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The Relationship Between CEO Power and Compensation

An Empirical Analysis of Norwegian Listed Firms

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Industrial Economics and Technology Management
Submission date: August 2016
Supervisor: Einar Belsom, IØT

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Preface

This paper is written as a pre project to an ending work of a master degree program at the Norwegian University of Science and Technology (NTNU), Department of Industrial Economics and Technology Management, Trondheim. The project has given me insight into diverse and interesting fields like quantitative methods in finance, sociology, corporate governance, law and social network analysis. It has been very challenging, but for the most part rewarding to learn about the topics.

I would like to thank Associate Professor Einar Belsom at Department of Industrial Economics and Technology Management at NTNU for excellent counseling. Furthermore, I would also like to thank Jeanett Bergan from KLP and Henrik Hagen and Henrik von Krogh Weltz for sharing the data from their papers.

I alone am responsible for the content of this paper and any errors.

August 2016, Trondheim

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Magnus Lund Melsom

Abstract

By using general estimation equations (GEE) on a sample of the biggest firms on Oslo Stock Exchange, the managerial power hypothesis is tested in a Norwegian context. The sample spans over 5 years and consist of 112 complete observations.

One of the measures of managerial power is using social network theory where the extent of the CEO's social network is represented by measures of the degree of connections through board positions. These measures are called centrality measures. The focus of the thesis is to evaluate whether there is a significant positive relationship between centrality and executive compensation, and whether there is a significant relationship between managerial power and executive compensation.

Only one of the centrality measures is found to be significantly, but the variable is negatively correlated with pay, and there is a concern that the variable capture a different effect than it was supposed to. Hence, there is not enough evidence to support that there is a positive relationship between connectedness and executive pay. Furthermore, some of proxies for managerial power were found to be significant, while others were not. Hence, the conclusion is that the influence of managerial power may be important and should be taken into account when explaining executive pay and designing compensation packages. However, the theory should be used as a supplement to existing models like agency theory, as the managerial power hypothesis can't fully explain all aspects of executive compensation.

The thesis acts as a platform for further research on managerial power as well as social network analysis. The results in this thesis can't be generalized outside the Norwegian context due to limited sample.

Sammendrag

Ledelsesmakthypotesen er testet i en norsk kontekst ved å bruke generelle estimeringsligninger (GEE) på et utvalg av de største bedriftene på Oslo Børs. Perioden strekker seg over 5 år og består av 112 komplette observasjoner. Ett av målene for ledelsesmakt benytter seg av sosial nettverksanalyse for å finne ut størrelsen av nettverket til daglige ledere ved å måle graden av kontaktflate gjennom styreverv. Disse målene kalles sentralitetsmål. Fokuset i oppgaven er å vurdere hvorvidt det er en signifikant positiv sammenheng mellom sentralitetsmål og lederlønninger, og om det er en signifikant sammenheng mellom ledelsesmakt og lederlønninger.

Kun ett av sentralitetsmålene ble vurdert til å være signifikante, men variabelen har en negativt sammenheng med lederlønn, og det er en bekymring hvorvidt variabelen fanger en annen effekt enn det skulle. Derfor er det ikke nok bevis til å støtte at det er en positiv sammenheng mellom sentralitetsmål og lederlønninger. Videre ble noen av målene for ledelsesmakt funnet å være signifikante, mens andre ikke var det. Anbefalingen er at påvirkning av ledelsesmakt kan være viktig og bør derfor tas i betraktning når forklare lederlønninger og designer lønnspakker. Imidlertid bør teorien brukes som et supplement til eksisterende modeller som agentteori, ettersom ledelsesmakthypotesen ikke kan forklare alle aspekter ved lederlønninger.

Avhandlingen fungerer som en plattform for videre forskning på ledelses makt, så vel som sosial nettverksanalyse. Resultatene i denne avhandlingen kan ikke generaliseres utenfor norsk sammenheng på grunn av begrenset utvalg.

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INTRODUCTION

Executive compensation attracts a lot of attention in media as well as in academia. An example is Helge Lund's arrival as BG Group's new CEO. His increased pay has been heavily discussed in British and Norwegian media (Fredriksen, Lorentzen, & Sundberg, 2014). Many theories can explain the salary leap; among these is the managerial power approach (Bebchuk et al 2002). Furtermore, after a public outrage, his stock bonus was cut in half (Nissen-Meyer and Lorentzen, 2014). This reaction from the shareholders is also consistent with the theory.

Ever since Berle and Means (1932), later expanded upon by Jensen and Meckling (1976), noted that the separation of corporate ownership from corporate control contribute to a principal-agent problem, agency theory has been a concern. Agency theory, optimal contracting approach, dictates that the board of directors, elected by one or more principals (shareholders), seeks to maximize shareholder value by providing the agent (CEO) with cost-effective incentives. The agent on the other hand seeks to maximize his or her profit, and thus a conflict of interests arises. To align the incentives of the manager and shareholder, linking firm performance to executive compensation is suggested. Hence options and stocks are often granted, to encourage CEOs to create firm value.

However, according to Bebchuk et al (2002) the compensation packages are not properly designed to ensure incentives are perfectly aligned. When granted stocks or stock options, CEOs are also rewarded for stock price rises that are due to industry or general marked trends - i.e. unrelated to his or her performance (Bebchuk and Fried 2003). Bognanno (2014) illustrate this by claiming that the average US CEO loses about one-quarter less from bad luck than they gain from good luck. Moreover, options are only exposed to upside risk, giving the manager incentive to gamble considering they don't lose more money whether the options are a little or deep out of the money. As a consequence of the extensive adoption of granting stock options, the median compensation of S&P 500 CEOs increased by approximately 150 percent from 1992 to 1998, where option-based compensation constituted the largest share of the growth (Perry and Zenner, 2000) .

According to the managerial power approach, the powerful CEOs, when certain conditions are met, can influence their own pay subject almost exclusively to an outrage constraint – that is avoiding public outrage and the ability to camouflage the excessive pay. The pay is also often less performance sensitive, thus leading to suboptimal incentives that may hurt shareholder value even more (Bebchuk et al 2002 ; Bebchuk and Fired 2003, 2013). The managerial power approach differs from other common theories that dictate that CEOs are paid what they deserve relatively to peers, as a result of a competitive market for managerial talent or other factors.

Purpose, research questions and hypotheses

The discussion regarding excessive CEO pay raises important questions that are to be investigated. A majority of the researches on managerial power have been done in the US, and even though it may be present there, it may not be present in Norway.

The purpose of this paper is to advance the literature on managerial power by evaluating whether managerial power is present in a Norwegian context. In order to properly evaluate the hypothesis, a panel data model based on recommended data and variables discussed in this paper is presented. The model can be expanded upon and utilized to include more data, variables or even more advanced methodology if needed, but is initially assumed to adequately evaluate the theory based on data that are easily available and not too time consuming to collect.

A comprehensive literature review is required in order to identify and discuss various data that can be used to measure managerial power. The literature review provides insight into the theoretical foundation of managerial power and other theories regarding executive compensation, as well as literature that can indicate whether findings in Norway consistent with other literature.

The thesis is meant to investigate the following research questions:

1 *How does the connectedness of CEOs influence their pay?*
2. *Can CEOs influence their pay by the use of power?*

The research questions can be answered by the following hypotheses:
$H_{0,1}$*: Measures of connectedness have no significant impact on executive compensation.*
$H_{1,1}$*: At least one of the measures of connectedness have a significant impact on executive compensation in the direction proposed by managerial power hypothesis.*

$H_{0,2}$*: Proxies for the power have no significant effect on executive compensation.*
$H_{1,2}$*: At least one of the proxies for the power have a significant effect on executive compensation in the direction proposed by managerial power hypothesis.*

The main contribution of this thesis is providing insights on the presence of managerial power in Norway, both theoretical and empirically. Social network analysis is also used, and introduces several topics for further research.

