier, we argue that a foreign owner will try to maintain tighter control over decision processes and hence, we expect a smaller board of directors as they are believed to be more efficient and

easier to manage. First of all, our results indicate a strong and significant relationship between board size and the presence of foreign owner. In our sample, firms that have a foreign parent appear to have boards that are on average 0.5646 people smaller than those of firms which do not have a foreign owner.

Last but not least, we include a dummy variable, *OtherCorpForm_dummy*, to account for differences between joint-stock companies, the reference group in this case, and all other corporate forms present in our sample (a total of 123 observations). The reasoning is very similar to that of listed companies. Joint-stock companies, although not automatically publicly traded, are subject to specific board rules which other firms are not. As these firms have more leeway in establishing their corporate boards, the high significance (1%-level) confirms our notion regarding the impact on board size. However, the magnitude of the coefficient as well as the direction are surprising. It appears that firms that are not joint-stock companies tend to have bigger boards by almost one person (0.95). This could imply that the freedom these firms have with respect to board establishment leads to voluntarily bigger boards as opposed to firms under specific obligations, like joint-stock companies.

Overall, our first model with only firm-specific variables appears to be a good fit for our data, as our right-hand-side variables explain almost 15% of the variation (as indicated by the R^2 of 0.1459) in board size.

5.1.1.2 Model 2

Our second model contains board-specific variables in addition to the firm-specific variables and dummies. The firm-specific variables are identical with the ones induced in model 1. We would like to emphasize the fact that we only included two of the three board-specific variables at hand. Whereas we include the ratio of women and the ratio of employee directors on board, we purposely omit the ratio of foreign directors on board due to multicollinearity concerns. The variable *ForeignRatio* is highly correlated with the dummy variable for foreign parent ownership. The reason we choose to incorporate the foreign parent dummy over the foreign ratio is causality-based. We believe that the presence of a foreign parent will influence the

presence of foreigners on board, and hence it is the more fundamental proxy for internationalization, and due to the high correlation, even board diversity.[11]

One of the most obvious changes compared to our findings of model 1 is the overall fit of model 2. The inclusion of board-specific variables in connection with the existing firm-specific parameters causes the R^2 to more than double (0.2954). This means that our model 2 is a good fit for our data sample, as it allows us to explain almost 30% of the variation in board size with the chosen variables.

The significance of most variables remains unchanged in comparison to model 1. However, it is interesting that the measure of firm size, *LnEmpl*, now becomes insignificant in the presence of board-specific variables. A possible explanation could be in the high correlation between the employee board representation (*WorkElectRatio*) and the number of employees. In fact, according to the Danish law, the introduction of employee board representation is triggered at specific size thresholds, implying that these two variables will be correlated. Hence, it seems plausible that the ratio of worker directors on board weakens the explanatory power of the *LnEmpl* variable. In addition, the coefficient of *WorkElectRatio* is 4.7471. This implies that a board composed of i.e. a third with employee directors (*WorkElectRatio* equal to 0.33) is associated with board size greater by roughly 1.57 board members compared to firms without worker-elected representation (*WorkElectRatio* equal to 0). A somewhat surprising result is the fact that *WomenRatio* is insignificant in relation to board size. This could indicate that the appointment of female directors is on average not necessarily associated with increases in board size. Furthermore, *Gearing* shows somewhat less significance than previously. However, as direction and magnitude of the coefficient practically remain constant, the variable is still significant at the 5%-level.

5.1.1.3 Model 3

Our third model is a variation of our complete model 2. By complete we mean that it contains both firm and board-specific variables. By variation we refer to a number of adjustments we make in order to ensure a holistic view of our available parameters and find the model that is best suited for our data sample. Therefore, we include

[11] Additional regression models have shown that the variable *ForeignRatio* is highly significant and positively associated with board size in the absence of *FrgnParent_dummy*. The results are not reported because of space requirements.

additional measures as well as replace some previously insignificant measures in order to potentially find more suitable variables.

As we found no significance in our first two models, we replace *ROA_Avg5* with *EBITDAOverAssets* to proxy firm performance and, as it is also used as a proxy for free cash flow in related literature, the scaled EBITDA variable can be seen as a measure of agency costs as well. However, none of the measures of firm performance seem to be significantly related to board size.

Furthermore, we replace the export variable with our import variable, because our export parameter is highly correlated with another newly added variable, the number of foreign subsidiaries (*NoFrgnSubs*). As both import and export measures should serve as proxies for firm complexity, we expect no problems to arise from this change. In fact, the import variable is also insignificant and thus it appears to be insufficiently associated with board size.

We opt to exclude ROE as a parameter due to its high correlation with gearing, which we already found to be significantly associated with board size. Even though ROE was highly significant at all levels in alternative models we tested, gearing seems to be the more decisive factor as the capital structure ultimately influences ROE. Additionally, ROE is a performance measure and cannot replace gearing as a measure of leverage.

As already mentioned, we include the number of foreign subsidiaries as an additional measure of firm complexity. The results show that it is highly significant at the 1%-level and positively related to board size. One additional foreign subsidiary is related to a board size larger by roughly 0.05 board members, which is a relatively small effect in terms of magnitude. These results suggest that it would take approx. 20 foreign subsidiaries to increase the board size by one member.

In line with Rose and Sheppard (1997), we introduce the number of segments (*NoSegments*) as a measure of firm complexity to our regression model. As the scope of operations theory suggests, more diversified firms in multiple segments tend to be more complex firms. In fact, our results support this notion as the variable is significant at the 10%-level and almost significant at the 5%-level. However, the direction of the coefficient is surprising, as it indicates a negative relationship with board size.

Overall, our third model seems to provide the best fit for our data sample, as we have strong significance of our right-hand side variables and the R^2 is the highest of all three models. With this extensive model, we are able to explain 30.33% of the variation in board size.

The results alone have already yielded some interesting insights. However, it is necessary and crucial for us to evaluate these initial findings in light of the theoretical foundation and hypotheses that we previously developed.

5.1.1.4 Hypothesis 1

Larger firms will have a larger board of directors

Based on the results for our three models we do not find support for this hypothesis. Based on the evidence the main proxy for firm size in our regression models, the variable *LnEmpl*, firm size is not significantly associated with board size. Hence, we cannot conclude that larger firms have a larger board of directors. Despite somewhat mixed evidence, the employee variable is significant in model 1 but insignificant in models 2 and 3, we tend to give greater meaning to the insignificant results, as these occurred in complete models that included both firm- and board-specific variables.

5.1.1.5 Hypothesis 2

More complex firms will have larger boards

Regarding the relationship between firm complexity and board size, we also find mixed evidence and cannot definitely conclude that more complex firms have larger boards or vice versa, with more complex firms having smaller boards. The evidence our models yield is mixed due to the different complexity measures we use. Whereas company age, the number of foreign subsidiaries, and the *Listed_dummy* variable seem to be always positively related to board size, the number of segments shows a negative relationship. The evidence the variable *Gearing* yields is highly significant in all of our three models, but the apparent negative association to board size is again counterintuitive to our hypothesis. Hence, we can neither conclusively reject nor accept our second hypothesis.

A key takeaway, however, is the fact that firm complexity is a significant parameter when discussing board size. All of the variables we use to account for firm complexity are very significant, at least at the 10%-level, but in most cases at the 5 and 1%-

level. The only exception in our models is the dummy variables for export and import activities. Yet, the direction of the relation seems to be unclear.

5.1.1.6 Hypothesis 3

Greater board diversity leads to bigger boards

Although our two measures of board diversity, the ratio of women and the ratio of employee directors on board, are not equally strong in their significance, we are still inclined to accept our third hypothesis and conclude that for our data set, greater board diversity is associated with larger boards. The case for the variable *WorkElectRatio* is very clear, as it is significant in both model 2 and 3 at all levels. However, the case for *WomenRatio* is less clear, because it is marginally insignificant at the 10%-level in both instances. Yet, in the more complete model 3 the significance level has already improved to around 13% (15% in model 2). We believe that this indication justifies the notion that, overall, greater diversity will lead to bigger boards, as the coefficients of both variables show a positive relationship to board size.

5.1.2 Poisson regression

As previously mentioned, the board size count variable is expected to have a Poisson distribution. We therefore run the same models as above, using Poisson instead of normal OLS regression to test whether any results change noticeably. Note that in this section we will only go into depth with the results insofar as they differ from the ones of our primary normal OLS regression. Our main focus is on the significance of the variable as well as the direction of the association. The coefficients will be different from normal OLS as they now have a different interpretation. The results of the Poisson regressions are depicted in table 33.

Table 33 – Main board size regression using Poisson

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – Poisson Coeff. [SE]	Model 2 – Poisson Coeff. [SE]	Model 3 – Poisson Coeff. [SE]
Firm specific			
LnEmpl	0.0632393*** [0.0134858]	0.00759858 [0.0131625]	0.00761347 [0.0137335]
EBITDAOverAssets			0.00019527 [0.0006718]
ROA_Avg5	-0.00076853 [0.0008977]	-0.00042853 [0.0008119]	
Gearing	-0.00044978*** [0.0001358]	-0.00029868** [0.0001258]	-0.00027936** [0.0001254]
ImportWW_dummy			-0.0328904 [0.0213168]
ExportWW_dummy	0.02608946 [0.024313]	-0.0115841 [0.0220745]	
Listed_dummy	0.25422145*** [0.0621727]	0.19924924*** [0.0548939]	0.19527088*** [0.0535526]
CompAge	0.00190877*** [0.0002793]	0.00078476*** [0.0002723]	0.00081556*** [0.00028]
NoSegments			-0.01827906* [0.0107508]
NoFrgnSubs			0.00855888*** [0.0027231]
FrgnParent_dummy	-0.12192936*** [0.026416]	-0.15528605*** [0.0234218]	-0.15055833*** [0.023227]
OtherCorpForm_dummy	0.19115218*** [0.0548229]	0.18758796*** [0.0570189]	0.1851887*** [0.0565506]
Board specific			
WomenRatio		0.09619051 [0.0712119]	0.10294664 [0.0719612]
WorkElectRatio		0.93781*** [0.0809998]	0.93628452*** [0.0829169]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	1077	1077	1077
Pseudo-R^2	0.0269	0.0543	0.0555

Note: * p<0.1; ** p<0.05; *** p<0.01

5.1.2.1 Model 1 to 3

When looking at our baseline model, we observe that the significance of the coefficients remains roughly the same. The R^2 is replaced with pseudo-R^2, which is 0.0269 for model 1.

Our complete model 2 also achieves the same results in terms of significance and direction of causality under Poisson as we saw in normal OLS. The pseudo-R^2 has now risen to 0.0543, which is the same pattern we observed with the ordinary R^2 using normal OLS when going from model 1 to 2.

The variation of our complete model, model 3, also yields the same overall results using the Poisson regression.

All in all, the above results solidify the conclusions we made from our initial normal OLS results and thus, the Poisson regressions served as good robustness checks. The fact that we did not observe very different results using Poisson vis-à-vis can most likely be attributed to the large amount of observations in our data set, which were approximately normally distributed.

5.1.3 Robustness regressions – sub-sample test

In this section, we will look at different sub-samples in our data set, where we will run the same regression models and methods as in the above, just on a restricted part of our data – subsamples. The purpose of this is to explore whether the observed relations hold only for specific types of firms, and to provide comparable results to the existing literature that primarily looks at publicly listed companies. For robustness, we (besides the regressions reported in tables below) also estimate Poisson regression for all the models. The results of these can be found in appendix 3. We only comment on the Poisson results if they yield any additional insight, e.g. if we achieve substantially different significances or direction of the relations. The sub-samples we will look at are joint-stock companies vs. other corporate form types, companies owned by a foreign parent vs. non-foreign owned, and large vs. medium companies, as defined by the EU criteria mentioned in the methodology.

5.1.3.1 *Joint-stock companies vs. other companies*

In this sub-sample, we divide the observations into joint-stock companies (A/S) and other corporate form types. By looking at these two groups of firms separately, we firstly aim to account for potential differences in the regulation of joint-stock companies and other firms and, secondly, provide comparable results to other studies involving mostly large publicly listed joint-stock corporations. There are 973 joint-stock companies and 104 other companies in our sample. As 104 observations make it harder to find significant results, we need to bear this in mind when evaluating the results of the regressions, which are reported in table 34 and table 35.

First, we compare joint-stock companies to our main regression on the whole sample and secondly, we relate to the other companies.

For stock companies we note that the size measure, number of employees, there is no change in comparison to the main regression. For other companies the size measure has no significance across all three models.

Table 34 – Board size regression for joint-stock companies using normal OLS

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – OLS Coeff. [SE]	Model 2 – OLS Coeff. [SE]	Model 3 – OLS Coeff. [SE]
Firm specific			
LnEmpl	0.36749355*** [0.0732311]	0.06262949 [0.0658047]	0.05181452 [0.0673821]
EBITDAOverAssets			0.00052922 [0.0026543]
ROA_Avg5	-0.00284544 [0.0042115]	-0.00156516 [0.0033032]	
Gearing	-0.00195521** [0.0009333]	-0.00117504 [0.0007706]	-0.00113485 [0.0007802]
ImportWW_dummy			-0.09639093 [0.0940717]
ExportWW_dummy	0.23887895** [0.1146979]	0.06118409 [0.0987898]	
Listed_dummy	1.4217172*** [0.3898436]	1.1014131*** [0.3514817]	1.0603834*** [0.3396056]
CompAge	0.00908536*** [0.0015696]	0.00308366** [0.0014136]	0.00321503** [0.0014451]
NoSegments			-0.07733947 [0.0517826]
NoFrgnSubs			0.05524846*** [0.0177427]
FrgnParent_dummy	-0.42627489*** [0.1177408]	-0.60973559*** [0.1009745]	-0.58111988*** [0.1009529]
Board specific			
WomenRatio		0.85517885*** [0.3303389]	0.87997123*** [0.3367191]
WorkElectRatio		5.0375338*** [0.3815955]	5.0189086*** [0.3850012]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	973	973	973
R^2	0.1695	0.3743	0.3827

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 35 – Board size regression for other companies using OLS

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – OLS Coeff. [SE]	Model 2 – OLS Coeff. [SE]	Model 3 – OLS Coeff. [SE]
Firm specific			
LnEmpl	-0.07087077 [0.3264753]	-0.13414804 [0.3309219]	-0.05908538 [0.3235088]
EBITDAOverAssets			-0.02137562 [0.0328356]
ROA_Avg5	-0.02727172 [0.030388]	-0.02400107 [0.0292703]	
Gearing	-0.00268554 [0.0016957]	-0.00316921* [0.0017792]	-0.00326813* [0.0019076]
ImportWW_dummy			-1.2009135 [0.9298313]
ExportWW_dummy	-0.60242906 [0.8076251]	-0.8629592 [0.8490255]	
CompAge	0.0141177 [0.0115087]	0.01455755 [0.013377]	0.01539108 [0.015567]
NoSegments			-0.09688518 [0.3857419]
NoFrgnSubs			-0.01114952 [0.0667783]
FrgnParent_dummy	-2.1284966** [0.8917621]	-2.1691055** [0.8703822]	-2.2978039** [0.9553028]
Board specific			
WomenRatio		-3.185688* [1.909495]	-3.1128751 [1.905193]
WorkElectRatio		1.8708742 [1.988623]	1.3676179 [2.077048]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	104	104	104
R^2	0.1714	0.2003	0.2071

Note: * p<0.1; ** p<0.05; *** p<0.01

With respect to complexity measures, we first note that gearing loses significance in comparison to the main regression, where it was significant at the 5%-level. With joint-stock companies it is not significant, whereas for other companies gearing it is significant at the 10%-level (and at the 5%-level in the Poisson regression). This casts doubt on the association between leverage and board size with respect to joint-

stock companies. Interestingly, the dummy for whether a company is exporting worldwide suddenly becomes significant at the 5%-level for joint-stock companies in model 1 in the absence of board-specific variables. With respect to company age, significant in the main regression, we see significance at the 5%-level for joint-stock companies while for the other companies it has no explanatory power. This could indicate that the association between company age, a complexity measure, and board size is stronger for joint-stock companies than other companies. However, as noted above, the lack of significance for other companies might be due to the small sample size for this subsample of firms (104). Moreover, given the cross-sectional nature of our data, we cannot imply anything about the direction of causality, i.e. whether complexity drives board size or vice-versa. The number of segments variable loses significance in both the joint-stock company regression and the other companies regression. The number of foreign subsidiaries variable retains the significance for joint-stock companies but loses all for other companies. For these two variables, *NoSegments* and *NoFrgnSubs* it appears that these complexity measures have more importance for board size with joint-stock companies.