This paper differs from previous literature on managerial power approach by presenting a more comprehensive way to properly measure and examine the managerial power theory based on available or recommended data. For instance, the unusual and powerful methodology social network analysis (SNA) is utilized. SNA not only captures the number of social ties, but also the underlying structure of a social network, and thus the potential to exert power. Capturing the underlying structure is usually ignored in previous literature, and will provide new insights and a more compressive analysis. Another advantage

with SNA is that once the networks are constructed, calculating measures of connectedness and other indicators of power are just a button press away in commercial software. Hence, adopting new SNA measures are easy to add to the analysis as long as they are implemented in the commercial software and the network already is constructed. Lastly, this paper also stands out by investigating the possible presence of managerial power in Norway. The Norwegian culture and political landscape (i.e. laws and regulations) dictate that the effect of managerial power should differ from the US and other countries, but it may still be present.

The panel data model measures managerial power by using board characteristics, ownership, CEO characteristics and social network analysis on Norwegian board of directors. These variables, as well as important control variables as firm size and industry, are implemented in the model and in relation to executive compensation that consists of basic pay, bonuses, option and stock grants and pension provisions. Several potentially important variables were excluded due to data possibly being too time consuming to collect or not available at all.

Delimitations and assumptions

As the framework of this thesis must be kept within reasonable limits and in order to avoid scope creep, most of the papers presented in this paper are published prior to 2013. Some of the newer research might even be more advanced, or even disprove some of the methods and approaches utilized in this paper, but that can't be accounted for without compromising the already wide scope of this thesis.

This thesis is an extension of the research gathered in Melsom (2015), although the proxies proposed is different due data availability. Furthermore, generalized estimations equations (GEE) is used instead of ordinary least squares (OLS). As the paper may not be available to the reader, important topics from the paper are enclosed in the appendix.

This paper only seeks to address whether there is a association between CEO compensation and power, and propose explanations to why this relationship does or does not exist. Most papers on executive compensation (e.g. Bebchuk et al, 2002; Bebchuk and Fried, 2013; Murphy 2012, Randøy and Skalpe, 2010) suggest how to address some of the issues in the executive compensation landscape. This part of the discussion isn't regarded as important in order to test the managerial power hypothesis and is thus omitted from this thesis. Moreover, the thesis will not try to convince the reader what is regarded as overpaid, as the term is highly subjective, but rather identify whether power and other factors influence compensation. Furthermore, the reader is assumed to be familiar with the basic theory regarding equity based pay (e.g. options), regression analysis and social network analysis. The latter topic is covered in the enclosed appendix, but the very basic should still be known to the reader to fully understand the enclosed information.

Lastly, the board of directors has the overall responsibility for determining the size and shape of the compensation packages of the company's top management - even if they choose to utilize compensation committees. Hence, CEOs are assumed to be able to influence their pay schemes even though compensation committees are utilized. Moreover, the CEO is assumed to form ties with all of the board members in their own firm, as the board also serves as a counsel.

Structure

The structure of this paper is as follows: First a literature review of the managerial power hypothesis. This chapter investigates empirical and theoretical literature related to managerial power, in which the latter parts are more focused on Norway. The next chapter presents the methodology and data used in the empirical analysis. This section also requires knowledge regarding power, proxies for power and social network analysis which are enclosed in the appendix. Next follows the empirical analysis in which the results are presented and discussed, as well as robustness test. The last chapter concludes the results of the thesis. The chapter also includes a section regarding weaknesses of the study, as well as suggested topics for further research related to evaluating the managerial hypothesis.

1.0 LITTERATURE REVIEW

The fields of executive compensation and corporate governance are immense, and the managerial power approach is only one of many theories. This chapter addresses relevant theories and literature regarding executive compensation and the managerial power approach, as presented by Bebchuk et al (2002) and Bebchuk and Fried (2003, 2013). Due to the vast amount of available research on the complex subjects, this chapter is only meant to provide an overview of the issues related to executive compensation and managerial power. The main purpose of the chapter is to identify variables that can influence executive compensation - not to argue which theory is more correct.

The first part of this chapter looks at managerial power and executive compensation from a more general and global perspective, the latter part of this chapter focuses on managerial power in other countries than the US. This part fixates mostly on Norway, as this is the country that is to be investigated. Norwegian literature concerning executive pay, managerial power and indicators of how present it may be in Norway are also presented here. Government intervention into executive pay and cultural differences between the two countries are among such indicators.

1.1 Managerial power

The term managerial power in the context of extracting excess pay have been introduced by papers like Lambert and Allen (1981) and Lambert et al. (1993), but didn't gather much public attention until Bebchuk et al. (2002) and Bebchuk and Fried (2004) published their views on the subject. In fact, their work are among the most heavily cited in the field of economics and law (Winter and Michels, 2012). Bebchuk et al (2002) describe managerial power as:

"[…] how managers with power use their power to influence the level and structure of their pay, and that managers with more power can be expected to do so to a greater extent. Managers with power are able to extract "rents"—value in excess of that which they would receive under optimal contracting—and managers with more power can extract more rents." (Bebchuk, et al., 2002 p. 783)

Flaws in the current compensation arrangements are exploited by managers. The arrangements distort incentives and create forces that lead directors to favor the CEO, and thus justifying their actions as long as the arrangements are consistent with current practices. Hence, the authors mainly criticize the system - not necessarily the managers and directors, as the system encourage such behavior. (Bebchuk and Fried 2013) The excess CEOs pay not only cost shareholders, but also weakens and distorts the managers' incentives by being less performance driven, which may impose an even greater cost on shareholder value. The way most compensation packages are designed doesn't ensure that the CEOs incentives are perfectly aligned with the shareholders' interests. The managerial power hypothesis can fully explain aspects of pay practices that long have been regarded as puzzling.

One last aspect of the theory, which often is incorrectly ignored by critics, is that the managerial power hypothesis is not proposed as a complete replacement for the optimal contracting approach:

"While the managerial power approach suggests that managers with more power are paid more, all else being equal, it does not suggest that more power is the only reason why some managers are paid more than others (Bebchuk et al, 2002, p. 91)."

Hence, compensation arrangements are shaped both by managerial power and by what would be optimal. However, the managerial power approach needs to be taken into account in order to fully understand the compensation practices. The main concern of the authors is not the high pay levels, as high absolute levels don't by themselves imply flaws in the negotiation process. The issue is rather the relationship between power and pay, compensation practices that obscure the amount and performance sensitivity of pay, and departing executives being awarded with golden parachutes (Bebchuk and Fried, 2004).

1.1.1 Outrage and camouflage

According to the managerial power hypothesis, the most limiting factor to extracting rent is outrage and the ability to camouflage them. The authors also argue that market constraints and the social costs coming from extracting rents are not sufficient in preventing deviations from optimal contracting.

Outrage is described as:

"'[…] the criticism of outsiders whose views matter most to [the directors of the board or the CEO] — institutional investors, business media, and the social and professional groups to which directors and managers belong" (Bebchuk and Fried, 2004 p.66)

The introductory example with Helge Lund illustrates what may arise when outrage occurs, and why the board of directors strives to avoid it. The directors, as well as the CEO, are concerned about the social and reputational costs if outrage occurs, and thus how outsiders might view the contract is the most important factor. That is why camouflage plays an important role. By hiding, packaging or dressing rent, i.e. camouflaging, the outrage, and thus outrage costs, is minimized. The more justified a package appears, the more rent managers will be able to extract without facing outrage. Examples of rents that are less observable (can be camouflaged) or more difficult to value are: Stock options, perquisites, pensions and severance pay. Compensation consultants (compensation committees) are used strategically to justify executive compensation to outsiders.

1.1.2 Agency theory

Berle and Means (1932) presented the problems that arise when there is a separation of ownership and control. In order to survive in the competitive business environment, small private firms need to grow beyond the financial capability of a single owner. To raise funds for the expansion of business operations, going public is a commonly preferred option due to being efficient and cost-effective. This leads to the tendency where big corporations have multiple owners or shareholders. These owners are regarded as the

principals when they enter into a contract with executives or managers to run the firm on their behalf. The agent is morally obligated to work towards maximum returns for the principals. However, the delegation of power may provide the manager with an opportunity for opportunistic behavior, and thus give rise to a principal-agent-problem.

Jensen and Meckling (1976) build upon the agency problem. The separation of ownership and management causes an information asymmetry between the agent and the principal(s). Firstly the principal must monitor the agent in order to evaluate the effort dedicated to his or her tasks. The agent on the other hand, knows this information and may not want to share it. Perfectly monitoring the agent is difficult, and the average shareholders in a dispersed ownership are likely to succumb to an ignorance incentive. This means that the investment of time and effort that is necessary to make informed voting decisions is rarely profitable. Hence, the shareholders rarely know the best course of action and effort levels of the CEO are usually cloaked. This latter is referred to as moral hazard, and may allow CEOs to make decisions that benefit themselves rather than the shareholders. Secondly, when constructing the contract of the CEO, the shareholders are unable to perfectly evaluate how much value (through ability and effort) the CEO will add to the firm. Also, when hired, the shareholders can rarely observe how good the CEO performs, and thus they have to measure the performance is some way.

A board of director is often hired by the shareholders. The board of directors acts on the behalf of the shareholders in order to monitor the CEO and to design a cost-effective incentive package that maximizes the shareholders' profit. To maximize the shareholder value, aligning the incentives of the principal and agent is essential. By granting the executive an ownership stake in the firm, equity linked compensation creates incentives to take actions that benefit shareholders. This performance measure is also a way to monitor the CEO. Costs that derive from the agency problem (e.g. monitoring the CEO or loss from decisions made by the CEO that is not in the best interest of the shareholders) are referred to as agency costs. Paradoxically, a board that is too focused on monitoring the executives and minimizing the agency costs can lead to worse performance. By not fully utilizing the directors' resources, time and energy on other value adding activities like providing advice and counseling, the firm risk losing value (Huse, 2006).

Another consideration is that the manager is a more risk averse agent, assuming they are unable to diversify their employment. Therefore the managers prefer fixed compensation over equity-based compensation. Principals on the other hand, are capable of diversifying their investments, and thus more risk neutral (Eisenhart 1989). When granted stocks and options, the risk averse manager expects increased compensation in order to compensate for the exposure to risk. Fixed pay, however, doesn't align the incentives of the managers and shareholders, and thus equity based compensation with a risk premium was preferred by the directors and shareholders. In the perspective of managerial power, this practice camouflages pay schemes that causes excessive pay (Bebchuk et al 2002).

The adoption of incentive based salary exploded in the US during the 1980's and 90's (Randoey and Skalpe, 2010). Jensen and Murphy (1990a,b) justified the increased adoption of options by arguing that granting equity based compensation would reduce the agency cost and provide more value to shareholders. However, given the rapidly growing economy in the U.S., the total executive pay skyrocketed as a consequence of excessive use of options. The same authors have later emphasized that there are several flaws in such option practices and other common pay practices (Jensen, Murphy and Wruck, 2004).

There were several factors contributing to this shift. Murphy (2012) claims that the effects of government intervention into executive pay (e.g. disclosure requirements and tax policies) are largely ignored by researchers, and have been both a response to and a major driver of time trends in CEO pay. Furthermore, the author claims that the CEO pay is influenced by political responses to perceived (or actual) abuses in pay. He identifies six main factors that he believes contributed to the explosion of stock options. One of these factors was the Omnibus Budget Reconciliation Act of 1993 (OBRA). The act *"[…] eliminated deductibility for executive compensation in excess of $1 million unless it qualified as "performance-based" pay"* (Rose and Wolfram, 2002). This lead to a drastic shift to more performance based pay like options.

1.1.3 Optimal Contracting Approach

Agency theory is highly related to what Bebchuk et al (2002) call the optimal contracting approach, which is the commonly viewed pay setting practice:

"Under the optimal contracting approach, the board designs compensation arrangements exclusively for the purpose of alleviating the agency problem between shareholders and executives. In contrast, under the managerial power approach part of the agency problem is that executives use their compensation to provide themselves with rents. (Bebchuk et al, 2002, p. 784)"

Hence, the premise of optimal contracting is claimed to be flawed, as the board of directors and compensation package fail to properly monitor the CEO, and the compensation package presented to the CEO deviate from what is predicted from the optimal contracting approach. The design of the contract serves as the practical basis for legal rules and public policy to justify the pay arrangements to shareholders, policymakers and public courts (Bebchuk and Fried 2013).

1.1.4 The Limitations of Optimal Contracting Approach

This subsection, primarily based on arguments by Bebchuk et al (2002), presents factors undermining boards' ability to engage properly in arm's length bargaining, and thus the assumptions of optimal contracting. This deviation from optimal contracting is manifested in the compensation schemes, as incentives provided by the pay package encourage CEOs to behave opportunistic.

CEO influencing the board of directors

Bebchuk et al (2002) goes into great detail explaining the various factors undermining boards' ability to engage properly in arm's length bargaining. Firstly, they suggest that the directors are not exclusively

serving the shareholders' interests. In fact, the directors are also subject to an agency problem, as the shareholder can't properly monitor the board of directors. The bargaining process is influenced by factor like the CEO's control over director appointment (interdependent directors), directors' insufficient and distorted economic incentives (e.g. directors may lose their position or compromise their reputation if they oppose the CEO) and informational barriers. Furthermore, factors that positively influence the group dynamics in favor of the CEO are collegiality, team spirit, conflict avoidance, friendship, loyalty and cognitive dissonance among directors that are CEOs in other companies (Bebchuk and Fried, 2013). Lastly, the shareholders, due to the dispersed ownership, don't possess sufficient power or have enough incentives to vote down a pay package. These factors together are so strong, that even with the increasing trend with more independent directors, managerial power may still be present:

"Even in those firms where a majority of the directors are sufficiently "independent" to fire the CEO in the event of dismal performance, the directors will generally not have an economic incentive and sufficient information to attempt to negotiate down the compensation of a CEO who is performing sufficiently well not to be fired. Such a CEO is likely to stay in his position for some time, and thus could retaliate against a director who sought to limit his compensation." (Bebchuk et al, 2002 p. 774)

Incentives encourage opportunistic behavior

Bebchuk et al (2002) suggest that the compensation package deviate from optimal contracting because it fails to provide the CEO with proper incentives. The excess CEOs pay not only cost shareholders, but also weakens and distorts the managers' incentives by being less performance driven, which may impose an even greater cost on shareholder value. When stocks or stock options are granted, CEOs are rewarded for stock price rises that are due to industry or general marked trends - i.e. almost completely unrelated to their performance. Consequently, Bebchuk et al (2002) refer to such options as windfall options. Another problem is the opposite scenario: Even if the CEO performance is perfect, other factors outside the manager's control can still prevent him or her from being rewarded. An option that filters general market or industry effect, a reduced windfall options, is suggested as a better solution. However, conventional options are considered legitimate by the public, and thus the powerful manager can, according to the theory, extract less performance sensitive rents without causing outrage.

Providing incentives for risk adverse executives to take more risk can be viewed as beneficial for the risk neutral shareholders. The problem is that options encourage too much risk taking. Managers are only exposed to upside risk when granted at-the-money options, giving them incentive to increase, or even maximize the risk, in order to increase the potential gain. For the options holder, there is a limited downside, as there is no difference in intrinsic value whether options are marginally out-of-the-money or deep out-of-the-money – the options still have no intrinsic value. Hence, a decrease in marked value isn't punished, but an increase in market value is rewarded. However, the difference between the two scenarios is drastic for shareholders who suffer from loss in the market value.