Looking into board-specific variables, we note that the significance of the ratio of women members to total board members is substantially higher for joint-stock companies, significant at the 1%-level, which was not even significant at the 10%-level for the main regression. For other companies it is significant at the 5%-level using Poisson regression, which might be more suitable given the small sample size, but not at all using OLS. This could suggest that in joint-stock companies, women are added to the board rather than replacing existing board members. Perhaps, the presence of women induces the board to have more people to counteract the female influence in the large firms. On the other hand, the relation between the presence of women and board size for other companies is not significant or, in model 2 marginally significant and negative. One explanation for the negative association between the share of women and board size might be that companies with smaller boards are smaller family firms, where the likelihood of a female family member to sit on the board might be higher. The *WorkElecRatio*, the ratio of worker-elected representatives to total number of board members, is highly significant for joint-stock companies just as in the main regression, but becomes insignificant for other companies. This could be related to the notion that companies with a different

corporate form than stock companies tend to be smaller and do not need to respond to public pressure for having worker-elected representatives, which would increase board size, and instead want to maintain tighter control.

Looking at the R^2 of the two sub-samples, we note that for joint-stock companies model 3 enables us to explain 38.3% of the variation, which is 8% more than the main regression. However, only 20.7% of the variation of the other companies' board sizes is explained by model 3. This could imply that the included variables have a greater influence on joint-stock companies than on other companies and that our model is simply a better fit for these type of companies. Perhaps, there are also some lurking variables[12] we cannot control for, but which have an important influence with respect to board size for other companies as opposed to joint-stock companies. These can be related to the internal dynamics of the board, which we cannot observe in our dataset. Examples of this could be information on board composition such as insiders vs. outsiders, ownership stakes, education, network with other boards, etc.

Next we summarize the implications for our hypotheses based on the above findings.
With respect to hypothesis 1, that larger firms will have larger boards, we find little or no evidence both for the joint-stock and the other companies.
With regards to hypothesis 2, that more complex firms will have larger boards, we again observe mixed evidence. Most of the variables in the joint-stock company regression have the same magnitude of significance as the unrestricted regression with some differences.
In relation to hypothesis 3, that more diversity leads to bigger boards, we find stronger evidence that board diversity effects relating to female influence have a positive association with board size. With respect to worker representatives, the hypothesis is supported by the evidence from joint-stock companies but not supported by the results from companies with other corporate forms. This may, however, be related to the small sample size or that the other companies do not have a lot of worker representatives.

[12] Lurking variables are variables which have an important effect but are not included in the regressions. For a more detailed explanation and discussion of consequences, see Franklin and Agresti (2009).

5.1.3.2 Companies part of foreign parent vs. companies with no foreign parent

In this sub-sample, we split the data into companies owned by a foreign parent (249 observations) and companies without a foreign parent (828 observations). The aim here is to see whether corporate governance and the composition of the board vary in relation to whether a company is under foreign control (and might therefore be subject to the influence of foreign governance practices) or not. The results are reported in table 36 and table 37.

Overall, the results imply that the presence of a foreign company results in tighter control by the shareholder (implying a lower need for a board), as indicated by a negative relationship of the foreign parent dummy and board size. We observe that the company size measure, *Empl*, as well several complexity variables lose significance. With respect to the board-specific variables, the *WomenRatio* loses all significance, while the *WorkElecRatio* maintains its significance. In the corresponding Poisson regression, all variables have a little more significance, especially with respect to complexity. Particularly noteworthy is that number of foreign subsidiaries is significant at the 5%-level, indicating that there is an association between board size and the scope of international operations in companies under foreign ownership. The R^2 of the regression is surprisingly high, with 51.4% of the variation being explained. Further analysis[13] revealed that including only the sector dummies as explanatory variables in the regression yields an R^2 of approx. 48% for this particular sample. Therefore, the industry sector a company is active in seems to be relevant for the board size in the presence of foreign ownership. To sum up, it appears that the variables we include cannot proxy the exact internal effects that might be associated with board size in the presence of foreign ownership. These effects seem to be industry-specific as industries are important determinants of board size in this subsample. Note that the reason for the low significance may also be attributed to the relatively small sample size.

The results of the sample for the companies without a foreign parent do not vary substantially from the results of the main board size regression. Some variables gain higher explanatory power and some a little less, but overall it appears that the models fit the data well. The most interesting aspect is that the dummy for importing worldwide is significant at the 5%-level.

[13] We ran regressions where we included different variables to see what was driving the R^2 in this case.

With respect to the hypotheses, at least hypotheses 1 and 2 are weakly supported by evidence from the companies with a foreign parent, while hypothesis 3 still holds true when it comes to worker-elected representatives. With respect to the companies not under a foreign parent, our conclusions do not vary in comparison to the main regression.

Table 36 – Board size regression for companies with foreign parent using OLS

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – OLS Coeff. [SE]	Model 2 – OLS Coeff. [SE]	Model 3 – OLS Coeff. [SE]
Firm specific			
LnEmpl	0.25588318** [0.1140862]	0.04081239 [0.1065646]	0.07412125 [0.1212204]
EBITDAOverAssets			0.00251883 [0.0050866]
ROA_Avg5	0.00683416 [0.0057996]	0.00390264 [0.0046173]	
Gearing	0.02385184 [0.0250755]	0.02145371 [0.0218032]	0.02493066 [0.0220978]
ImportWW_dummy			0.2194995 [0.184145]
ExportWW_dummy	-0.18619607 [0.2345054]	-0.21885014 [0.1838915]	
CompAge	0.01120766*** [0.0027976]	0.00458854* [0.0026415]	0.00394482 [0.0024922]
NoSegments			-0.07858749 [0.0820246]
NoFrgnSubs			0.0411727* [0.0222437]
OtherCorpForm_dummy	0.27164538 [0.2401892]	0.24738513 [0.2318689]	0.24126563 [0.2123824]
Board specific			
WomenRatio		0.05096457 [0.4347065]	0.03739388 [0.4343327]
WorkElectRatio		4.1664004*** [0.5516973]	4.2163285*** [0.5341703]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	249	249	249
R^2	0.3071	0.5061	0.5138

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 37 – Board size regression for companies without a foreign parent using OLS

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – OLS Coeff. [SE]	Model 2 – OLS Coeff. [SE]	Model 3 – OLS Coeff. [SE]
Firm specific			
LnEmpl	0.32110705*** [0.0855723]	0.01519254 [0.0797051]	0.00613873 [0.0815057]
EBITDAOverAssets			0.00129433 [0.0034737]
ROA_Avg5	-0.0073192 [0.0056078]	-0.00467202 [0.0047999]	
Gearing	-0.00222764*** [0.0007099]	-0.00148836** [0.0006161]	-0.00145901** [0.0005939]
ImportWW_dummy			-0.29541744** [0.1309979]
ExportWW_dummy	0.22543307 [0.1424667]	0.02366031 [0.1278008]	
Listed_dummy	1.3697612*** [0.3894097]	1.0681846*** [0.3529925]	1.0873567*** [0.3320897]
CompAge	0.00956361*** [0.0018433]	0.00425985** [0.0017284]	0.00436691** [0.0017967]
NoSegments			-0.09156967 [0.0648201]
NoFrgnSubs			0.06410301*** [0.0196856]
OtherCorpForm_dummy	1.2802076*** [0.4120469]	1.2301237*** [0.4247789]	1.2370079*** [0.4219296]
Board specific			
WomenRatio		0.55184806 [0.4414245]	0.52861522 [0.4469682]
WorkElectRatio		4.9308427*** [0.4923459]	4.9308677*** [0.4913623]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	828	828	828
R^2	0.1529	0.2876	0.2982

Note: * p<0.1; ** p<0.05; *** p<0.01

5.1.3.3 Large vs. medium companies

In this sub-sample regression, we split the companies into large and medium firms. The aim here is to analyze whether the factors associated with board size differ in relation to firm size. There are 303 large and 774 medium. The results are reported in table 38 and 39.

With respect to large-sized companies, we observe that several complexity measures (ROE, gearing, and number industry segments) as well as the size measure lose significance in comparison to the main regression. The variable *OtherCorpForm_dummy* also loses a lot of significance, which may arise due to the presence of very few large-sized companies which are not joint-stock companies. Some of the complexity variables, however, do "regain" some significance when run in a Poisson regression. The Poisson approach might fit the data better given the sample size. Interestingly, the board specific variable *WomenRatio* becomes more insignificant, even though it was highly significant for joint-stock companies, which are usually larger companies than other corporate forms such as private limited companies (ApS). The joint-stock company sample did, however, have approx. 900 observations, whereas there are only approx. 300 large company observations, which can also be a reason. It could also be a sign that women tend to replace, rather than being added, existing board members if they are put on the board.

In relation to medium-sized companies, we observe some complexity measures losing significance, especially company age and the *Listed_dummy*. The board specific variable, *WomenRatio*, however, becomes significant at the 5%-level indicating that the presence of women in medium-sized companies is associated with a larger board. This is surprising as we would expect this to be more prevalent with larger companies that might be subject to larger pressure to have a board with women on the board. However, the barriers to female appointments in these large companies might also be higher and shareholders might be relying more on the existing homogenous networks to recruit new directors (see Gregoric et al., 2012).
With respect to hypothesis 1, there is no new evidence to add. When it comes to hypothesis 2, we see some complexity measures losing significance but most maintain their importance, so there is only a slight weakening of hypothesis 2. With

respect to hypothesis 3, we see new evidence for the gender diversity effect where it appears to have some merits when it comes to medium-sized companies.

5.1.3.4 Summarizing on the results of the sub-sample regressions

From the sub-sample regressions, it appears that our models fare best when it comes to joint-stock companies that are medium-sized and not owned by a foreign parent. It also appears that our hypotheses are mostly unchanged, no notable results on hypothesis 1, hypothesis 2 has mixed results, while hypothesis 3 seems to fare well in most cases with some support for the impact of women influence in some sub-sample regressions. Note that the mixed results in relation to hypothesis 2 might be due to the fact that there are lot of complexity variables in relation to size and board-specific variables, and it is thus harder to locate weaknesses or strengths when it comes to the explanatory power of the complexity variables taken together.

Table 38 – Board size regression for large-sized companies using OLS

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – OLS Coeff. [SE]	Model 2 – OLS Coeff. [SE]	Model 3 – OLS Coeff. [SE]
Firm specific			
LnEmpl	0.21471468 [0.1452594]	0.02651016 [0.1407137]	0.01085893 [0.151678]
EBITDAOverAssets			-0.00590726 [0.0065844]
ROA_Avg5	-0.0114699 [0.0081148]	-0.00549043 [0.0074676]	
Gearing	-0.00095764 [0.0006085]	-0.00067417 [0.0005956]	-0.00060684 [0.0005793]
ImportWW_dummy			-0.33697054 [0.2663816]
ExportWW_dummy	0.09985197 [0.2796431]	-0.09945937 [0.2559818]	
Listed_dummy	1.647011*** [0.6179919]	1.5847058*** [0.5770627]	1.5395727*** [0.5507837]
CompAge	0.01123673*** [0.0030988]	0.00667221** [0.003214]	0.00595239* [0.0031941]
NoSegments			0.03223792 [0.1240257]
NoFrgnSubs			0.03690001* [0.0196042]
FrgnParent_dummy	-1.0561037*** [0.3017891]	-0.98990251*** [0.2863045]	-0.99761128*** [0.2816701]
OtherCorpForm_dummy	0.83125181 [0.5585015]	0.93751791* [0.5678914]	0.90663699 [0.5522216]
Board specific			
WomenRatio		-0.56650287 [0.7219307]	-0.47589677 [0.7288271]
WorkElectRatio		3.9047054*** [0.853036]	3.9172361*** [0.8707726]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	303	303	303
R^2	0.2731	0.3525	0.3627

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 39 – Board size regression for medium-sized companies using OLS

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – OLS Coeff. [SE]	Model 2 – OLS Coeff. [SE]	Model 3 – OLS Coeff. [SE]
Firm specific			
LnEmpl	0.18928362 [0.1177757]	-0.06918754 [0.0977995]	-0.03508405 [0.0985859]
EBITDAOverAssets			0.00295544 [0.0032693]
ROA_Avg5	-0.00066781 [0.0050541]	-0.00144225 [0.0043766]	
Gearing	-0.01082884 [0.0077919]	-0.00698887 [0.0070739]	-0.00405523 [0.0068309]
ImportWW_dummy			-0.1135894 [0.100666]
ExportWW_dummy	0.11787677 [0.1310035]	-0.04621982 [0.1148697]	
Listed_dummy	0.824917** [0.3915881]	0.47148802 [0.3673351]	0.57319176* [0.3200243]
CompAge	0.00857595*** [0.0019456]	0.00260804 [0.0018084]	0.00297684 [0.0018321]
NoSegments			-0.11994846** [0.0563596]
NoFrgnSubs			0.08310837** [0.0363345]
FrgnParent_dummy	-0.40447715*** [0.1488331]	-0.71413995*** [0.1231847]	-0.70486636*** [0.1237712]
OtherCorpForm_dummy	0.94321921** [0.368326]	0.87885902** [0.3786118]	0.86229667** [0.3752883]
Board specific			
WomenRatio		0.80806981** [0.3926244]	0.85756173** [0.389486]
WorkElectRatio		4.9125898*** [0.4192352]	4.93407*** [0.4126794]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	774	774	774
R^2	0.1264	0.3025	0.3097

Note: * p<0.1; ** p<0.05; *** p<0.01

5.2 The determinants of board composition

As an extension to our research regarding the determinants of board size, we also aim to evaluate the relationships between different dimensions of board diversity, namely female, worker, and foreign representation on board, and selected board-, firm- and industry-specific characteristics. Hence, this analysis section consists of three parts and is structured in the following way. First, we discuss our empirical findings on female board representation and proceed to our results on worker-elected representatives on corporate boards. Last, we look at foreign board members as part of our discussion on board diversity. All empirical findings are related and evaluated in light of our previously established hypotheses, which are based on the relevant literature regarding board diversity and its determinants. In line with our section on board size, we present our marginal effect results of three probit regression models in table form.

As also conducted in the board size regression, we provide an overview of the diversity regressions by summarizing the relevant independent variables used in the regressions in table 40. We outline the names of the various measures used in the analysis, state which variables or factors these measures are supposed to proxy, and a prediction of the direction. The prediction is based on the hypotheses.