The managerial power theory can also explain features and practices that optimal contracting approach fail to do, like a near uniform use of at-the-money options and the freedom to unwind incentives (e.g. resetting the exercise price) and to choose the time of unwinding. The idea behind such practices is that incentives are necessary in order motivate and retain the manager when the stock price falls to levels that make existing options far out-of-the-money. The problem is when options only are reset when the stock price falls – not the opposite when the market rises – and thus managers can be rewarded for falling stock prices: *"Indeed, if executives anticipate that the exercise price will be reset if the stock price falls, they might have an incentive to take steps to reduce the share price in the short run in order to lower the exercise price."* (Bebchuk et al, 2002, p. 822). The pay schemes encouraged CEOs to pursue short-run stock prices at the expense of long-run value.

1.1.5 Power sources

Bebchuk et al. (2002) state that the following 5 factors are sources of power:

"Other things being equal, managers would tend to have more power when (a) the managers are protected by antitakeover arrangements, (b) the board is relatively weak or ineffectual, (c) the managers have a large ownership stake, (d) there are fewer institutional shareholders, or (e) there is no large outside shareholder" (p. 837)

These sources of power can be split into two categories: Strengthened CEO position or weakened director position. The authors refer to studies which find that larger board, older outside directors, directors that serve on at least five boards, tenure and CEO duality weaken or make the board ineffectual. Moreover, the ownership of the board is negatively related to the CEO pay. Bebchuk and Friend (2013) suggest that institutions with no other business relationship with the firm are more resistant to management pressure, due to having no other concerns than the firm's share value. Lastly, the threshold for being considered as a large outside shareholder is suggested to be at a 5% ownership-level. All these factors need to be addressed when testing the managerial power theory.

1.2 Aspects of managerial power that have attracted discussion

Being a controversial theory, the managerial power hypothesis has attracted a lot of attention in academia. This chapter presents some areas that have been discussed, mostly criticized, by other researchers and economists.

1.2.1 Can't fully explain executive compensation since the 1970's

The managerial power theory struggles to fully explain the steady increase in CEO pay since the 1970s (Frydman and Jenter, 2010), especially when considering that indicators show an increase in corporate governance over the same period. Explaining the development of CEO compensation during the 1990's is the component that attracts most critics (Winter and Michels, 2012). Murphy (2012) argues that over this decade executive pay was heavily increased, whereas boards became more independent and

compensation disclosure rules tighter. Hence the managerial power and therefore pay should have decreased according to the managerial power theory. However, Winter and Michels (2012) claim that as long as there is no clear cut measure of power, the question of whether managerial power increased or decreased over the 1990's remains open.

Bebchuk and Friend (2004) defend the managerial power theory by claiming that other factors may have offset the changes in board composition and compensation disclosure. They suggest that increased antitakeover defense, and thus decreasing the threat of hostile takeover, could be an important factor. Moreover, good firm performance during this decade combined with increased use of equity based pay led to favorable compensation arrangements for managers. Lastly, as mentioned in subchapter 1.1, managerial power isn't the only explanation for executive compensation. Moreover, the CEO power isn't always exerted, and some have more power than others.

1.2.2 Compensation levels are justified by performance

The increased firm performance may offset the excessive pay, as executive compensation usually makes up only a small fraction of the total revenue/cost (Randoey and Skalpe, 2010). From the perspective of the company, the consequences of overpaying the new CEO may be limited compared to selecting the wrong CEO. Furthermore, turmoil when hiring a new CEO could decrease the stock price, which is usually way more costly to the firm than the monetary value of excessive CEO pay. If the appointment of the new CEO is received as positive news by outsiders, the increased stock price as a result of the news may also offset any excessive pay. Gabaix and Landier (2008) claim that in an efficient contracting framework, CEOs are worth what they are paid. Kay and Van Putten (2007) support this by claiming that executive compensation follows a well-executed pay-for-performance model. Moreover, Holmstrom and Kaplan (2003) state that despite corporate scandals in the US, the economy is robust and has performed well on an absolute basis and relatively to most other countries. Hence the corporate governance system, executive pay included, is working well and is not hurting shareholders as bad as suggested by the managerial power hypothesis. There are also numerous papers claiming that a manager is more focused on company performance when stock-based compensation is involved (e.g. Hall and Liebman, 2003; Mehran ,1995). Jensen and Murphy (1990a,b) argue that shareholders should focus much more about providing managers with sufficient incentives than about the amounts spent on executive pay. However, Jensen et. al. (2004), after reviewing the consequences of extensive adoption of issuing options, suggested that the use of different bonuses must be limited, and that incentive based salary requires directors with competence in order to properly evaluate the costs.

One the other side, there are several examples that contradict the notion that the CEOs are paid what they deserve. For instance, huge payouts are rewarded to CEOs despite substantial loss (Markedwired, 2007) or large payout after being fired (e.g. Fortune, 2011…). While these examples fortunately aren't the norm, and should be considered as exceptions, a properly working governance system wouldn't allow for these harmful instances to happen in the first place. Bebchuk & Grinstein (2005) claim that the US growth in

CEO pay in the period 1993-2003 has been much greater than what can be explained by the growth in the companies' market or industry. This claim is supported by Bogle (2008), who investigated pay and performance from 1980 to 2004. He found that the increase in CEO pay was almost three times greater than the value growth of corporations the CEOs ran. Additionally, Mishel and Sabadish (2012) claim that the nominal CEO compensation grew substantially faster than stock market growth from 1978 to 2011. Moreover, Randøy and Skalpe (2011) argue that after the financial crisis, criticisms of incentive wages have become more extensive. The agency problem equity-based pay was intended to solve, would in many cases grow with the increased scope of various bonus systems.

1.2.3 Measuring managerial power and empirical foundation

Winter and Michels' (2012) striking arguments towards the managerial power hypothesis can't be overlooked. The authors argue that when considering managerial power, not only power needs to be measured, but also the amount of power exerted and the amount of pay a CEO possibly can extract due to the firm's economic constraints. The latter factor, while important, can be estimated. How much power the CEO has exerted is, however, very difficult to measure, and no empirical literature is yet to consider this factor. Thus, they claim that *"the existence of a relation between power and pay has not and cannot be established empirically,"* (Winter and Michels 2012, p. 2). The authors also criticize Bebchuk et al (2002) for not sufficiently defining the term "power", and that the proponents of managerial power interpret research on the subject incorrectly – especially when the results on empirical studies on managerial power do not show the expected effect on pay.

Even though the theory is difficult to properly prove or disprove in a quantitative study, the shortcomings doesn't verify that the theory, or at least the major parts of the theory, are wrong. Even a few instances of severe rent extractions are still a few instances too many. The managerial power hypothesis raises concern over corporate governance practices that can give rise to lackluster performance and destruction of shareholder wealth, and thus should be investigated thoroughly – not discarded because the theory has some weaknesses.

Having said that, the other arguments presented by Winter and Michels (2012) are more valid, and highlight some of the major weaknesses of the approach. Bebchuk et al (2002) should properly define power. The authors devote a whole subchapter to what makes a CEO more powerful, but fail to indicate the influence of common sources for power like charisma and human capital (i.e. the skills and abilities that an individual possess, e.g. education). As there are so many factors contributing to how much power a CEO hold, every factor needs to be considered. This makes the managerial power approach hard to prove or falsify which is evident when the authors defend their theory. If not all power sources are considered, they can always argue that exclusion of a power source (.e.g. anti-taker defenses) from an analysis can explain why a survey was inconsistent with the hypothesis. Consequently, the theory is difficult to prove or falsify. Also the magnitude of how influential each factors is, are not considered. Moreover, there may possible synergy effects between the different sources of power, but that either addressed either. From an

empirical standpoint, the managerial power hypothesis isn't properly tested by Bebchuk et al. (2002), only proposed as a theory with some supporting evidence.

Omitting power exertion from the theory gives rise to another problem. If power and executive compensation are not positively correlated, a valid argument counter-argument to defend the theory is always that the manager didn't exert his or her power. Moreover, with no measure capturing the amount of power exerted, there is no way to properly capture how significant managerial power is. However, as will be discussed in subchapter 2.1., it is reasonable to assume that CEOs on average at least will exert some power, i.e. the power exertion will be positive. Hence, a correlation between power and pay can still be found, but to what degree and how effectively a manager can extract rents from power will be impossible to estimate.

Lastly, controlling thoroughly for the amounts of pay a CEO possibly can extract due to the firms' economic constraints is not that important in this paper. Most of the companies considered are large and have huge revenues. Hence, the firms have enough resources to provide the CEOs with increased salary if needed. Keeping a good performing CEO may be even more important during times of bad firm performance.

1.2.4 Camouflage and outrage are vague terms

Related to last, subchapter, Holman (2002) highlights that outrage and outrage costs are vague terms that are hard to measure and falsify. Murphy (2012) supports those claims, and states that: *"[T]here is no principled way to refute any trend in pay given the authors' [flexible (and unmeasurable) definition of both the "outrage constraint" and its importance (Jensen, 2012, p. 142)."* Bebchuk and Friend (2013) have countered such arguments by underlining that one way to measure the effect of outrage, is to see if there is a firm lowers the compensation after a public outrage or negative publicity. Helge Lunds' decreased compensation is an example of this (e24.no). Furthermore, as formerly noted, vague terms don't imply that the theory necessarily is wrong, rather that it is hard to falsify.

1.2.5 CEO compensation packages provide sufficient performance incentives

Core, Guay and Thomas (2005) argue that optimal contracting, or efficient contracts as they call it, is the best possible contract given the contracting cost in a given situation. Hence the contract is optimal in order to avoid opportunism by the manager, but not perfect. Moreover, they claim that CEOs due to their large stock and options portfolios have very strong pay for performance equity incentives. The authors present an example in which a 20 percent decrease in firm value would lead to an equity portfolio loss of $8,6 million for the median CEO in 1993, which is higher than the median CEO pay ten years later (Core, Guay, and Thomas, 2005 p. 1174).

1.2.6 Other factors determining pay may be more important than managerial power

Bainbridge (2005, p. 1629) argue that the occurrences of allegedly questionable compensation practices both in companies with dispersed ownership as well as concentrated ownership may suggest that the practice is a result of factors other than managerial control.

1.2.7 Summary

As this subchapter reveals, the managerial power hypothesis has its weaknesses. While some of the criticisms seem like misinterpretations or an attempt to undermine the importance of extracting rents, other critics, like Winter and Michels (2012), have more convincing arguments. However, the topic of rent extraction, especially when managers face incentives that may hurt firm performance, presents an issue that should be taken seriously. Thus managerial power should still be considered relevant – even though the rent extraction might not be significant.

1.3 Other relevant hypothesizes to executive compensation

Other theories explaining executive compensation are presented in this subchapter. The field is so vast, that all theories have supporting and disapproving findings. Some papers are not nuanced in the way the executive pay landscape is presented. This subchapter proposes a more objective overview of relevant work. Several models are excluded, e.g. the compensating wage differentials model, the tournament model and the multitask model, as this chapter only presents the most central and reoccurring theories in the literature.

1.3.1 Size of firm

Jensen and Murphy (1990a,b) argue that the most of the variation in pay is due to the sheer size of the firm. Gabaix and Landier (2008, p. 2) support that argument, and state that *"a CEO's equilibrium pay is increasing with both the size of his firm and the size of the average firm in the economy"*. The same is found in Norway, as Randøy and Skalpe (2007) research on Norwegian CEO compensation from 1996 to 2005, found that the size of firm is the major explanatory variable determining pay. Bigger firms require CEOs with higher human capital, due to increased responsibility and firm complexity (e.g. internationalization, diversification or market uncertainty), which justifies a higher pay. Firm complexity is also found to be a significant explanatory variable for executive pay (Hengartner, 2006). Tang, Tam & Firth (1999) add a few more arguments to back up the theory: *"[L]arge organizations have a more extensive hierarchical management structure and each level has a salary differential."* (Tang, Tam & Firth, 1999, p, 619). Hence, managers at larger firms will be compensated more than their counterparts at smaller firms. The authors also claim that the absolute profits of big companies are usually immense, and thus the magnitude of even high executive compensation may appear as an insignificant expense.

Few, if any, disagrees that the size of firm affects the salary, or that a certain amount of increased pay isn't justified by the reasons mentioned in the last paragraph. The key question, however, is what magnitude of extra pay is reasonable to reward the CEOs given the increased firm size? A CEO has more influence on

the size of the firm than firm performance (Myklebost and Hansen, 2009), and thus can be encouraged to focus on increasing the firm size rather than improving the firm performance. Bebchuk and Grinstein (2007) find that "[…] *compensation levels increased far beyond what can be attributed to changes in firm size and form performance* (Bebchuk and Grinstein, 2007), p. 286). They acknowledge that the CEO compensation grows after expansions that increase the size of the firm. However, when the opposite is the case, i.e. the firm size decreases, there is no reduction in the executive compensation, and thus there exist an asymmetrical relationship that isn't explained by size alone. CEOs will be encouraged to build empires (increase firm size) if researchers claim that the increased pay is justified by the growth in firm size. The managerial power hypothesis, on the other hand, focuses on the fact that large companies usually have a more dispersed ownership, and thus are more prone to managerial influence.

1.3.2 CEO Compensation Benchmarking

According to Bizjak et al (2008) and Faulkender & Yang (2010) CEO compensation benchmarking is a fundamental part of CEO pay setting that the vast majority of top firms in the US apply. The authors also claim that boards tend to benchmark the CEO salary at the same level or above the median of peer CEOs' compensation. This leads to an overall rise in CEO pay over time. If the selected peer firms are skewed towards the top paying firms instead of the median paying firms, the effect is even larger. Bebchuk et al (2013) refer to practice as ratcheting, and agree that the practice may indeed increase the pay. However, they claim that ratcheting act as camouflage to justifying excessive pay: *"Such ratcheting is consistent with a picture of boards that do not seek to get the best deal for their shareholders, but are happy to go along with whatever can be justified as consistent with prevailing practices"* (Bebchuk et al., 2013, p. 123).

Hagen and Waltz (2014) create a driver analysis based on all the annual reports for 2012, and find that the most important factor influencing executive compensation is providing the CEO with a competitive pay. A compensation set at median salary is often referred to as below average, whereas a pay package set between the median and the 75% percentile is referred to as competitive (Jensen, Murphy and Wruck, 2004). Hence, the ratcheting is likely to continuously increase the average pay, as the benchmark apparently usually is set above the average. Even worse is the tendency that CEOs with a low initial market value are awarded with compensation set at the average (Holden, 2007). Consequently, the whole pool of CEOs is over time likely to be, and probably is, overpaid.

CEO compensation benchmarking also relates to inequity theory. From Adams (1963) the theory predicts that pay inequity creates tension and dissonance within the CEO, motivating the actor to reduce the inequity. When experiencing pay inequity, he or she is motivated to reduce the inequity by encouraging their boards of directors to implement peer benchmarking and restore pay equity.

1.3.3 Competition to land the best talents

Another way to look at CEO benchmarking is that the board is forced to pay more in order to land the best talents. When there's a scarcity of qualified candidates available, the salaries are pushed even higher

than expected from the supply and demand curve. This theory also relates to the size of firm, as the biggest firms desire to hire the best talents, or at least are willing to pay the most for talents. Human capital theory (e.g. Randøy and Skalpe, 2010) is another related model, in which the executive compensation is said to reflect the skills (i.e. human capital) of the CEO. An important assumption for this theory is that firm performance is affected by the performances of the CEO.

Another factor contributing to increased pay during the hiring process is the tendency that negotiations of the pay package usually begins after selecting the new CEO (Randøy and Skalpe, 2010; Murphy, 2012). This increases the bargaining position of the CEO, as the upcoming CEO is aware that he or she is the best candidate and knows that turmoil during negotiations or losing the candidate can influence the stock price. This is usually more costly for the shareholders than the value of the excessive pay. It may also be argued that due to OBRA (see subchapter 1.1.2), companies where forced to increase the use of equity based pay when the total pay required to attract talents increased.