Table 40 – Important variables in diversity regressions

			Expected direction of association (+/-)*		
Short name	Long name	Measure of	Fem	Work	Frgn
Firm specific					
TotBal	Total balance sheet (total assets)	Firm size	**+**		**+**
Empl	Employees	Firm size		**+**	
EBITDAOverAssets	EBITDA divided by total asssets	Performance/FCF	**+/-**	**+/-**	**+/-**
ROA_Avg5	Avg. ROA over 5 the most recent years	Performance	**+/-**	**+/-**	**+/-**
ROE_I	Most recent ROE figure	Performance	**+/-**	**+/-**	**+/-**
Gearing	Gearing (total debt divided by equity)	Complexity	**+**	**+**	**+**
ImportWW_dummy	Importing worldwide	Complexity	**+**	**+**	**+**
ExportWW_dummy	Exporting worlwide	Complexity	**+**	**+**	**+**
Listed_dummy	Listed on a stock exhange	Complexity	**+**	**+**	**+**
CompAge	Company age (time since founded)	Complexity	**+**	**+**	**+**
NoSegments	Number of segments active in	Complexity	**+**	**+**	**+**
NoFrgnSubs	Number of foreign subsidiaries	Complexity	**+**	**+**	**+**
FrgnParent_dummy	Foreign parent owns company	Foreign influence	**+/-**	**+/-**	**+**
OtherCorpForm_dummy	Other corporate form than joint-stock comp.	Company type	**+/-**	**+/-**	**+/-**
Board specific					
Board size	Total number of board members	Board size	**+/-**	**+/-**	**+/-**
WomenRatio	Ratio of women to total board members	Diversity		**+**	**+/-**
WorkElectRatio	Ratio of worker-elected representatives to total board members	Diversity/worker influence	**+**		**+/-**
ForeignRatio	Ratio of foreign directors to total board members	Diversity/foreign influence	**+/-**	**+/-**	

Note: *Indicates the prediction by our hypotheses. "+/-" indicates that our hypotheses have no definite prediction. "Fem " stands for females on board, "Work" for workers on board and "Frgn" for foreigners on board.

5.2.1 Women on board

To measure the effect on different factors on female board representation, we use a dummy variable indicating the presence of at least one woman on board as the dependent variable in a probit regression with robust standard errors. We again start out by using a baseline model consisting of firm-specific variables to explain the variation in the presence of women on board. In our second model, we add a set of relevant board-specific variables and aim to capture their effects. Our third model is essentially a variation of model 2, using a few different firm-specific variables. Additionally, all models contain industry dummy variables. Companies without a board of directors are excluded; STATA additionally excludes some observations due to multicollinearity, which leads us to a total of 1065 observations. The results of this empirical analysis are presented in table 41 below. As customary for probit regression, we present the marginal effects at the mean of explanatory variables.

Table 41 – Women_dummy regression results using probit marginal effects

	Dependent variable:		
	Women_dummy		
Independent variables	Model 1 – Probit, ML dy/dx	Model 2 – Probit, ML dy/dx	Model 3 – Probit, ML dy/dx
Firm specific			
LnTotBal	0.0267678 [0.01842]	-0.000124 [0.01769]	0.0023907 [0.01842]
EBITDAOverAssets			-0.0000122 [0.00113]
ROA_Avg5	-0.0000116 [0.00113]	0.0001832 [0.00127]	
Gearing	-0.0047903** [0.00233]	-0.0052433** [0.00229]	-0.0056582** [0.00233]
ImportWW_dummy			-0.0061114 [0.03765]
ExportWW_dummy	0.0374455 [0.03765]	0.0187279 [0.03839]	
Listed_dummy	-0.069225 [0.10208]	-0.1517298 [0.10207]	-0.1500631 [0.10208]
CompAge	0.0023485*** [0.00051]	0.0014228*** [0.00051]	0.0013391*** [0.00051]
NoSegments			0.0226554 [0.01705]
NoFrgnSubs			-0.0050187 [0.00543]
FrgnParent_dummy	0.0080125 [0.01705]		
OtherCorpForm_dummy	0.2043528*** [0.00543]	0.1783393*** [0.05941]	0.17685*** [0.05965]
Board specific			
BoardSize		0.0656618*** [0.01236]	0.067409*** [0.0126]
WorkElectRatio		0.2705611** [0.11126]	0.2607658** [0.11248]
ForeignRatio		-0.0432398 [0.05259]	-0.043469 [0.05266]
Industry specific			
Industry dummies	Yes	Yes	Yes
Selected industries			
Autos	-0.2656488** [0.10717]	-0.305034*** [0.07139]	-0.2997702*** [0.07582]
Enrgy	0.3687922** [0.16701]	0.380078** [0.15391]	0.3896023*** [0.14954]
FabPr	-0.0932644 [0.07012]	-0.1693235*** [0.06386]	-0.1647044** [0.06529]
Mach	-0.0667839 [0.06829]	-0.1188011* [0.06576]	-0.1058712 [0.06489]
Meals	0.3858317**' [0.12066]	0.3772105*** [0.12303]	0.3646147*** [0.12626]
Rtail	0.2322272*** [0.0683]	0.2113319*** [0.07107]	0.1975771*** [0.07082]
Trans	0.1146455* [0.06802]	0.700584 [0.06768]	0.0721704 [0.0689]
Txtls	-0.163554 [0.18304]	-0.273192*** [0.1015]	-0.2515985** [0.12032]
Util	0.3799223*** [0.10034]	0.2935315** [0.11667]	0.2759866** [0.11913]
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	1065	1065	1065
Area under ROC curve	0.6744	0.7281	0.7303
y = Pr(Women_dummy)	0.37784427	0.37378619	0.37290648

Note: * p<0.1; ** p<0.05; *** p<0.01

5.2.1.1 Model 1

In our baseline model – model 1 – the explanatory firm-specific variables and industry dummies account for an area under the ROC curve of 0.6744 (figure 7), meaning that the model has some explanatory power. Figures 7 to 15 all demonstrate the quality of our probit models. The 45° line indicates a model that would have random explanatory power of the dependent variable. In this case, the corresponding area under the ROC curve would be equal to 0.5. Hence, the greater the area beneath the ROC curve, i.e. above the 45° line, the better the quality of the model. A perfect fit of any probit model would be indicated by an area underneath the ROC curve equal to 1.[14]

In general, only three of the selected firm-specific variables show significance in relation to female board presence. Whereas firm size and performance, as accounted for by using the log of total balance (*LnTotBal*) and the ROA average of the past five years respectively (*ROA_Avg5*), are insignificant and appear not to be associated with women on board, the picture is different for capital structure. Again, the variable *Gearing* is significant at the 5%-level and seems to be negatively associated with the presence of female directors on board. In fact, if we assume that all independent variables are at their mean value (meaning that we are looking at the ideal, typical company, which is a theoretical rather than a real firm), a one unit increase in gearing relates to a decrease in the probability of having women on board by 0.48 percentage points. Hence, more women on board are presumably associated with lower levered firms.

With respect to our complexity measures, only company age turns out to be significant at the 1%-level in our baseline model. The association with females on board is positive and a one year increase in company age relates to approx. a 0.235 percentage point marginal increase in the probability of female board presence, given all explanatory variables are at their mean value. The dummy variables for export activities and the listing status are insignificant, as well as the dummy variable for foreign ownership. Yet, the dummy variable *OtherCorpForm* is significant and positively related to women on board, indicating that firms which are not joint-stock companies are more likely to have women directors. In fact, the probability of female board presence increase by approx. 20.4 percentage points when the company is of

[14] Refer to the methodology section for a detailed description of ROC and how to interpret the graph.

a corporate form other than a joint-stock company, given that all explanatory variables are at their mean values.

Regarding the industry dummies, a few highly significant sectors should be mentioned for the purpose of being connected to our hypotheses later on. In the baseline model, transportation (10%-level), automotive, energy, and meals (all 5%-level), as well as retail and utilities (both 1%-level) are significant and, with the exception of automotive, appear to be positively associated with female board presence. As a matter of fact, companies in the retail sector seem to be associated with an increase in the probability of having female board directors by approx. 23.2 percentage points, given that all right hand side variables are at their mean values. Note that a few industry dummies were automatically excluded in STATA due to perfect prediction or collinearity.

5.2.1.2 Model 2

As previously outlined, we add selected board-specific variables to our baseline model. The firm-specific variables essentially remain the same, with the exception of the foreign parent dummy. Due to the inclusion of *ForeignRatio*, a board-specific variable, and its high correlation and related causality concerns with the foreign parent dummy, we opt to exclude the latter. Whereas the area under the ROC curve increases to 0.7821 (figure 8), indicating a better model fit, the results for the right-hand side variables practically stay the same. Despite negligible changes in the magnitude of a few coefficients, no variations in the significance of the firm-specific variables is observed compared to our baseline model.

Figure 7 – Women_dummy model 1

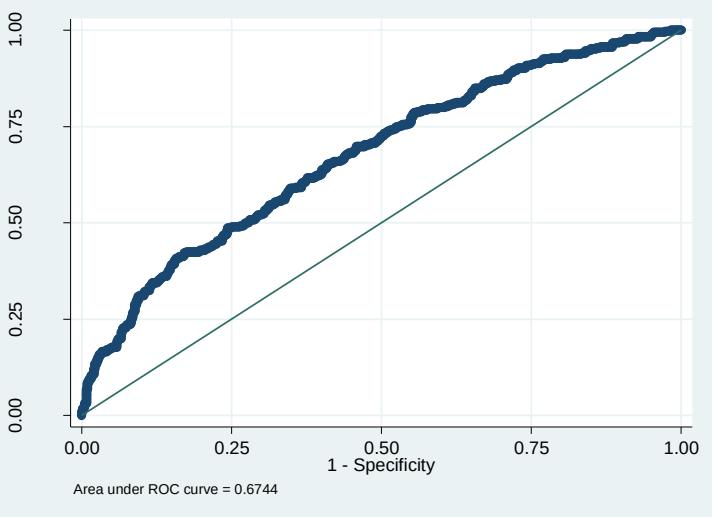


Figure 8 – Women_dummy model 2

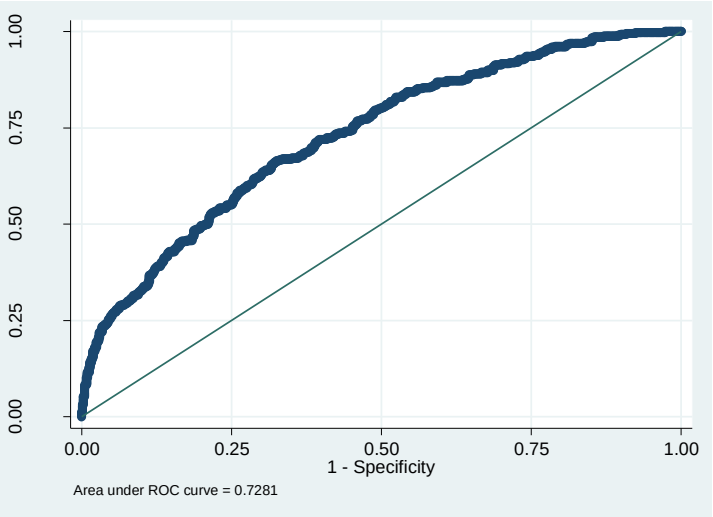
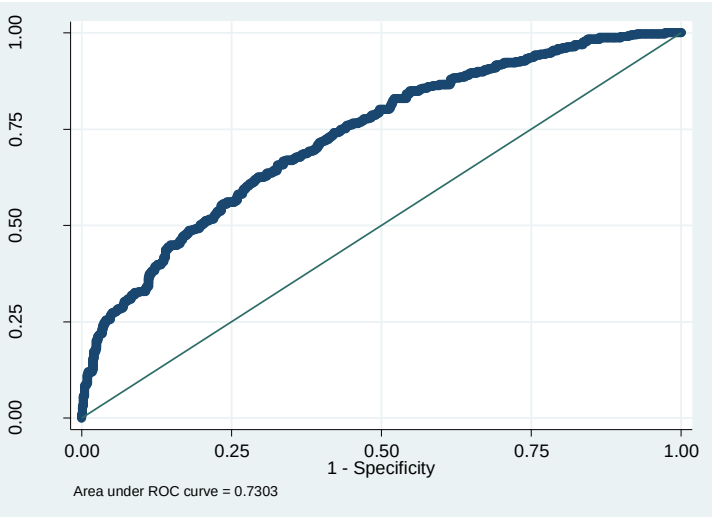


Figure 9 – Women_dummy model 3



More interesting, however, are the results for the three board-specific variables. Board size is highly significant (1%-level) and an increase by one board member is associated with an increase in the likelihood of female board presence by roughly 6.6 percentage points, again granted that all independent variables are assumed to be at their mean value. The ratio for worker-elected directors is significant at the 5%-level, and the association with females on board is positive and stronger in the magnitude. If the presence of worker directors is increased by 33 percentage points, the probability of women on board increases by approx. 8.9 percentage points given all explanatory variables are at their means, as the coefficient for a board completely run by employees is 0.2706. These results indicate that larger boards are associated with greater female board presence, as well as the implication that workers tend to promote women on board more than the shareholders. The latter results might also indicate the workers may find it easier to elect female representatives on board since they recruit these members from the employees, of which women today represent a substantial share. This is, on the other hand, not the case for shareholder-elected members, whose recruitment is mostly from among the directors' networks that are still mostly male dominated (see Gregoric et al., 2012).

The third board-specific variable, *ForeignRatio*, is insignificant and appears not to be related to women on board. This could, however, be due to multicollinearity problems potentially arising due to the correlation between *ForeignRatio* and *BoardSize.*

With regards to the industry dummies, a few noticeable changes can be seen from table 41. Overall, the prediction of directions remains the same and the magnitudes of the coefficients vary only slightly. However, automotive and meals are not significant at the 1%-level and utilities shows significance now at the 5%-level. The transportation sector dummy becomes insignificant, whereas machinery is significant at the 10%-level.

The most striking results, though, can be seen from the sector textiles. Insignificant in our baseline model, it is now significant at the 1%-level. The negative coefficient indicates that firms in the textiles sector are associated with a decrease in the probability of having women on board by approx. 27.3 percentage points, given that all independent variables are at their mean values. This can fairly be seen as counterintuitive to our understanding formulated in the hypotheses section, as this

industry should have a larger female employment base, and hence be positively associated with women on board.

5.2.1.3 Model 3

Our model 3 is a variation of our second model, in which we replace *ROA_Avg5* with the scaled EBITDA variable as a measure of performance and use the dummy variable for import rather than export activities. Additionally with respect to proxies for firm complexity, we add variables for the number of segments and the number of foreign subsidiaries of a firm.

However, none of the newly introduced variables are significant and hence, do not seem to be associated with the presence of women on board. Yet, the results of our right-hand side variables confirm the notions we saw in the previous two models, as the exact same variables are significant or insignificant. Therefore, the firm-specific variables *Gearing*, *CompAge*, and the *OtherCorpForm* dummy are still significant at the 5 and 1%-levels, respectively. *BoardSize* and *WorkElectRatio* as board-specific parameters are still significant at the 1 and 5%-level, respectively.

We also experience only minor changes in the results related to industry dummies. Energy is the only sector whose significance level increases compared to model 2 to the 1%-level. Fabricated products and textiles are now significant at the 5%-level with a negative direction and machinery becomes insignificant altogether. The directions remain unchanged, as well as the magnitude for most of the coefficients.

Overall, the area under the ROC curve for this third and final model to measure associations with female board presence equals 0.7303, indicating that this model has the best fit of the three models (figure 9). With respect to the shape of the curve, we observe how the model is an improvement over a random guess – it is, however, not as nicely shaped as the other diversity regressions below.