Bebchuk et al. (2002) claim that the scarcity argument is not persuasive. They emphasize that although U.S. firms employ a particularly large number of CEOs, the number of junior executives are even larger. Thus, it is unclear why qualified CEOs would be relatively scarcer than qualified junior executives. Moreover, Stensbak (2005) claims that, given the ratios of qualified candidates are about the same for each gender, the competition hypothesis is falsified by the fact that female CEOs are greatly underrepresented. Hence, there must be other factors than talent alone that determine who is hired and their consequential pay. However, there are many possible factors that may disprove the premise that there are an approximately even number of qualified candidates from each gender. For instance, women might prefer to prioritize their families, might be less risk-taking and might have less desire to become a CEO. Also, there may be a lower amount of women in the industry with relevant education or experience, hence a smaller pool of candidates. Lastly, even if this premise holds, the potential issues of conscious or unconscious gender discrimination prevent qualified women from being selected or even considered. Hence, the actual pool of qualified female candidates that are being considered may be even smaller. Yet, Stensbak (2005) conclusion may still hold given the significant low amount of female CEOs. As of December 2015 only 4,2% woman hold a CEO positions at S&P 500 companies (Catalyst, 2015).

1.4 Empirical literature on managerial power

There is a large number of papers on managerial power. However, while some theoretical arguments for relationships between power and executive pay are strong, empirical evidence is often ambiguous and contradictory, and sometimes even lacking (Hengartner, 2006). This subchapter only highlights a few empirical studies on managerial power, as there are numerous studies supporting each side. Many of the papers listed in subchapters 1.2 and 1.3 are also empirical, and thus also directly or indirectly disapprove of or support the managerial power hypothesis.

1.4.1 Support of the Managerial Power Approach

Even though there are theoretical papers that disapprove the managerial power hypothesis, there are numerous empirical studies that support the theory. Hengartner and Ruigrok (2011) found a positive relation between power and compensation of top management in Switzerland. Subrahmanyam (2008, p.633) concludes that empirical tests support that "[…] *there is a better governance and lower executive compensation in firms where networks are less likely to form."* Renneborg and Zhao (2011) investigate the relation between executive and non-executive directors' networks and the CEO's compensation structure in the UK. Their findings were mostly consistent with the managerial power theory. Brown et al. (2009) also found support for managerial power in the UK when focusing on the CEO network.

1.4.2 Disapproval of the Managerial Power Approach

However, there are also empirical literatures that indicate that managerial power isn't present. By investigating if there was a positive relation between executive pay and compensation committees containing affiliated directors, numerous papers disapprove the managerial power hypothesis (e.g. Daily et al. 1998; Newman and Mozes 1999). Engelberg et al. (2013) disapprove the manager power hypothesis by claiming that managers are rewarded for valuable network connection they bring to the firm – the extensive pay is not a result of rent extraction.

1.4.3 A more balanced view on the Managerial Power Approach

There are also papers that present a more balanced view, and these papers seem to be more neutral, as some authors seem to disapprove managerial power in order to highlight their own theories. Frydman and Sacks (2010, later expanded upon by Frydman and Jenter (2010) suggest that both managerial power and competitive market forces are important determinants of CEO pay, but that neither approach is fully consistent with the available evidence. Even though the studies lack some data on pensions and perquisites, the authors claim that *"the theories both have trouble explaining some of the cross-sectional and time-series patterns in the data (Frydman and Jenter 2010, p.2)."* For instance, they claim that managers were more powerful in 1950 to 1980, but that the increased power was not reflected in the compensation packages. Furthermore, they claim that there is no evidence that boards have become weaker or more captive over time.

A combination of different models can explain the compensation landscape. Combining different models, though, also means that the interpretation of the combined model always can be manipulated in order to explain the competition landscape. Still, the managerial power theory is not a stand-alone theory and should therefore not be treated as one.

1.5 Managerial Power in the US versus other countries

The managerial power hypothesis is primarily based on data and examples from the US, but some of the results are likely to be transferable to other countries. This subchapter presents how managerial power

may deviate from country to country. As Norway is the country that is to be investigated, most of this subchapter is devoted to highlighting differences between the two countries that may influence the presence of managerial power. This chapter highlights cultural (social and historical) and political (framework and laws firms must adhere to) factors that may influence executive pay. These factors also create a contextualized framework and possible explanations when discussing and analyzing the results. Cultural dimension theory, as defined by Hofstede (2015), is used to compare the two cultures.

1.5.1 General differences between countries

Bebchuk et al. (2002, p. 842) claim that "*U.S. CEOs are paid considerably more than their non-U.S. counterparts.*" When considering differences in the cultural and political landscape between countries, some conclusions of what to be expected can be drawn. Factors that may increase the magnitude or frequency of public outrage are important. The authors highlight that companies in the US tend to have more power, especially due to more dispersed ownerships with no large shareholder. Other avenues for rent extractions are also suggested as a reason for lower executive pay in other countries, as the CEO can be affiliated with the controller. Bebchuk et al. (2002) don't go into further detail on distinctions between countries, but given the framework and power positions presented in their paper, expected differences between countries can be proposed.

1.5.2 Expected differences in Norway

Cultural differences between Norway and USA

Hofstede (2015) research on different cultures is commonly used as a source to compare different cultures. Countries are rated on 6 different dimensions (power distance, individualism, masculinity, uncertainty avoidance, pragmatism and indulgence) on a scale with values that are relative to each other. The two latter dimensions are recently added and lack accuracy due to more limited data. The scores for different countries are quite stable over time due to the fact that values are relative to each other. Shifts in cultures tend to be global, thus countries' relative positions stay the same (Hofstede, 2015). It is very important to note that this study explains differences between cultures based on national averages, and thus national scores should not be interpreted as equal to individual values.

Dimension	Norway	United States	Difference
Power Distance	31	40	9
Individualism	69	91	22
Masculinity	8	62	54
Uncertainty Avoidance	50	46	4
Pragmatism	35	26	9
Indulgence	55	68	13

Table 1 Cultural dimensions of Norway versus the United States

Power distance is obviously a very relevant dimension in terms of managerial power. Masculinity and Individualism are important dimensions, not only due to the substantial difference in score between the two countries, but also for what the dimensions represent. The difference in Uncertainty Avoidance score of only 4 will most likely not make a significant impact. Lastly Pragmatism and Indulgence are not included further in the analysis as the dimensions lack accuracy and are less related to managerial power. A further elaboration of three most relevant dimensions and how they may impact managerial power are presented next.

Power Distance:

Power Distance represents the degree to which the less powerful members of a society accept and expect that power is distributed unequally (Hofstede, 2014). A higher Power Distance in terms of managerial power indicates that the threshold for public outrage is increased, and that more powerful CEOs are more accepted and possibly more prevalent. Norway has a fairly low score of only 31, and this is supported by characteristics as hierarchy for convenience only, equal rights, decentralized power, consensus orientation and more informal managerial style. Decentralized power and consensus orientation reduce CEOs decision power and influence which according to Bebchuk et al (2002) may reduce the managerial power.

However, Norway has a score that is only 9 lower than the US. Even though the difference in Power Distance may not appear substantial on this scale, it could still make a significant impact when combined with other cultural and political factors.

Individualism:

Individualism express a preference for a loosely-knit social framework in which individuals are expected to take care of only themselves and their immediate family (Hofstede, 2014). The United States with a score of 91 is the most individualistic country in the world. Even though Norway scores 61, which is relatively high, there is a bigger tendency to allow people to rely on authorities for support. Both countries are expected to be accustomed to doing business or interacting with people they don't know, i.e. a bigger social network is expected and thus more power deriving from social connections. Grønmo and Løyning (2012) support the notion that networking is more important in the U.S than Norway. Furthermore, Norway has more regulations - especially concerning executive pay - which will be highlighted later.