In order to conclude and evaluate our findings properly, we need to view them in light of the relevant hypotheses regarding women on board, which were derived from relevant literature and empirical work in this field.

5.2.1.4 Hypothesis 4

Women on boards are more prevalent in large and complex firms from industries with a larger female employment base

Due to our mixed evidence regarding the various aspects our fourth hypotheses postulates as potential associations with women on board, we cannot provide a clear cut answer to whether or not we fully accept this hypothesis. Therefore, it seems more appropriate to dissect the hypothesis into its three components in order to provide meaningful answers.

With respect to firm size, the evidence from our data is surprisingly straightforward and provides no support to what the majority of the research claims. At least in our sample, firm size, as proxied by the logs of both the number of employees[15], and total balance, does not appear to be related to female board presence. Hence, we do not find evidence for this part of hypothesis 4.

The argumentation becomes more complicated when discussing the results on the various measures of firm complexity. The variables for import and export activities, the firm's listing status, the number of segments, and the number of foreign subsidiaries are all insignificant in all of our models. Only company age is highly significant (gearing is significant at the 5%-level) and it appears to be positively related to women on board. Because the majority of the complexity measures are insignificant and it seems plausible that company age could have another underlying notion that is positively associated with female board presence, e.g. the maturity of a firm or a hierarchical structure that promote women, we also lean towards not accepting this part of the hypothesis, as we cannot clearly identify a significant and positive association of firm complexity with women on board.

We, however, find significant evidence that industries that can reasonably be assumed to have a larger female employment base, are significantly associated with women on board. The claim of a positive association is strongly supported the evidence from the retail sector. Yet, textiles, which we would expect to also have a positive relation to women on board, shows in fact a negative relation, i.e. companies in this segment might be associated with fewer women on board. This contradicts our expectations, as well as the fact that the energy and utilities sector are highly

[15] Note that the results of the regression using *LnEmpl* are not reported.

significant and positively related with female board presence. Conventional wisdom would link these two sectors to a smaller rather than a larger female employment base. Hence, without further research and clear insight into the actual female employment base of the industries in question, we can neither reject nor fail to reject this claim of our hypothesis.

5.2.1.5 Hypothesis 5

Employee-elected directors are positively associated with female board representation

Our second hypothesis that is concerned with women on board is, given the evidence from our data, a straightforward case. We find solid evidence that worker directorship is positively associated with female board representation. In both model 2 and 3, the variable *WorkElectRatio* is significant at the 5%-level. The magnitude of the coefficients, in the case in which the presence of employees is increased by 33 percentage points, indicates that employee-directors increase the probability of female board presence of approx. 8.5 to almost 9 percentage points, given that all explanatory variables are at their mean values. Hence, as this evidence contradicts our expectations, we can confidently reject our fifth hypothesis. Instead, it appears that diversity drives diversity.

Interestingly, a few factors that are unrelated to our two hypotheses dealing with women on board, have yielded the most precise results. Board size seems to promote female board presence, as well as other corporate forms besides joint-stock companies that seem to be positively associated with women on board. These associations could arise due to concerns over public scrutiny for not valuing diversity enough or due to specified diversity targets. A negative association can be established with the capital structure and leverage in particular. All these aspects could be evaluated in further research directly targeted at justifying these claims evidenced here.

5.2.2 Worker-elected representatives on board

In line with the previous analysis on women on board, we use the same procedure to measure possible associations between our selected explanatory variables and the dummy variable for worker-elected representation on board. Hence, the appropriate method is once again a probit regression with marginal effects. As before, we present our results for our three models, starting with a baseline model containing firm-specific variables and industry dummies and moving on to adding board-specific variables (model 2) and slight variations in the explanatory variables overall (model 3). Companies without a board are once again excluded and STATA eliminates a few observations due to multicollinearity problems, leading us to a total of 1,061 observations. The results of this analysis are presented in table 42 below.

5.2.2.1 Model 1

We include the log of employees in our baseline model as a measure of firm size.[16] In line with our expectations, the log of the number of employees is highly significant at the 1%-level and shows a positive association with employees on board. Specifically, a 1% increase in the employment base is related to an increase in the probability of worker representation of approx. 18.2 percentage points, given all explanatory variables are at their mean values. These strong results intuitively make sense and appear to be associated with the legal setting in Denmark, where larger employment bases tend to lead to greater worker representation on board.

[16] Testing of different models has suggested that both size measures, *LnEmpl* and *LnTotBal* are highly significant. We opted to stick with the employee variable as it was deemed more relevant in the worker context and it was even more significant than total balance. Due to size limitations regarding the thesis, the results of the corresponding tests are not reported.

Table 42 – Worker_dummy regression results using probit marginal effects

	Dependent variable:		
	Worker_dummy		
Independent variables	Model 1 – Probit, ML dy/dx	Model 2 – Probit, ML dy/dx	Model 3 – Probit, ML dy/dx
Firm specific			
LnEmpl	0.1819186*** [0.02165]	0.1720243*** [0.02189]	0.1678608*** [0.02246]
EBITDAOverAssets			-0.0003567 [0.00116]
ROA_Avg5	-0.001158 [0.00122]	-0.0012472 [0.0013]	
Gearing	-0.0091301** [0.00383]	-0.011116*** [0.00385]	-0.0108066*** [0.00387]
ExportWW_dummy	0.1100174*** [0.03736]	0.123122*** [0.03788]	0.119764*** [0.03844]
Listed_dummy	0.3257499** [0.13171]	0.1797961 [0.1489]	0.1913422 [0.15184]
CompAge	0.0035862*** [0.00053]	0.0024856*** [0.00053]	0.0024094*** [0.00053]
NoSegments			0.017289 [0.01803]
NoFrgnSubs			0.0014536 [0.00637]
FrgnParent_dummy	0.0788117** [0.03911]	0.2716058*** [0.04864]	0.2702717*** [0.04878]
OtherCorpForm_dummy	0.0347455 [0.05815]	-0.1261896** [0.05833]	-0.1286009** [0.05821]
Board specific			
BoardSize		0.1321264*** [0.02363]	0.1329969*** [0.02373]
WomenRatio		0.2154848** [0.10929]	0.2103091* [0.11019]
ForeignRatio		-0.2085032*** [0.06317]	-0.2068149*** [0.06353]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	1061	1061	1061
Area under ROC curve	0.7979	0.9096	0.9098
y = Pr(Worker_dummy)	0.33609233	0.28814954	0.28934602

Note: * p<0.1; ** p<0.05; *** p<0.01

Figure 10 – Worker_dummy model 2

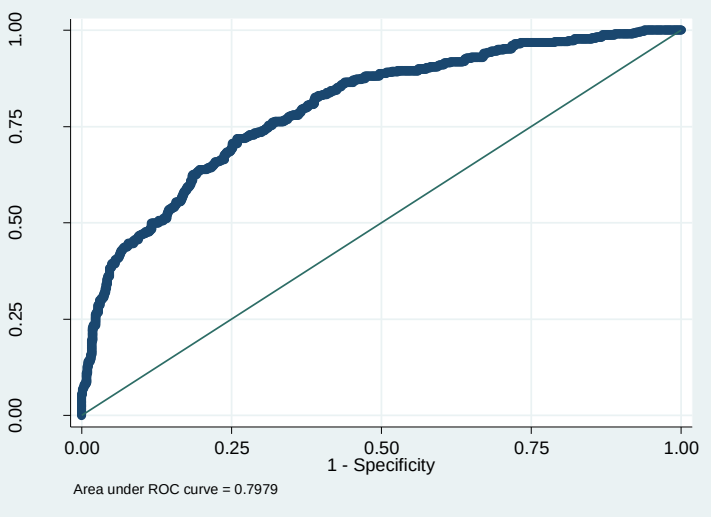


Figure 11 – Worker_dummy model 1

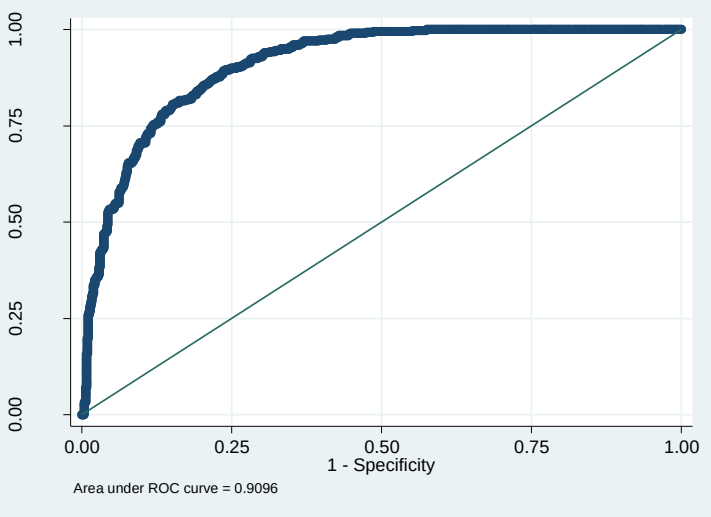
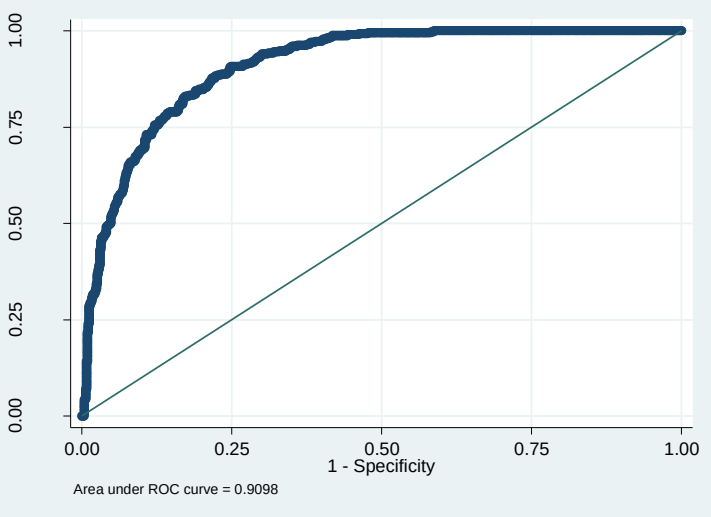


Figure 12 – Worker_dummy model 3



Whereas the performance measure *ROA_Avg5* is insignificant, leverage as accounted for by the variable *Gearing*, is significant at the 5%-level. Most notably, however, are the results for the three complexity measures in our baseline model (column 1 table 42). The *Listed_dummy* is significant at the 5%-level and both the dummy for export activities[17] as well as company age are significant at the 1%-level, where a one year increase in firm age is associated with a marginal increase in the probability of having employee directors by 3.6 percentage points, given all explanatory variables are at their mean value. This can be seen as early evidence to our postulated belief that complexity might be positively related to worker representation on boards.

Somewhat of a surprising result is given by the dummy variable for foreign ownership. Contrary to the notion that a foreign parent might exert tighter control over the board of directors, our evidence suggests a positive association between the presence of a foreign parent and employee directors on board. Specifically, the presence of a foreign parent seems to be associated with an increase in the probability of having employee directors on board by approx. 7.9 percentage points, given that all explanatory variables are at their mean values. However, an influential factor of this could be the fact that companies with a foreign parent are prone to be bigger and more complex companies as they would be comparable to a subsidiary and be part of tightly-woven vaster company network, which could in turn explain the positive relation to worker presence on board.

5.2.2.2 Model 2

As before, model 2 represents our baseline model including the newly added board-specific parameters. Note that all variables are at least significant at the 5%-level, most however at the 1%-level, with the exception of only *ROA_Avg5* and *Listed_dummy*. As the interpretation of the firm size and complexity measures is not altered by these results compared to model 1, we therefore focus on the board-specific variables.

Board size and the ratio of women on board are significant at the 1 and 5%-level, respectively. Both seem to be positively related to the presence of workers on board.

[17] Import and export dummies were subject to the same testing as the measures of firm size. Both variables turned out to be highly significant, yet the dummy for export activities showed even greater significance. Results are not reported due to size limitations.

In the case of board size, the evidence implies that an increase in board size by one member is associated with a marginal increase in the likelihood of worker representation on board by roughly 13.2 percentage points, given that all explanatory variables are at their mean values.

The variable *ForeignRatio* is highly significant and indicates a negative association with employee directorship. In this case, if the presence of foreigners is increased by 33 percentage points from the average value, the probability of workers on board decreases by just under 7 percentage points, given that all explanatory variables are at their mean value. Interestingly, and despite their assumed correlation, both variables *ForeignRatio* and *FrgnParent_dummy* are significant at the 1%-level. Hence, as indicated above, it seems plausible that the variable *FrgnParent_dummy* captures another effect, such as firm complexity.

5.2.2.3 Model 3

In our third model, we replace the performance measure *ROA_Avg5* with *EBITDAOverAssets* and further add the complexity measures number of segments and number of foreign subsidiaries to arrive at our holistic model. As table 42 indicates, the results compared to the two previous models remain practically unchanged. All three of the new variables do not seem to be associated with worker representation on board and are insignificant.

The notion that firm size and complexity are positively associated with worker-elected representatives on board is further supported by model 3, as all of these parameters are significant at the 1%-level and their direction and magnitude of the coefficients barely vary compared to previous results.

A result we have not commented on up to this point is the evidence provided by the dummy variable for other corporate forms. It is significant at the 5%-level and exhibits a negative association with employee director presence on board. This intuitively seems reasonable, as the companies that are grouped under the *OtherCorpForm_dummy* are not subject to the strict legal rules that joint-stock companies are, and hence have more leeway in promoting workers on board. In fact, these companies seem to be associated with a decrease in the probability of having worker directors on board by approx. 12.9 percentage points.

As a final remark on model 3, note that the area under the ROC curve is 0.9098 (figure 12), which is the highest of our three models and quite close to the maximum value of 1. This indicates that our model has very high explanatory power. If we look at the shape of the curve for our model, we see that it is very good at predicting 1-values that boards have employees present. This is indicated by the steep curve with high sensitivity (true positives) with a low 1-specificity (false positives).

Again, these findings need to be critically assessed and tied back to our initial hypothesis related to worker-elected representatives on boards.

5.2.2.4 Hypothesis 6

Large and complex firms will have more employee directors above their legal requirements than smaller and simpler firms

The evidence our three models related to employee directors on board have yielded is very clear. All size and complexity measures, with the exception of number of segments and number of foreign subsidiaries, are highly significant at the 1%-level. This verifies our hypothesis 6 and confirms previous research that associated large and complex firms with more employee directors than smaller and simpler firms.

An interesting field, however unrelated to our hypothesis, is the association of foreign influence on the presence of workers on board. Since we get mixed evidence, foreign ownership suggests a positive while foreign directors indicate a negative relation, it seems plausible that FrgnParent_dummy captures other associations, e.g. firm complexity. Hence, this evidence could be subject to future research.

5.2.3 Foreigners on board

The presence of foreign directors on board is our third and final aspect of board diversity that we hope to derive significant associations for. Once again, we rely on three probit regression models with marginal effects to test the significance of our right-hand side variables. The setup of the three models is exactly the same as in the previous two sections and the overall results are shown in table 43 below. Companies without a board are once again excluded and STATA excludes some observations due to multicollinearity issues. In total, we are able to analyze the relations to foreigners on board for 1,066 observations.