Winter and Michels (2012) suggest that CEOs in Western societies may have a higher inclination towards using their power due to higher individualism, and thus may explain why Japanese managers earn less than US managers. Norway is also regarded as a part of the Western society, but considering the gap in individualism score compared to the US, it is likely that high CEO pay is more accepted in the US. Supporting that argument is the law of Jante (Sandemos 1933). Even though the term is only a fictional law in a novel, and thus has no scientific foundation, it is commonly referred to in media and in everyday speech. The social behavior arising from the law of Jante is said to be deeply embedded in Scandinavian group culture and expresses an ideology of equality that discourages individual brilliance and

achievements. In short, the 10 laws state that you're no better than anyone else. The phenomenon is even more typical in small towns or communities where no one is anonymous. The law of Jante predicts more public outrage if the CEO pay is considered too high, which would indicate a decline in managerial power in Norway and other two other Scandinavian countries. How much influence the Law of Jante actually exerts on managerial power is unknown, but if the social phenomenon is present in Norway, the managerial power hypothesis dictates a decrease in managerial power.

Masculinity:

A masculine culture represents a preference in society for achievement, assertiveness and material rewards for success. Whereas a masculine culture is very competitive and focused on being the best, the opposite, a feminine culture, is more focused on cooperation, caring and liking what you do. A feminine culture stands for modesty, caring for the weak and quality of life. These types of cultures are also more consensus-oriented. In terms of managerial power, a more feminine culture indicates a lower threshold for public outrage.

Norway is second to only Sweden as the most feminine country in the world with a masculinity score of only 7, thus making Norway a predominantly feminine culture. The United States on the other hand is a masculine culture with a score of 62. This dimension therefore represent what is the most distinct difference between the two cultures. These different values are reflected in the school systems. In Norway the weak are heavily cared for and the average student is the norm. There are few special programs for gifted young students, and honoring exceptional academic achievements are not nearly as prevalent as in the US. In stark contrast to the expensive education system in the US, the Norwegian government provide citizens with free education even on college level, and thus ensuring equality for everyone and high social mobility.

International rankings and other measures

The Gini coefficient (OECD, 2015a) is a measure based on the comparison of cumulative proportions of the population against cumulative proportions of income they receive, and it ranges between 0 in the case of perfect equality and 1 in the case of perfect inequality. Because the underlying household surveys differ in method and in the type of data collected, the data are not strictly comparable across countries. However, the measure gives an adequately representation of reality, and significant differences in scores between two countries implies that there are substantial differences between the two countries in reality as well.

According to the Gini index (disposable income post taxes and transfers) Norway is one of the world's most equal countries with a score of only 0,25 in 2011 (OECD, 2015b). The other data points are 0,222 in 1986 and 0,276 in 2004. The US has a coefficient of 0,389 in 2011 and 2012, which is an all time high. In 1983, the coefficient was 0,336 and has monotonically increased ever since. Even though Norway only has a few data points it is clear that there is a substantial difference between the two countries. Calculating

average Gini index values over a time period may give an even better estimate, but considering Norway's highest ever value (0,276 in 2004) is notably lower than the US' lowest ever value (0,336 in 1983), further calculations aren't necessary to highlight that there is a substantial difference between the two countries.

Other international rankings and papers also indicate a difference between the two countries. Hay Group's Global Management Pay Report (Hay Group, 2009) ranks the total cash salary gap between senior managers and clerical staff. The report was compiled by comparing detailed cross-country salary information from a total of 56 countries. The authors state that the data are globally consistent, thus meaningful comparisons can be made between countries. Norway ranks as the most equal country with a pay gap between senior managers and clerical staff of only 2,6. The US scores 3,8, which is surprisingly only 0,1 above a more economically regulated France. An explanation may be that the financial crises in 2008 can have impacted the executive pay more in some countries than others. Especially countries with extensive use of equity based salary are prone to this issue, and thus the numbers may not give a good representation: *"Incentive compensation for many people will also be zeroed out this year or will be lower than previous years " (Hay group, 2009, p. 8).* The ranking indicates that there is a substantial difference between compensation in Norway and the US – especially considering that the average executive compensation in the US is likely to be more underestimated, due to the more widespread use of equity based salaries. Svalund (2008) notes that the samples chosen in this ranking may not be representative of the whole population and thus may not reflect the actual pay levels of CEOs in the countries under investigation. This issue is especially true for small countries like Norway. Still, the ranking indicate a clear difference between the two countries - even if the margin of error is large. Moreover, Svalund (2008, p. 47) refer to other studies that also compare executive salaries in Norway to other countries, and these studies also indicate that Norway has relatively low CEO pay.

Lastly, without going into too much detail, the Norwegian tax system supports the notion that Norway is a country where equality and social indifferences are important values. Norway has progressive taxation, value-added tax (VAT) and even tax on net wealth. Especially the tax on net wealth is an example of a tax system that seeks to enforce equality. While Norway's total tax revenue (in % of GDP) has been steadily above 40% from 1990 to 2013, the U.S. has fluctuated between 23,3% and 28,4% (OECD, 2013) . From to 1990 to 2013, Norway has been at least 6 percentage points above the OECD average.

Influence of government and regulations

In the last decades, reducing executive compensation has been a priority in Norwegian politics, and heavily discussed theme. In 2012, for instance, the former Norwegian industry minister Trond Giske even threatened to fire chairmen in these companies if the compensation landscape didn't change (NRK, 2012). Reforms have been adopted to ensure the increase in CEO compensation levels are stagnating, or even better, decreasing.

This chapter list years in which amendments to the law relevant to managerial power took effect in Norway. It must be noted that some of the amendments allowed for a transitioning period, like the gender quota, and thus effects of amendments could be noticed up to two years prior to the law took effect. Information not cited in this subsection is retrieved from the Norwegian Public Limited Liability Companies Act (Lovata, 2015)

1997: Before 1997 the same rules applied for all types of corporation. Post 1997, laws were split into public limited liability companies (also referred to as PLC) and limited liability companies. The former law is being applied to companies with a minimum share capital of 1 million NOK, which involve larger companies with a dispersed ownership (Lovdata, 2015). These companies are the ones that are being assessed in this paper.

Firstly §6-1 dictates that the board of directors must consist of at least three members, and they serve for two years, but that time can be extended by two years. Companies which have a corporate assembly shall have a board comprising of at least five members. Moreover, CEO duality, when the CEO also holds the position as the chair of the board, is not allowed. The exception to this rule is small corporations, but those are not considered in this paper and thus deemed irrelevant. Before the law took effect in 1997, there were approximately 59.000 cases of CEO duality in Norway (Tore Braathen, 2003). Furthermore, §6-3 to §6-6 ensure that the board of directors only are elected and dismissed either by the general meeting, corporate assembly or the majority of the employees. §6-4 states that the majority of employees may require the election of at least (depending on the number of employees) one member of the board of directors and one observer, both with deputies by and amongst the employees. Lastly, §6-10 state that the remuneration of directors, deputy directors and observers is fixed by the general meeting. Hence, the CEO has no opportunity to shape composition or remuneration of the board without substantial support from others.

1998: All Norwegian companies on the Oslo Stock Exchange were required to provide information about the CEO's compensation, i.e. more transparency in order to reduce the growth in executive pay (Hagen and Weltz, 2014). However, transparency might increase the effect of compensation benchmarking, as CEOs where comparing they compensation to peer CEOs (Randøy and Skalpe, 2010). From a managerial power perspective, more transparency might incentivize executive to shift elements of the pay towards compensation that are more easily camouflaged. Randøy and Skalpe (2010) claim that the effect of the amendment on the executive compensation where difficult to observe.

Dec 2003, § 6-11 a: Requirement of both sexes on the board of directors. Each sex shall represent at least 40% of the members of the board. However, companies were allowed for a two year transitioning period (January 1st 2006), and hence many companies didn't meet these requirements until 2006.

2005: Listed companies were required to follow the international accounting standard IFRS 5 (Hagen and Weltz, 2014). The most relevant change was the new requirement to post options at their fair value at the

grant date in the income statement. The effects can be seen when collecting data on executive compensation, as data regarding options prior to this year is vague.