5.2.3.1 Model 1

In our baseline model – model 1 – we include *LnTotBal* as a measure of firm size instead of the log of the number of employees, as it turns out to be a much better proxy for firm size with respect to our dependent variable. The variable log of total balance is significant at the 1%-level and seems to be positively related to foreign board representation. In fact, a one percent increase in total balance is associated with an almost 7 percentage points marginal increase in the probability of foreign director board presence, given that all explanatory variables are kept at their mean values.

However, with the exception of the foreign parent dummy variable, all remaining firm-specific variables are insignificant. It is no surprise that the *FrgnParent_dummy* is highly significant at the 1%-level and positively associated with foreign board presence. It supports the notion that a foreign parent company will strive to exert control over the board, and the most convenient way to ensure that its own interests are being valued, is through physical board presence. As evidenced, the presence of a foreign parent appears to be related to an increase in the probability of having foreign directors on board by approx. 58 percentage points, given that all explanatory variables are at their mean values.

Overall, the quality of this baseline model is quite high, as the area under the ROC curve equals 0.8075 (figure 13), which indicates very solid explanatory power of our model 1.

Table 43 – Frgn_dummy regression results using probit marginal effects

	Dependent variable:		
	Frgn_dummy		
Independent variables	Model 1 – Probit, ML dy/dx	Model 2 – Probit, ML dy/dx	Model 3 – Probit, ML dy/dx
Firm specific			
LnTotBal	0.0696183*** [0.01982]	0.0745682*** [0.02025]	0.0695937*** [0.02106]
ROA_Avg5	-0.0016424 [0.00147]	-0.001706 [0.00146]	-0.0016842 [0.00146]
Gearing	0.0001321 [0.00042]	0.0000806 [0.00042]	0.0000864 [0.00042]
ImportWW_dummy			0.0244544 [0.04115]
ExportWW_dummy	0.0265722 [0.04259]	0.285818 [0.0428]	
Listed_dummy	0.1643969 [0.12457]	0.17613 [0.12303]	0.1729117 [0.12334]
CompAge	-0.0007002 [0.00056]	-0.0005023 [0.00058]	-0.0004927 [0.00058]
NoSegments			-0.0060028 [0.01958]
NoFrgnSubs			0.0061641 [0.00633]
FrgnParent_dummy	0.5797629*** [0.02732]	0.5754285*** [0.02775]	0.5778474*** [0.02747]
OtherCorpForm_dummy	0.0725329 [0.06829]	0.0922315 [0.07014]	0.097856 [0.06959]
Board specific			
BoardSize		-0.0152736 [0.01062]	-0.0160298 [0.01067]
WomenRatio		-0.0956255 [0.11708]	-0.0906882 [0.11771]
WorkElectRatio		0.0200905 [0.12165]	0.0212099 [0.12234]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	1066	1066	1066
Area under ROC curve	0.8075	0.8100	0.8094
y = Pr(Frgn_dummy)	0.46127294	0.46065804	0.46083911

Note: * p<0.1; ** p<0.05; *** p<0.01

Figure 13 – Frgn_dummy model 1

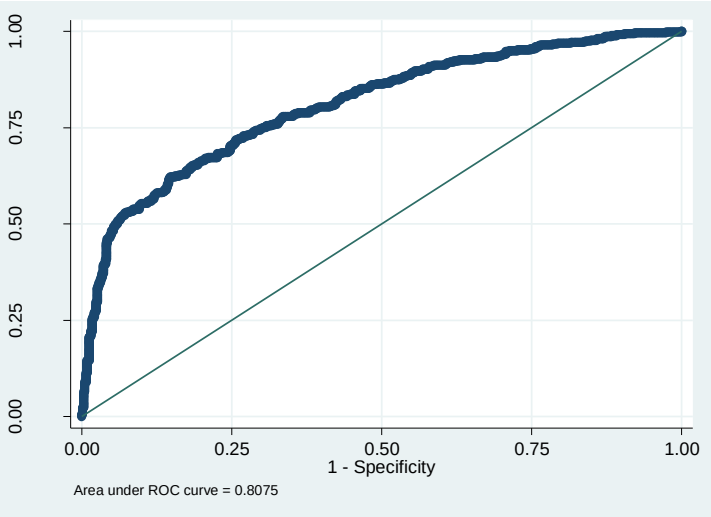


Figure 14 – Frgn_dummy model 2

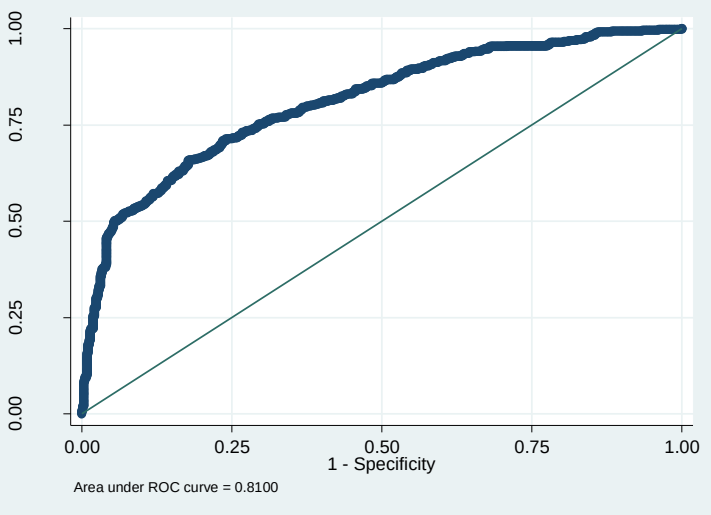
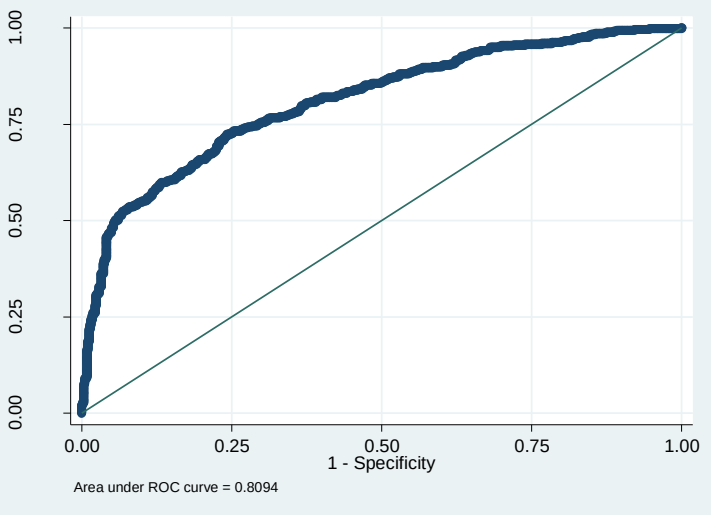


Figure 15 – Frgn_dummy model 3



5.2.3.2 Model 2

Even in the presence of board-specific variables, the results outlined above do not change in our model 2. The newly included board-specific parameters are all insignificant. Again, the only significant variables remain *LnTotBal* and *FrgnParent_dummy* at the 1%-level. The magnitude for total balance actually increases, to approx. 0.075. Overall, the results give the impression that foreign board presence is associated with the presence of a foreign owner and on firm size, as alternative tests have proven the number of employees to be insignificant. The reason why firm size is at least partially significant could be that with greater firm size companies tend to be more international, and hence require more international expertise on board. If we accept this argument, then we automatically imply other factors of internationality that are not captured by any of our measures of firm complexity, predominantly the dummy variable for export activities. Note that the area under the ROC curve is 0.8100 (figure 14), which is quite high considering that the maximum value possible is 1. It is also an improvement compared to our baseline model 1.

5.2.3.3 Model 3

In fact, the evidence from our third model is in line with the argumentation of uncaptured effects of internationality that might be associated with foreigners on board. Even in this complete model, newly added variables, from which it is reasonable to expect an association with foreign board representation, are insignificant. Most notably, the dummy variable for import activities or the number of foreign subsidiaries are highly insignificant and cannot be conclusively related to foreign directors on board.

Once again, only the log of total balance and the dummy variable for foreign parent ownership are highly significant.

Interestingly, the area under the ROC curve for model 3 (figure 15 – 0.8094) is lower than for model 2 (0.8100), which was not the case for either of the other diversity regressions. This indicates that model 2 has the best model fit. Overall, the shape of the curve looks good but the flatness in the curve, which is not that near the top,

indicates that the model has a good true positive rate but commits a substantial amount of false positive errors.[18]

5.2.3.4 Hypothesis 7

Large, international, and complex firms with foreign ownership are more likely to have foreign directors on board than other firms

The evidence from our three models as reported in table 43 is not conclusive to a point where we could completely support our hypothesis 7. Large firms, according to our results, appear to be associated with greater foreign board presence. Also, we see strong significance for foreign ownership and its positive relation to foreigners on board. However, we do not find supporting evidence for the aspects of internationality or firm complexity. Especially regarding internationality, it seems reasonable that our models do not capture all effects related to this measure.

5.2.4 Poisson board diversity regression

In this section, we will test our initial results for robustness using Poisson regression containing the same explanatory variables from the models above but three different dependent variables for the respective diversity regressions. We will thus replace the three dummy dependent variables with: number of women on board (*TotWomenBoard*), number of worker representatives on board (*NoWorkElecReps*), and number of foreigners on board (*TotForeignBoard*), respectively. By replacing the dummy variables with count variables, we will measure the degree of presence rather than the absolute presence in terms of board diversity. This is, however, not as important in relation to accepting or rejecting our hypotheses. The primary focus is to see if the direction and significance of the coefficients change given the different method and dependent variable. Hence, we will only go into depth with results insofar as there are notable changes in relation to the above results.

Poisson is appropriate because the variables are count variables with a substantial amount of observations being zero, but also with a significant amount of observations in the range of 1-7.[19] Due to space limitations, the results of the Poisson regressions have been placed in appendix 5.

[18] See also Hammel (2007) for more on interpretation of ROC curves.
[19] For a more detailed review of the variables' distributions, please refer to the descriptive statistics section.

5.2.4.1 Women on board

As evidenced by the results in table 53, we do not observe a notable change in the company size variable, which remains insignificant. The variable on leverage, G*earing*, which was significant at the 5%-level in our main probit regression, is now only significant at the 10%-level, and only in models 2 and 3. Hence, it appears that the previously established association between female presence on board and leverage appears lower. The sign is, however, unchanged. In relation to the complexity measures, we do not note any changes in the signs or significances. With respect to the board-specific variables, there is no change for *BoardSize* but both *WorkElectRatio* and *ForeignRatio* gain more significance without changing the signs of the coefficients. *WorkElectRatio* is now significant at the 1%-level (instead of 5% as before), constituting stronger evidence for the case that female representation is positively correlated with worker presence on board. This strengthens hypothesis 5, that employee directors are positively associated with female board presence, even further. *ForeignRatio* is significant at the 10%-level only for models 2 and 3 with a coefficient of approx. -0.25, indicating a negative association between foreigners on board and female board representation. It would, however, take more analysis to confirm this result as a 10% significance is relatively weak evidence to draw any sound conclusions from.

Regarding the industry dummies, we observe that automobiles, machinery, and textiles lose their significance while energy, fabricated products, meals, retail, transportation, and utilities retain their significance and direction of causality. This solidifies our result for these industries. In addition, the Poisson regression results suggest that several other industries could help explain the degree of female presence: books, business services, clothing, computers, guns, healthcare, mines, tobacco, soda, and toys. We will not interpret the results of these industries further as several of them are represented by very few observations (cf. descriptive statistics) and the Poisson results will therefore be biased.

5.2.4.2 Workers on board

With respect to our size variable, the log of number of employees, we observe that it retains its significance and direction of causality in table 54. In relation to our complexity measures, all previously significant variables have the same signs but some change significance. The *Listed_dummy* becomes significant at the 10 and

5%-level in models 2 and 3, respectively, where it was insignificant previously in these two models. This strengthens hypothesis 6, that large and complex firms will have more employee directors, even more. The *ExportWW_dummy* and *FrgnParent_dummy* lose some significance for model 1. The focus, however, lies mainly on the results of the complete models so we choose not to attribute much relevance to this result. With regards to our board-specific variables, we see no change for *BoardSize* and *ForeignRatio*. The *WomenRatio*, however, is now significant at the 1%-level and not just the 5%-level. The relationship is still positive, which is further evidence in support of hypothesis 5.

5.2.4.3 Foreigners on board

In the original probit regressions with marginal effects only the log of total balance and the dummy variable to account for foreign ownership were significant (cf. table 55). These two variables are still significant at the 1%-level with the same signs, but now more variables gain significance. The complexity variable, *Listed_dummy*, becomes significant at the 5%-level with a positive direction of causality, indicating that more complex firms are associated with foreign presence. In other words, this is support for the complexity part of hypothesis 7, that large, international, and complex firms with foreign ownership are more likely to have foreign directors than other firms, which was not supported before at all. Additionally, we note that *BoardSize* becomes significant at the 5%-level with positive coefficients, suggesting that the degree of foreign presence on board is positively related to the number of members on the board. We have, however, not hypothesized on this.

Considering the hypotheses, we do not evaluate that there are any notable changes to the conclusions made previously based on these Poisson results. Most noteworthy is further strengthening of hypothesis 5, 6, and 7. It will be necessary to conduct further analyses to make more solidified claims.

6 Discussion

In the analyses section, we have investigated different hypotheses with respect to board size and board composition. The purpose was to shed light on which type of companies are associated with particular board sizes and particular board compositions in light of relevant theory. In this section, we discuss our results in relation to our hypotheses and the theory underlying them. This will allow us to demonstrate how we contribute to the existing literature and where future research in this area could be directed. As we are investigating two distinct areas of research, we split this section into a discussion on board size and board diversity.

6.1 Discussion of board size results

In relation to board size, we follow the string of literature which focuses on determinants of board size and leave the particular effects from having different board size in terms of impact of performance, etc. Complementary to existing studies on the determinants of board size, our paper delivers a comprehensive study of three different associations on board size, namely firm size, firm complexity, and board diversity.

With respect to board size, we hypothesized that larger firms tend to have larger boards. The main idea is that larger firms need larger boards due to higher advising needs. Our empirical results are unable to either confirm or reject this hypothesis as they were not statistically significant across our different models. This contrasts the results of e.g. Lehn et al. (2004), Coles et al. (2007) and the views of e.g. Klein (1998) and Boone et al. (2007). Several potential explanations can be considered. First, differently from other studies that are primarily based on large publicly listed firms, we only consider medium-sized and large companies, where our data has a substantial skew with clustering of observations for both size measures in the lower region of the data. Similarly, the pattern for board size is a clustering around values in the range of 3-6 board members. These factors may not yield enough variation to find any significance for the firm size measures. An interesting further study could include small and potentially micro firms as well to see if this would yield more significance. Second, we might be faced with multicollinearity problems or endogeneity concerns, which are associated with our particular empirical setting and availability of the data.

With regards to firm complexity, our study provides several interesting results although the end results is that we can neither accept nor reject the hypothesis that more complex firms will have larger boards than simpler firms. Almost all of our complexity measures were significant across the three models using both OLS and Poisson. The problem is that the direction of the association was unclear for different complexity variables. Some of our variables gave significant results consistent with the expectations from theory: company age was found to have a positive effect as suggested by Boone et al. (2007), number of foreign subsidiaries did also show a positive relationship as implied by the arguments by Boone et al. (2007) and Linck et al. (2007) on the effect of geographic dispersion, and the listed/unlisted status also gave the expected positive association. Contrary to our hypothesis, we found a negative association between board size and number of business segments. This contradicts the expectations of e.g. Rose & Shephard (1997) and Linck et al. (2007) that the diversification effect will result in increased advising needs. In addition, our empirical results suggest a negative relationship between gearing and board size, which is contrary to the view by Pfeffer (1972), Klein (1998), and Coles et al. (2007), who hypothesize that a higher debt ratio implies a greater need for advise and ultimately a larger board. Several potential explanations as to why we observe these apparently counterintuitive results can be given. First, the firm complexity as defined and measured in this paper might include variables too diverse to be included in a single category. Formulated differently, different firms may be sensitive to different types of complexity and it could thus be necessary to decompose complexity into several specific effects. This could be the individual effect of leverage, dispersed operations, or degree of diversification. Second, we might be subject to endogeneity problems (i.e. inability to control for some relevant variables or reverse-causality issues) inherent in our empirical setting, which could explain the negative directions observed for our gearing and number of segments variables.

In addition, it is interesting to note that our dummies for importing and exporting worldwide did not prove to be significant. Perhaps, they are not qualified measures for complexity in this setting.

Overall, we think that complexity has several important implications for board size. Our results suggest, however, that complexity can be most advantageously studied by modeling different aspects of complexity more separately and then make

individual hypotheses for each type of complexity. These hypotheses could also be related to individual settings where certain complexity variables might be judged more important.

We found some evidence to confirm the last hypothesis on board size, that higher board diversity is associated with larger boards. In the following we will try to decompose the empirical results.

The evidence is very strong in relation to worker representation on board, which is found to have a significantly positive relationship to board size. This is an indication that the increased presence of workers is associated with a larger board. Although existing literature is vague on this aspect, it could suggest that workers were added to the existing board members, rather than replacing them, because they possess unique information and thus function as important additional advisers as implied by Bainbridge (1998) and Fauver and Fuerst (2006). Research with longitudinal data will be needed to make any definite comments about these more dynamic relationships with respect to employees.

We also document a potential association between female presence and board size. The relationship is not significant at the 10%-level (although close) in our main regression, but for joint-stock companies we note that the association is significant at the 1%-level. As suggested in the literature behind this part of the hypothesis, which is based on Farrel and Hersch (2001) in particular, there is public pressure to increase board diversity in terms of women and this can result in women being added to the board rather than replacing existing board members. It is interesting to note that the female effect is strong with particular types of companies as revealed in our sub-sample regressions. This indicates that there are some factors we cannot capture in our main regressions. It would be fruitful for future research to delve further into these issues by using longitudinal data coupled with particular data on the reasons as to why women were included on the board, which is very hard to come by. An example of this could be information on the education and experience of the women being put on the board in comparison to their male counterparts.

With regards to the effect of foreigners on the board, we abstained from specifically reporting these results due to high multicollinearity issues with foreign ownership. Including the *ForeignRatio* variable would, however, lead to a strong negative

association with board size. This is contrary to our hypothesis, which is partly based on Oxelheim et al. (2012). The expectation is, however, that this result is driven by the ownership by a foreign parent, which could be expected to place a small team of foreigners on the board to maintain control, implicitly driving down the board size. Further research with panel data will, however, be needed to document any causality in this regard. The very reason we included foreign ownership and not the proportion of foreigners on board as an explanatory variable in the model is also that we consider the former the underlying driver of the board size.

Overall, we interpret the empirical result in relation to board size as suggesting that complexity matters to a certain extent, giving credence to the theories that link advising needs with board size. In addition, we find that diversity is a driver of board size when it comes to worker presence and, to some extent, female presence. These results were robustness tested using different methods and sub-samples, which strengthens the above conclusions we have drawn.

6.2 Discussion of board diversity results

Based on the relevant literature in the field of board diversity, we analyze and emphasize the associations of women, employee, and foreign directors on board with various firm- and board-specific features. We specifically evaluate our findings from the probit regressions and Poisson robustness tests in light of the prevailing research.

With regards to women on board, we find no significance for our two measures of firm size, *LnEmpl* and *LnTotBal*. Therefore, our analysis fails to yield supporting evidence for the claim uttered by Hillman et al. (2007), who find a significant and positive relation between firm size and female board presence. The authors also find the same evidence for firm complexity and diversity, stating that an increase in either area is related to an increase in female board presence. We are able to only partially substantiate these claims, as we find a significant and positive association between company age, one of our measures of firm complexity, and women on board. However, and contrary to Hillman et al.'s findings, *Gearing* shows a negative association. To be in line with previous research, we expected this relationship to be positive, as it is a measure of firm complexity.

With respect to Harrigan (1981), who focuses on the importance of industries and their effects on female board presence, we are able to find some strong results in support of his claim that female directors will be more likely in industries that have a larger pool of women among the employment base. However, it is important for us to note that, while observing some significant results in support of Harrigan's claim, we also see evidence for a few sectors that is completely counterintuitive. For example, the significantly positive association with female board presence of the retail and meals (which e.g. includes restaurants and hotels) sector appears to be intuitive and can be seen in line with previous research. However, the same significance and relation can be observed for the energy and utilities sector. We would naturally assume these sectors to have a lower female employment base, and hence expected a negative association with female board presence. Therefore, in order for us to make solidified claims regarding the overall evidence from our sector dummy variable, further research regarding the structure of the respective employment bases is required.

We are able to find significant results regarding our board-specific parameters in both our probit and Poisson regressions. We find a strong positive relation between the presence of worker-elected directors and women on board using both probit and Poisson. This finding support previous evidence from Gregoric et al. (2012). The reason for this observation could lie in the behavior of workers on board, as they appear to be more inclined to choose other directors from the workforce where they will naturally find a greater pool of women to select board members from. The size of this pool of women, however, seems to vary with respect to the industry a company is active in.

Additionally, an interesting aspect our analysis revealed, unrelated to our hypotheses, is that our board size variable is evidenced to have a positive association with female board presence. A reasonable explanation of this could be based on the argument that more visible companies with their larger boards strive for more diversity out of concern over public scrutiny (Singh et al., 2001; Hillman et al., 2007; Van der Walt & Ingley, 2003).

With respect to our hypothesis on worker directors, we find supporting evidence regarding the positive association between firm complexity and worker directors on board. It appears, given the very high significance levels of almost all of our

measures of firm complexity, that employee directors are seen as a source of or as transmitters of information in complex firms. This reasoning and our findings are in line with previous work conducted by Fauver and Fuerst (2006) and Bainbridge (1998).

Employee directors also seem to be more likely in larger firms, as evidenced by the strong positive association of our *LnEmpl* variable, the measure of firm size in our regressions on worker board presence. We feel that it is fair to apply the same reasoning as in the case of women on board. Larger firms are prone to be subject to public scrutiny, and hence might purposely strive for visible diversity in the form of more employee directors on board.

We have already touched upon the apparent contradiction between the results evidenced from our variables *FrngParent_dummy* and *ForeignRatio*, which we both assumed to account for foreign influence or the degree of internationalization of a firm. Additional, our belief was that the presence of a foreign owner will be associated with more foreign directors on board, which is in fact the case (see later section on foreigners on board). Hence, it appeared reasonable to assume both predictors with the same direction. However, whereas the *ForeignRatio* seems negatively associated with worker presence on board, the *FrgnParent_dummy* shows the opposite direction. Therefore, in light of our overall findings, we believe that we capture other effects with the dummy variable on foreign ownership, such as firm complexity.

As mentioned in the discussion on women on board, board size and now the female board presence (as opposed to workers before) are positively associated with employee directors on board. Given that we cannot prove causality with respect to the relation between female and employee board presence, we view our results as general support of the notion that diversity drives diversity, as proposed by Gregoric et al. (2012).

As the findings on the presence of foreign parent companies and foreigners on board have already been discussed, we turn our attention to other parameters that appear to be associated with foreign directors on board.

In line with the study performed by Masulis et al. (2012), we find supporting evidence for the claim that firm size is positively associated with foreign board presence, with high significance of our size measure on total balance. It might be plausible to assume larger firms to automatically be more international, given the globalized economies of today's world. This could result in the need for foreign directors on board based on crucial experience in foreign markets or enhanced access to foreign capital markets (Oxelheim & Wihlborg, 2008). Oxelheim et al. (2012) make an interesting distinction between board members of foreign origin and board members with international experience, as both count towards the overall internationalization of the board. This could lead to further research aimed at singling out the associations with respect to "truly" foreign directors and board members with an international expertise background. In line with these possible explanations, it is not surprising we find strong and positive evidence with respect to the presence of a foreign parent company.

Oxelheim et al. (2012) build their case further around firm complexity. We are able to find supporting evidence of the positive association between firm complexity and foreign directors on board in our Poisson robustness tests, where some of our measures become significant at the 5 and 10%-levels.

In general, we interpret our empirical findings related to board diversity that firm complexity matters with respect to female and employee board presence to a certain extent. Firm size appears to be a relevant association when evaluating worker-elected representation and foreign board presence. Additionally, we identify a positive relationship between employee and female board presence and vice versa, although we cannot establish the direction of causality of the apparent relationship. Last but not least, foreign ownership appears to be of great importance with respect to foreign board representation.

7 Conclusion

In this thesis, we examine the determinants of board size and composition for Danish medium and large companies using a database with extensive, updated data on almost all Danish firms. In this process, we follow the tradition of Hermalin and Weisbach (2003) by investigating how board size and composition are endogenous and associated with particular firm characteristics. We rely on both, variables used before in empirical studies of boards, but also variables not previously investigated in this connection. Therefore, several of our results go beyond what has been previously studied. As such, this study is unique in studying the Danish context using the approach we apply.

Our thesis delves into two major topics – board size and board composition. With respect to board size, we investigate the effect of firm size, complexity, and board diversity. Our results do not support the positive association between board size and firm size, as previous research does. The evidence pertaining to the relationship between board size and complexity provides mixed evidence, where many attributes of complexity exhibit the theoretically expected results, a positive association, while others do not. In line with theory, we document a positive relation between board size and diversity. These results were subject to robustness tests, using both different methods and sub-samples. The latter method revealed that our models might fit particularly well with certain types of companies.

As evidenced by the empirical results from our diversity regressions, we do not find support for the theory that larger firms are more inclined to elect female directors. We do, however, find positive associations between certain measures of firm complexity, as well as certain industries with a large female employment base, and female presence on board. In addition, we find that diversity appears to be driving diversity, as employee directors are positively associated with female directors. We also find strong evidence that there is a positive association between employee directors and firm complexity as well as firm size. The latter is also positively associated, as is the presence of a foreign owner, with foreign directorship.

Some of our results provide counterintuitive insights, which may arise due to endogeneity concerns inherent in our empirical setting. Future research could advantageously use longitudinal board data with more explanatory measures to

further delve into some of these results, especially to uncover the direction of causality. Our thesis also indicates that several areas of research remain unexplored in depth. Fruitful research could be directed towards decomposing the different effects associated with firm complexity on board size and board composition, the effect of board size on board diversity, how foreign directors put in place by a foreign parent can be separated from foreign directors elected because of their international expertise in terms of their effect on the board composition, and the effect of worker representation on board size.

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9 Appendix

9.1 Appendix 1 – Existing variables in WebDirect database

Standard variables provided in WebDirect

Practical information	KOB number	Municipality code 2007
	Company name	County code
	CO Company name	Region code
	Address	Road code
	Zip code	Road name
	Postal district	Number
	Telephone	Letter
	Telefax	CVR number
	Home page	SEnumber
	Email	Registration number
	Municipality code	Year established
Type of company information	Corporate form	Employees - most recent
	Corporate form - code	Employees - most recent - code
Segment information	Industry code 1-9 (DB07 classification)	Export 1-9
	Import 1-9	Listed?
Ownership information	Stockholder 1-50	Parent company country code
	Proportion owned 1-50	Subsidiary name 1-50
	Parent company name	Subsidiary country code 1-50
Financial information	Accountant 1-2	Net profit per empl.
	Bank 1-4	Fixed assets per empl.
	Financial year	Net revenue growth (%)
	End date	Gross margin growth (%)
	Public date	Depreciation growth
	Net revenue (1000 DKK)	EBIT growth
	Contribution margin (1000 DKK)	Net financial income growth
	Depreciation	Ordinary income growth
	EBIT	Extraordinary items growth
	Net financial income	Calculated tax growth (%)
	Result from ordinary operations	Profit before tax growth
	Extraordinary items	Net profit growth (%)
	Calculated tax (1000 DKK)	Profit paid out growth
	Profit before tax	Fixed assets growth
	Net profit (1000 DKK)	Property and buildings growth
	Result paid out	Public valuation of property growth
	Fixed assets	Current assets growth

	Property and buildings	Inventory growth
	Public real estate valuation	Trade payables growth
	Current assets	Liquid funds growth
	Inventory	Equity growth (%)
	Trade receivables	Company capital growth (%)
	Liquid funds	Provisions growth
	Equity (1000 DKK)	Invested capital - low priority - growth
	Company capital (1000 DKK)	Long term debt growth
	Provisions	Mortgage debt growth
	Invested capital - low priority	Short term debt growth
	Long term debt	Trade receivables growth
	Mortgage debt	Total balance growth
	Short term debt	Revenue per empl. growth
	Trade payables	EBIT per empl. growth
	Total balance (1000 DKK)	Ordinary income per empl. growth
	Employees	Net profit per empl. growth
	Rev. per empl.	Fixed assets per empl. frowth
	EBIT per empl.	Contribution ratio (%)
	Ordinary income per empl.	Profit margin (%)
Key financial ratios	Capacity ratio	Profit margin growth (%)
	ROA	Capacity ratio growth
	Capital ratio	ROA growth
	Inventory turnover	Capital ratio growth
	Asset turnover	Inventory turnover growth
	Credit period - debitor	Asset turnover growth
	Credit period - creditor	Credit period creditor growth
	Cash-to-current-liablities ratio I	Credit period debitor growth
	Cash-to-current-liablities ratio II	Cash-to-current-liablities ratio I growth
	Equity ratio	Cash-to-current-liablities ratio II growth
	ROE I	Equity ratio growth
	ROE II	ROE I growth
	Break even sales	ROE II growth
	Safety margin	Break even sales growth
	Net worth	Safety margin growth
	Gearing	Net worth growth
	Contribution ratio growth (%)	Gearing growth
Board and management info.	Chairman of the board	Chairman of the board
	Board member(s)	Board member 1-18
	Worker elected board representative(s)	Worker elected board representative 1-5
	CEO	CEO1-2
	Director code 1-20	CFO
	CFO	Board code 1-20
	Functional code 1-20	

9.2 Appendix 2 – Fama and French (1997) industry code transformation

Fama & French 1997			
Short name	**Long name**	**Corresponding SIC codes**	**DB07 codes grouped into these**
Agric	Agriculture	0100-0799, 2048-2048	16400
Food	Food products	2000-2046, 2050-2063, 2070-2079, 2090-2095, 2098-2099	101110, 101190, 101200, 101300, 102020, 103100, 103200, 103900, 104100, 105100, 106100, 107110, 107120, 107200, 108200, 108400, 108500, 108900, 109100, 109200
Soda	Candy and Soda	2064-2068, 2086-2087, 2096-2097	110700
Beer	Alcoholic Beverages	2080-2085	110100, 110500
Smoke	Tobacco Products	2100-2199	120000
Toys	Recreational Products	0900-0999, 3650-3652, 3732-3732, 3930-3949	324000
Fun	Entertainment	7800-7841, 7900-7999	182000, 591120, 591200, 591300, 602000, 791100, 791200, 799000, 910400, 931100, 931200, 931300, 932100
Books	Printing and Publishing	2700-2749, 2770-2799	181100, 181200, 581100, 581300, 581410, 581900, 582900
Hshld	Consumer Goods	2047-2047, 2391-2392, 2510-2519, 2590-2599, 2840-2844, 3160-3199, 3229-3231, 3260-3260, 3262-3263, 3269-3269, 3630-3639, 3750-3751, 3800-3800, 3860-3879, 3910-3919, 3960-3961, 3991-3991, 3995-3995	234100, 275200, 310100, 310200, 310300, 310900
Clths	Apparel	2300-2390, 3020-3021, 3100-3111, 3130-3159, 3965-3965	141200
Hlth	Healthcare	8000-8099	861000, 881010
MedEq	Medical Equipment	3693-3693, 3840-3851	**NON-EXISTENT IN THE SAMPLE**
Drugs	Pharmaceutical Equipment	2830-2836	211000, 212000
Chems	Chemicals	2800-2829, 2850-2899	201100, 201300, 201400, 202000, 203000, 204100, 204200, 205200, 205900
Rubbr	Rubber and Plastic Products	3000-3000, 3050-3099	221900, 222200, 222900
Txtls	Textiles	2200-2295, 2297-2299, 2393-2395, 2397-2399	132000, 139210, 139220, 139500

BldMt	Construction Materials	0800-0899, 2400-2439, 2450-2459, 2490-2499, 2950-2952, 3200-3219, 3240-3259, 3261-3261, 3264-3264, 3270-3299, 3420-3442, 3446-3452, 3490-3499, 3996-3996	161000, 162200, 162300, 222300, 231400, 231900, 239910, 233200, 236100, 236200, 236300, 236400, 236500
Cnstr	Construction	1500-1549, 1600-1699, 1700-1799	412000, 421000, 422000, 429000, 432100, 432200, 432900, 433200, 439990
Steel	Steel Works, Etc.	3300-3369, 3390-3399	241000, 242000, 244200, 245100, 255000, 256100, 256200
FabPr	Fabricated Products	3400-3400, 3443-3444, 3460-3479	222100, 251100, 251200, 252100, 253000, 257200, 259200, 259300, 259400, 259900, 281400
Mach	Machinery	3510-3536, 3540-3569, 3580-3599	281200, 281300, 281500, 282100, 282200, 282500, 282900, 283000, 284100, 289200, 289300, 289900, 331200
ElcEq	Electrical Equipment	3600-3621, 3623-3629, 3640-3646, 3648-3649, 3660-3660, 3691-3692, 3699-3699	261100, 264000, 266010, 266090, 267000, 271100, 273200, 273300, 274000, 275100, 279000, 325000
Misc	Miscellaneous	3900-3900, 3990-3990, 3999-3999, 9900-9999	281110, 329900
Autos	Automobiles and Trucks	2296-2296, 2396-2396, 3010-3011, 3537-3537, 3647-3647, 3694-3694, 3700-3716, 3790-3792, 3799-3799	291000, 292000, 293200
Aero	Aircraft	3720-3729	231200, 331600
Ships	Shipbuilding, Railroad Eq	3730-3731, 3740-3743	331500
Guns	Defense	3480-3489, 3760-3769, 3795-3795	254000
Gold	Precious Metals	1049-1049	**NON-EXISTENT IN THE SAMPLE**
Mines	Nonmetalic Mining	1000-1039, 1060-1099, 1400-1499	81200, 89200, 89300
Coal	Coal	1200-1299	**NON-EXISTENT IN THE SAMPLE**
Enrgy	Petroleum and Natural Gas	1310-1389, 2900-2911, 2990-2999	61000, 91000, 192000
Util	Utilities	4900-4999	351100, 351400, 352200, 353000, 360000, 370000, 381100, 382120, 382200, 383200
Telcm	Telecommunications	4800-4899	263000, 611000, 612000

PerSv	Personal Services	7020-7021, 7030-7039, 7200-7212, 7215-7299, 7395-7395, 7500-7500, 7520-7549, 7600-7699, 8100-8199, 8200-8299, 8300-8399, 8400-8499, 8600-8699, 8800-8899	452020, 452040, 772900, 951100
BusSv	Business Services	2750-2759, 3993-3993, 7300-7372, 7374-7394, 7397-7397, 7399-7399, 7510-7519, 8700-8748, 8900-8999	620100, 620200, 620300, 620900, 631200, 691000, 692000, 701010, 702200, 711100, 712010, 711210, 711220, 711230, 712090, 712020, 731110, 731190, 731200, 732000, 741030, 749090, 771100, 771200, 773200, 773900, 782000, 811000, 812100, 821100, 812290, 812900, 823000, 829200, 829900, 960110
Comps	Computers	3570-3579, 3680-3689, 3695-3695, 7373-7373	262000
Chips	Electronic Equipment	3622-3622, 3661-3679, 3810-3810, 3812-3812	261200, 273100
LabEq	Measuring and Control Equip	3811-3811, 3820-3830	265100, 271200
Paper	Business Supplies	2520-2549, 2600-2639, 2670-2699, 2760-2761, 3950-3955	162100, 171200, 172900, 821900
Boxes	Shipping Containers	2440-2449, 2640-2659, 3210-3221, 3410-3412	162400, 231300,
Trans	Transportation	4000-4099, 4100-4199, 4200-4299, 4400-4499, 4500-4599, 4600-4699, 4700-4799	309200, 331700, 491000, 492000, 493110, 493120, 494100, 501000, 502000, 511010, 511020, 512100, 521000, 522120, 522130, 522220, 522300, 522400, 522910, 522920, 532000
Whlsl	Wholesale	5000-5099, 5100-5199	451110, 451920, 453100, 461400, 461500, 461600, 461800, 462100, 462200, 462400, 463100, 463200, 463300, 463410, 463500, 463600, 463700, 463810, 463890, 463900, 464100, 464210, 464220, 464310, 464320, 464330, 464340, 464350, 464410, 464420, 464500, 464610, 464620, 464700, 464800, 464910, 464920, 464990, 465100, 465210, 465220, 466100, 466200, 466300, 466500, 466600, 466900, 467100, 467200, 467310, 467400, 467500, 467600, 469000, 472400, 477890

Rtail	Retail	5200-5299, 5300-5399, 5400-5499, 5500-5599, 5600-5699, 5700-5736, 5900-5999	451120, 471110, 471120, 471130, 471900, 474300, 475100, 475220, 475300, 475400, 475910, 475920, 475930, 476410, 476500, 477110, 477120, 477210, 477500, 477620, 477810, 477830, 772200
Meals	Restaurants, Hotel, Motel	5800-5813, 5890-5890, 7000-7019, 7040-7049, 7213-7213	551010, 551020, 552000, 561010, 561020, 562100
Banks	Banking	6000-6099, 6100-6199	**DELIBATELY REMOVED**
Insur	Insurance	6300-6399, 6400-6411	**DELIBATELY REMOVED**
RlESt	Real Estate	6500-6553	681000, 682030, 682040, 683120, 683210
Fin	Trading	6200-6299, 6700-6799	**DELIBATELY REMOVED**

9.3 Appendix 3 – Poisson regressions on board size for sub-samples

Table 44 – board size regression for joint-stock companies using Poisson

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – Poisson Coeff. [SE]	Model 2 – Poisson Coeff. [SE]	Model 3 – Poisson Coeff. [SE]
Firm specific			
LnEmpl	0.07537791*** [0.0143227]	0.01297326 [0.0132139]	0.01128633 [0.01378]
EBITDAOverAssets			0.00010803 [0.0005882]
ROA_Avg5	-0.00062732 [0.000876]	-0.00033895 [0.0007321]	
Gearing	-0.00052472** [0.0002389]	-0.00030877 [0.0002003]	-0.00029625 [0.0002006]
ImportWW_dummy			-0.02030807 [0.0201782]
ExportWW_dummy	0.04710117** [0.0234637]	0.00999085 [0.0209181]	
Listed_dummy	0.2528533*** [0.06481]	0.19586571*** [0.0582733]	0.1924172*** [0.0567368]
CompAge	0.00177457*** [0.0002852]	0.00057865** [0.0002625]	0.00059998** [0.0002678]
NoSegments			-0.01466004 [0.0104972]
NoFrgnSubs			0.00841383*** [0.0029151]
FrgnParent_dummy	-0.09283534*** [0.0253525]	-0.13009864*** [0.0218603]	-0.12404515*** [0.0216885]
Board specific			
WomenRatio		0.17317882** [0.0695268]	0.17630704** [0.0711728]
WorkElectRatio		1.0087483*** [0.0813325]	1.0068092*** [0.0825731]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	973	973	973
Pseudo-R^2	0.0269	0.0595	0.604

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 45 – board size regression for other companies using Poisson

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – Poisson Coeff. [SE]	Model 2 – Poisson Coeff. [SE]	Model 3 – Poisson Coeff. [SE]
Firm specific			
LnEmpl	-0.01326734 [0.0555288]	-0.02330783 [0.0539099]	-0.00959645 [0.0531251]
EBITDAOverAssets			-0.00416525 [0.0049946]
ROA_Avg5	-0.00524777 [0.0050851]	-0.00443093 [0.0048723]	
Gearing	-0.00054073** [0.0002575]	-0.00061019** [0.0002614]	-0.00063679** [0.0002781]
ImportWW_dummy			-0.23403801 [0.1448704]
ExportWW_dummy	-0.11010399 [0.1332454]	-0.16638308 [0.1408088]	
CompAge	0.00235775 [0.0016176]	0.00245852 [0.0018295]	0.00281564 [0.0022535]
NoSegments			-0.025112 [0.061198]
NoFrgnSubs			-0.00226462 [0.0121715]
FrgnParent_dummy	-0.4229235*** [0.1376831]	-0.42872342*** [0.1311346]	-0.45509431*** [0.1414251]
Board specific			
WomenRatio		-0.55553376* [0.2849128]	-0.55577834** [0.2820076]
WorkElectRatio		0.359709 [0.3196267]	0.28036308 [0.3125322]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	104	104	104
Pseudo-R^2	0.0601	0.0696	0.0727

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 46 – board size regression for companies with foreign parent using Poisson

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – Poisson Coeff. [SE]	Model 2 – Poisson Coeff. [SE]	Model 3 – Poisson Coeff. [SE]
Firm specific			
LnEmpl	0.05862804** [0.023562]	0.00727405 [0.0221695]	0.01499609 [0.025459]
EBITDAOverAssets			0.00063086 [0.001105]
ROA_Avg5	0.00173135 [0.0013283]	0.00114806 [0.0010742]	
Gearing	0.00483497 [0.0044562]	0.00416314 [0.0038415]	0.00490741 [0.0038292]
ImportWW_dummy			0.04928244 [0.0379181]
ExportWW_dummy	-0.0449808 [0.0487409]	-0.04902308 [0.0380618]	
CompAge	0.0024171*** [0.0005415]	0.00098576* [0.0005222]	.00083123* [0.0004934]
NoSegments			-0.01834197 [0.0169476]
NoFrgnSubs			0.00952031** [0.0046243]
OtherCorpForm_dummy	0.06713883 [0.0535026]	0.06018388 [0.0498214]	0.06045094 [0.0457944]
Board specific			
WomenRatio		-0.00053633 [0.0928142]	-0.00170328 [0.0933161]
WorkElectRatio		0.93704245*** [0.1082517]	0.95104046*** [0.1053884]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	249	249	249
Pseudo-R^2	0.0355	0.0614	0.0624

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 47 – board size regressions for companies without a foreign parent using Poisson

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – Poisson Coeff. [SE]	Model 2 – Poisson Coeff. [SE]	Model 3 – Poisson Coeff. [SE]
Firm specific			
LnEmpl	0.06312233*** [0.0159441]	0.00444162 [0.0152566]	0.00334109 [0.0158783]
EBITDAOverAssets			0.00024649 [0.0007488]
ROA_Avg5	-0.00149003 [0.0011094]	-0.0009609 [0.0010054]	
Gearing	-0.00053957*** [0.0001465]	-0.00035529*** [0.0001314]	-0.00034463*** [0.000128]
ImportWW_dummy			-0.06063674** [0.0268883]
ExportWW_dummy	0.0426983 [0.0282037]	0.00037293 [0.0259148]	
Listed_dummy	0.24544759*** [0.0635984]	0.19530503*** [0.0565526]	0.20194075*** [0.0542705]
CompAge	0.00181679*** [0.0003194]	0.00078284** [0.0003082]	0.00078662** [0.0003209]
NoSegments			-0.01737652 [0.0127298]
NoFrgnSubs			0.01000721*** [0.0031481]
OtherCorpForm_dummy	0.24243231*** [0.0683625]	0.23659969*** [0.071269]	0.23784673*** [0.0706512]
Board specific			
WomenRatio		0.10565587 [0.0869826]	0.10107221 [0.088183]
WorkElectRatio		0.93901255*** [0.0973606]	0.94312034*** [0.0973188]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	828	828	828
Pseudo-R^2	0.0296	0.0556	0.0574

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 48 – board size regression for large-sized companies using Poisson

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – Poisson Coeff. [SE]	Model 2 – Poisson Coeff. [SE]	Model 3 – Poisson Coeff. [SE]
Firm specific			
LnEmpl	0.04382332* [0.025817]	0.00931961 [0.0248205]	0.0071106 [0.0270197]
EBITDAOverAssets			-0.0015642 [0.001277]
ROA_Avg5	-0.002428 [0.0014799]	-0.00146409 [0.0013705]	
Gearing	-0.00025482** [0.0001287]	-0.00017036 [0.0001303]	-0.00016231 [0.0001274]
ImportWW_dummy			-0.06639506 [0.0479386]
ExportWW_dummy	0.01387645 [0.0496833]	-0.0195513 [0.0454486]	
Listed_dummy	0.27383842*** [0.0906084]	0.25791737*** [0.0863525]	0.25173053*** [0.0838347]
CompAge	0.00202869*** [0.000502]	0.00120293** [0.0005245]	0.00105547** [0.0005261]
NoSegments			0.00369122 [0.021225]
NoFrgnSubs			0.00564848* [0.0030678]
FrgnParent_dummy	-0.20892083*** [0.0545456]	-0.19586528*** [0.0516289]	-0.19598688*** [0.0512696]
OtherCorpForm_dummy	0.16038113* [0.0956944]	0.18294828* [0.0969644]	0.17826209* [0.0936525]
Board specific			
WomenRatio		-0.11435328 [0.1312359]	-0.10129462 [0.1310131]
WorkElectRatio		0.74030104*** [0.1491239]	0.74492374*** [0.1509639]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	303	303	303
Pseudo-R^2	0.0515	0.0677	0.0697

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 49 – board size regression for medium-sized companies using Poisson

	Dependent variable:		
	BoardSize		
Independent variables	Model 1 – Poisson Coeff. [SE]	Model 2 – Poisson Coeff. [SE]	Model 3 – Poisson Coeff. [SE]
Firm specific			
LnEmpl	0.04034312* [0.0241697]	-0.01360704 [0.020768]	-0.00757985 [0.0208533]
EBITDAOverAssets			0.00072154 [0.0007263]
ROA_Avg5	-0.00019034 [0.00108]	-0.00024694 [0.0009809]	
Gearing	-0.00263634 [0.0018701]	-0.0016302 [0.0016762]	-0.00090749 [0.0015993]
ImportWW_dummy			-0.0225418 [0.0212939]
ExportWW_dummy	0.02677821 [0.0275099]	-0.00791565 [0.0244935]	
Listed_dummy	0.16470199** [0.0741284]	0.10605798 [0.0690326]	0.12990873** [0.0601233]
CompAge	0.00175847*** [0.0003665]	0.00050372 [0.0003481]	0.00058667* [0.0003509]
NoSegments			-0.02607646** [0.0115937]
NoFrgnSubs			0.01744324** [0.0070326]
FrgnParent_dummy	-0.09059321*** [0.0326557]	-0.15708375*** [0.0269205]	-0.15501093*** [0.0268441]
OtherCorpForm_dummy	0.19074789*** [0.0667189]	0.17904003** [0.0697838]	0.17707239** [0.0689155]
Board specific			
WomenRatio		0.16755241** [0.0800528]	0.18103305** [0.0790531]
WorkElectRatio		1.0015289*** [0.0793767]	1.0104108*** [0.0780506]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	774	774	774
R^2	0.0222	0.0522	0.0536

Note: * p<0.1; ** p<0.05; *** p<0.01

9.4 Appendix 4 – Diversity probit regressions using probit

Table 50 – Women_dummy regression results using probit

	Dependent variable:		
	Women_dummy		
Independent variables	Model 1 – Probit, ML Coeff. [SE]	Model 2 – Probit, ML Coeff. [SE]	Model 3 – Probit, ML Coeff. [SE]
Firm specific			
LnTotBal	0.0704248	-0.00032727	0.00631585
	[0.0437679]	[0.0467025]	[0.0486606]
EBITDAOverAssets			-0.00003214
			[0.0029824]
ROA_Avg5	-0.00003053	0.00048356	
	[0.0033226]	[0.0033577]	
Gearing	-0.01260303**	-0.01384154**	-0.014948**
	[0.0063576]	[0.0060807]	[0.0062164]
ImportWW_dummy			0.0161306
			[0.0992984]
ExportWW_dummy	0.09813032	0.04933196	
	[0.0981547]	[0.1009073]	
Listed_dummy	-0.18839655	-0.44163433	-0.43671265
	[0.3409954]	[0.3392419]	[0.3387864]
CompAge	0.00617889***	0.00375602***	0.00353768***
	[0.001272]	[0.0013443]	[0.0013525]
NoSegments			0.05985216
			[0.0450562]
NoFrgnSubs			-0.01325877
			[0.0143426]
FrgnParent_dummy	0.02104407		
	[0.0994308]		
OtherCorpForm_dummy	0.52065231***	0.45517585***	0.45155042***
	[0.1371945]	[0.1502865]	[0.1508226]
Board specific			
BoardSize		0.17333875***	0.17808446***
		[0.0323603]	[0.0330041]
WorkElectRatio		0.71424611**	0.68890455**
		[0.2942165]	[0.2976369]
ForeignRatio		-0.11414742	-0.11483868
		[0.1388921]	[0.1391613]
Industry specific			
Industry dummies	Yes	Yes	Yes
Selected industries			
Autos	-0.8971895	-1.147672**	-1.114548**
	[0.5483891]	[0.5089718]	[0.518227]
Enrgy	0.9739153*	1.007235**	1.037064**
	[0.5183297]	[0.4847493]	[0.4797678]
FabPr	-0.2565516	-0.4955521**	-0.4807282**
	[0.2036851]	[0.2153701]	[0.218242]
Mach	-0.1808524	-0.3333894*	-0.2949111
	[0.1911758]	[0.1992453]	[0.1928701]
Meals	1.026109***	0.9968712**	0.9578225**
	[0.3854419]	[0.3827451]	[0.3827695]
Rtail	0.5915217***	0.5382618***	0.5033234***
	[0.1766099]	[0.1817407]	[0.1801731]
Trans	0.2933825*	0.181165	0.1866404
	[0.1713412]	[0.172273]	[0.1753571]
Txtls	-0.4797945	-0.9512505*	-0.8408694
	[0.625795]	[0.5635492]	[0.5883401]
Util	1.006262***	0.7538152**	0.7062801**
	[0.3146633]	[0.3187042]	[0.3193209]
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	1065	1065	1065
Pseudo-R^2	0.0740	0.1294	0.1309

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 51 – Worker_dummy regression results using probit

	Dependent variable:		
	Worker_dummy		
Independent variables	Model 1 – Probit, ML Coeff. [SE]	Model 2 – Probit, ML Coeff. [SE]	Model 3 – Probit, ML Coeff. [SE]
Firm specific			
LnEmpl	0.49871094*** [0.0592748]	0.50406342*** [0.0636358]	0.49090508*** [0.0655142]
EBITDAOverAssets			-0.00104318
ROA_Avg5	-0.00317461 [0.0033439]	-0.00365457 [0.0038326]	
Gearing	-0.0250292** [0.0107716]	-0.03257211*** [0.0118555]	-0.03160377*** [0.0118831]
ExportWW_dummy	0.29740034*** [0.0998404]	0.34740793*** [0.1055543]	0.34245759*** [0.1072009]
Listed_dummy	0.84074476** [0.358406]	0.47939957 [0.3747425]	0.50796957 [0.3812008]
CompAge	0.00983117*** [0.0014294]	0.00728426*** [0.001546]	0.00704633*** [0.0015462]
NoSegments			0.05056136 [0.0526624]
NoFrgnSubs			0.00425104 [0.0186113]
FrgnParent_dummy	0.21160952** [0.103211]	0.74091795*** [0.1297163]	0.73652051*** [0.1299413]
OtherCorpForm_dummy	0.09383889 [0.1548373]	-0.41268507* [0.2189589]	-0.42051927* [0.2191234]
Board specific			
BoardSize		0.38715528*** [0.0711154]	0.38894618*** [0.0715442]
WomenRatio		0.63141095** [0.3188467]	0.61504399* [0.3208291]
ForeignRatio		-0.61095344*** [0.1837845]	-0.60482537*** [0.184437]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	1061	1061	1061
Pseudo-R^2	0.2162	0.3994	0.3996

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 52 – Frgn_dummy regression results using probit

	Dependent variable:		
	Frgn_dummy		
Independent variables	Model 1 – Probit, ML Coeff. [SE]	Model 2 – Probit, ML Coeff. [SE]	Model 3 – Probit, ML Coeff. [SE]
Firm specific			
LnTotBal	0.17533388*** [0.0499154]	00.18782889*** [0.0509959]	0.17529064*** [0.0530377]
ROA_Avg5	-0.00413648 [00.0037]	-0.00429727 [0.0036725]	-0.00424201 [0.0036796]
Gearing	0.00033274 [0.0010478]	0.0002031 [0.0010549]	0.00021759 [0.0010537]
ImportWW_dummy			0.06154146 [0.1035143]
ExportWW_dummy	0.06687489 [0.1071322]	0.07193983 [0.1076788]	
Listed_dummy	0.41734374 [0.3277883]	0.44828383 [0.3267727]	0.43977131 [0.3267246]
CompAge	-0.00176355 [0.0014134]	-0.00126526 [0.0014499]	-0.00124094 [0.0014528]
NoSegments			-0.0151196 [0.0493069]
NoFrgnSubs			0.01552594 [0.0159519]
FrgnParent_dummy	10.720993*** [0.1233211]	10.7008818*** [0.1229417]	10.7117767*** [0.1226151]
OtherCorpForm_dummy	0.18211632 [0.1716147]	0.23171094 [0.176903]	0.24590679 [0.1757757]
Board specific			
BoardSize		-0.03847255 [0.0267338]	-0.04037551 [0.0268565]
WomenRatio		-0.24086967 [0.2949303]	-0.2284229 [0.2965051]
WorkElectRatio		0.05060566 [0.3064075]	0.0534229 [0.3081385]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	1066	1066	1066
Pseudo-R^2	0.2416	0.2437	0.2443

Note: * p<0.1; ** p<0.05; *** p<0.01

9.5 Appendix 5 – Diversity Poisson regressions using Poisson

Table 53 – Total number of women on board regression results using Poisson

	Dependent variable:		
	TotWomenBoard		
Independent variables	Model 1 – Poisson Coeff. [SE]	Model 2 – Poisson Coeff. [SE]	Model 3 – Poisson Coeff. [SE]
Firm specific			
LnTotBal	0.03311018	-0.02509445	-0.01582293
	[0.0418422]	[0.0436707]	[0.044241]
EBITDAOverAssets			0.00080503
			[0.0030017]
ROA_Avg5	0.00010299	0.00168258	
	[0.0033166]	[0.0034755]	
Gearing	-0.01237398	-0.01072058*	-0.0116473*
	[0.0090052]	[0.0059939]	[0.006427]
ImportWW_dummy			-0.00667338
			[0.098113]
ExportWW_dummy	-0.0310405	-0.02738575	
	[0.0997435]	[0.1018669]	
Listed_dummy	-0.26731708	-0.40740401	-0.40356323
	[0.3690209]	[0.3501401]	[0.3516129]
CompAge	0.00627381***	0.00356502***	0.00347342***
	[0.000917]	[0.0009822]	[0.0009935]
NoSegments			0.0447377
			[0.0406589]
NoFrgnSubs			-0.01453567
			[0.0118941]
FrgnParent_dummy	-0.06506444		
	[0.1057268]		
OtherCorpForm_dummy	0.55090481***	0.36894135***	0.35700479***
	[0.1139176]	[0.1200477]	[0.1215482]
Board specific			
BoardSize		0.1447042***	0.14719954***
		[0.017427]	[0.01755]
WorkElectRatio		0.97514789***	0.93926323***
		[0.2823836]	[0.2823816]
ForeignRatio		-0.25325242*	-0.25366184*
		[0.1491004]	[0.1487114]
Industry specific			
Industry dummies	Yes	Yes	Yes
Selected industries			
Aero	-14.54885***	-15.41069***	-14.39311***
	[0.7222636]	[0.0436707]	[0.7207877]
Books	0.7321408**	0.3501061	0.36141
	[0.330556]	[0.3519006]	[0.357146]
BusSv	0.3001149*	0.0611773	0.0776826
	[0.1597762]	[0.1569856]	[0.1630829]
Clths	1.610885***	1.738654***	1.89188***
	[0.1260424]	[0.1306584]	[0.1625716]
Comps	1.125012***	0.5939815***	0.598747***
	[0.1455985]	[0.1498058]	[0.1507223]
Enrgy	0.89253501***	0.7554857***	0.7687365***
	[0.2984013]	[0.2102351]	[0.2257794]
FabPr	-0.3620334	-0.5712832**	-0.5803515**
	[0.2614217]	[0.2630851]	[0.2638621]
Guns	1.076001***	1.487466***	1.51202
	[0.1255518]	[0.1538528]	[0.1590246]
Hlth	1.078531	1.261828*	1.285571
	[0.7193013]	[0.7428455]	[0.7401559]
Meals	1.134983***	1.031188***	1.018486***
	[0.3142218]	[0.1976533]	[0.2001288]
Mines	-14.85422***	-15.12773***	-14.12363***
	0.5911361	[0.6165354]	[0.6137945]
Rtail	0.7260289***	0.6614577***	0.6486701***
	[0.1507728]	[0.1432672]	[0.1420386]
Smoke	-14.47012***	-15.58716***	-14.57624***
	[1.010117]	1.012073	[1.011588]
Soda	-14.66214***	-15.05249***	-14.11019***
	[0.7256921]	[0.7251374]	[0.726755]
Toys	0.4742293**	0.3233626	0.204899
	[0.2170353]	[0.2167574]	[0.2392164]
Trans	0.3467735*	0.2615176	0.2640668
	[0.1895194]	[0.173335]	[0.1769089]
Util	0.9763606***	0.6536382***	0.6150248***
	[0.2300873]	[0.2138517]	[0.2178444]
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	1077	1077	1077
Pseudo-R^2	0.0788	0.1304	0.1313

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 54 – Total number of workers on board regression results using Poisson

	Dependent variable:		
	NoWorkElecReps		
Independent variables	Model 1 – Poisson Coeff. [SE]	Model 2 – Poisson Coeff. [SE]	Model 3 – Poisson Coeff. [SE]
Firm specific			
LnEmpl	0.38330778*** [0.0410083]	0.330014*** [0.0375207]	0.32876877*** [0.0403317]
EBITDAOverAssets			-0.00112657
ROA_Avg5	-0.00339893 [0.0028676]	-0.00306102 [0.0028665]	
Gearing	-0.02564621** [0.0122312]	-0.02431805*** [0.0087564]	-0.02441472*** [0.0087365]
ExportWW_dummy	0.17079292** [0.0811049]	0.22520848*** [0.0766799]	0.23649712*** [0.0773091]
Listed_dummy	0.51481466** [0.213598]	0.37118038* [0.1906984]	0.38544558** [0.188496]
CompAge	0.0067164*** [0.0008348]	0.00404273*** [0.0008191]	0.00397591*** [0.0008315]
NoSegments			0.01615135 [0.0335096]
NoFrgnSubs			-0.00730767 [0.0066398]
FrgnParent_dummy	0.1135202 [0.0844693]	0.52308039*** [0.0939345]	0.5164513*** [0.0943921]
OtherCorpForm_dummy	-0.11202733 [0.1518532]	-0.5287353** [0.231435]	-0.5331498** [0.2327479]
Board specific			
BoardSize		0.24974013*** [0.0263388]	0.25115675*** [0.0267079]
WomenRatio		0.68096545*** [0.2446108]	0.66514027*** [0.2462962]
ForeignRatio		-0.58917963*** [0.1550695]	-0.58087938*** [0.1560894]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	1077	1077	1077
Pseudo-R^2	0.1352	0.2512	0.2512

Note: * p<0.1; ** p<0.05; *** p<0.01

Table 55 – Total number of foreigners on board regression results using Poisson

	Dependent variable:		
	TotForeignBoard		
Independent variables	Model 1 – Poisson Coeff. [SE]	Model 2 – Poisson Coeff. [SE]	Model 3 – Poisson Coeff. [SE]
Firm specific			
LnTotBal	0.17729404*** [0.0393108]	0.16300683*** [0.038444]	0.169526*** [0.0396117]
ROA_Avg5	-0.00342788 [0.0027471]	-0.00308814 [0.0027637]	-0.0032104 [0.0027404]
Gearing	0.00096482 [0.0009669]	0.00096394 [0.0009755]	0.0009224 [0.0009669]
ImportWW_dummy			0.07961208 [0.0840842]
ExportWW_dummy	0.07132218 [0.0886307]	0.07877816 [0.0876508]	
Listed_dummy	0.66997151** [0.3080379]	0.58714491** [0.29538]	0.57970495** [0.2910945]
CompAge	-0.00132778 [0.0013278]	-0.00156219 [0.0013518]	-0.00126735 [0.0013287]
NoSegments			-0.06663263* [0.0393474]
NoFrgnSubs			0.00160397 [0.0123836]
FrgnParent_dummy	1.1644983*** [0.0790074]	1.2195788*** [0.0791605]	1.2270841*** [0.0793813]
OtherCorpForm_dummy	0.19157327 [0.1256729]	0.16377977 [0.119822]	0.17691299 [0.1193832]
Board specific			
BoardSize		0.06789477** [0.0269901]	0.06481848** [0.0268998]
WomenRatio		-0.39719603 [0.243875]	-0.38349738 [0.2434459]
WorkElectRatio		-0.24180131 [0.2479563]	-0.20640359 [0.2470691]
Industry specific			
Industry dummies	Yes	Yes	Yes
Adjustments to data			
Companies without a board	Excl	Excl	Excl
Robust standard errors	Yes	Yes	Yes
Intercept included	Yes	Yes	Yes
Summary statistics			
Number of observations	1077	1077	1077
Pseudo-R^2	0.1630	0.1678	0.1690

Note: * p<0.1; ** p<0.05; *** p<0.01