Dec 2006, § 6-16 a: The board of directors must prepare a declaration on the fixing of salaries and other remuneration to the CEO and other senior employees. Bonuses, options, stock, pension schemes, severance pay arrangements and any other form of variables in the remuneration, or special compensation in addition to the basic salary, must be included in the declaration. Furthermore, the declaration shall also contain guidelines for the fixing of salaries and other remuneration as mentioned for the previous and next financial year. The report must be sent to shareholders no later than one week before the general meeting where it is presented.

Dec 2006: Norwegian authorities presented new guidelines to prevent issuing options as a part of the executive compensation in state dominated companies. The Government also expects that the board of directors sets an upper limit on the value of equity linked compensation package in relation to the fixed salary.

2011, § 6-1: The CEO is no longer allowed to be a member of the board, with a maximum transition period of one year (Lovdata, 2015).

Some of these laws came into effect after the time period, 1995 to 2006, that is going to be considered in this paper, but are an indication that managerial power is likely to be lower than the US, and can be expected to be even more reduced when some of the laws take effect.

Tax rules are also influential. Svalund (2008) emphasizes that the tax rules relating to options have been strict in the late 1990s, but have changed numerous times after that time. One of the regulations would require the CEO to pay tax of a future, uncertain gain the same year the option agreement was signed. Obviously, this lead to options becoming less attractive to CEOs. However, in **1999, 2000** and **2002**, the strict tax rules were relaxed in order to make them more attractive again Svalund (2008). Consequently, options became more common.

1.6 Managerial Power in Norwegian Literature

Norwegian literature on managerial power is sparse. Most of the papers mentioning the theory only include the view as a part of a literature review. There are no available papers that exclusively test the hypothesis, but there are some papers that utilize aspects of the hypothesis when researching executive pay. Some of the papers falling into the latter category are highlighted in this subchapter.

Randøy and Skalpe (2007, 2010) research on executive compensation in Norway are the most relevant papers. They find some support for managerial power, but the size of firm is the major explanatory variable determining pay in the data set from 1996 to 2005. In Norway equity based compensation makes up 34% of the salaries of top executives in 2005 (Randøy and Skalpe, 2007), from almost not being

present at the beginning of the 1990s. However, the volatile part of the executive compensation package is still relatively small in Norway compared to other countries. Executive salaries in the Norwegian-owned private companies are 30-40% higher than in the public sector, while executive salaries in foreign-owned private enterprises are almost twice as high as in the public sector. The CEO pay in private companies is also growing more than in the public sector. Listed companies have the highest pay and growth in executive compensation, and in 2008 the average CEO salary was almost three times bigger than leaders in the public sector. From 2004 to 2008, the average increase in industrial salary was below 5% per year, while executive compensation in the publicly traded companies increased by 16%. However, despite the rapid growth in executive compensation in Norway from 2004 to 2008, the level of pay is still among the lowest in the world. The difference is somewhat reduced if firm size is taken into account.

These finding of Randøy and Skalpe (2007, 2010) are consistent with Svalund (2008). He investigated executive compensation among the biggest firms in Norway from 1998 to 2006. The largest increase in CEO pay was clearly found to occur from 2002 to 2006. During those four years, the accumulated increase in executive compensation was found to be as high as 124,7%. Especially the three latter years stand out, with 28,7%, 22,6% and 34,0% increase in 2004, 2005 and 2006, respectively. Equity-based compensation is suggested to be one the major factors influencing this development, as options constituted an increasingly larger fraction of the total pay package. The managers were also granted generous pension plans. This is consistent with the managerial power theory. Another factor possibly influencing wage levels in Norway is globalization. Oxelheim og Randoey (2005, rendered in Randoey and Skalpe 2010) claim that international investors are more willingly to accept high compensation since they are used to high levels. Also, foreign directors are affected by the compensations landscape from their own country.

1.7 Summary

The managerial power approach has its weaknesses, as highlighted by this chapter, but the theory is still relevant. Empirical and theoretical literature indicates that managerial power could possibly be present in Norway, but probably to a lesser extent than in the US due to cultural and political differences. Equality is deeply rooted in the Norwegian culture, which is reflected in regulations, governance and international rankings. Furthermore, the CEO pay levels in Norway are small compared to the US, and the pay gap between senior managers and clerical staff are significant smaller in Norway. This chapter also underlines the importance to control for firm size. The variable is expected to be positively correlated with executive compensation, but the interpretation of the variable is more complex. Performance is another important aspect that should be addressed.

2.0 METHODOLOGY AND DATA

This chapter presents the model and variables included for examining the managerial power approach in a Norwegian context. After that follows an explanation on how the sample was selected, sources and an overview of the data.

The hypotheses the model is trying to answer are as follows:

$H_{0,1}$: Measures of connectedness have no significant impact on executive compensation.
$H_{1,1}$: At least one of the measures of connectedness have a significant impact on executive compensation in the direction proposed by managerial power hypothesis.

$H_{0,2}$: Proxies for the power have no significant effect on executive compensation.
$H_{1,2}$: At least one of the proxies for the power have a significant effect on executive compensation in the direction proposed by managerial power hypothesis.

2.1 Regression method

This subchapter presents the model, the variables included and the regression method, GEE. Apart from the centrality measures, the variables included in the model are common in literature discussed in this paper.

2.1.1 Panel data model

The initial panel data model is as follows:

$$\begin{aligned}\text{CEO total compensation}_{it} = \alpha &+ \beta_1 \times \text{Ownership measures}_{it} \\ &+ \beta_2 \times \text{Connectedness measures}_{it} + \beta_3 \times \text{CEO characteristics} \\ &+ \beta_4 \times \text{Board characteristics}_{it} + \beta_5 \times \text{Control variables}_{it} \\ &+ \beta_6 \times \text{dummy sector}_{it} + \varepsilon_{it}\end{aligned}$$

Assumptions and delimitations

The variables included are subject to data availability, validity of the data and time required to collect the information. Some excluded variables may be somewhat captured by other variables (e.g. social capital and age for human capital and size of firm for firms complexity, globalization etc), while other excluded variables have to be captured by the error term. Furthermore, power is not easily measured, so proxies are computed to capture different facets of power. Restrictions in time and data availability dictate which variable are included. This paper assumes that actors on average exert some power. All CEOs may not extract rents, as some may have intrinsic motivation or are satisfied with the initial contract, but the average CEOs will utilize at least some power. This doesn't imply that economic incentives is the only motivation managers have, but that they do prefer and will try to receive a higher pay if possible. The

consequence of not being able to quantifying the power exertion is that quantifying the possible influence power has on pay is impossible. Hence, finding whether there is a significant relationship is possible, but not the true magnitude of the relationship will remain unknown.

Sources of error and information not captured

The most obvious weakness is that there are possibly important variables excluded from the model – for instance variables on compensation committee and the independence of the directors. A discussion regarding independence of directors is conducted in the appendix. Moreover, controlling for compensation benchmarking and competition to land the best CEOs are also not included.

Some CEOs even hire skilled contracting agents to negotiate on their behalf (Murphy 2012). These factors are impossible to capture without proper research. Furthermore, it is reasonable to assume that new CEOs are aware that their bargaining position is strengthened when pay package negotiations start after being selected as the new CEO. This power of this bargaining position may even exceed the effect of managerial power.

Another source of error may be, as Jensen et. al. (2004) highlighted, that directors may not possess sufficient expertise in order to properly evaluate the cost of equity based compensation. However, with increased awareness regarding executive compensation in the media and academia, and the even lower CEO pay in Norway, this is not necessarily a problem in Norway.

Omitted-variable bias is another worry. The bias never fully be removed in a model with so many potential variables, but robustness tests can be utilized to reduce the bias. Furthermore, the model assumes a linear relationship between power and pay. If not linear, the model will produce biased results. Data captured from reports leads to two potential errors: The writer of the report may purposefully hide or state information in a more vague manner. Firms also have different procedures for reporting. The second error comes from collecting the data, as interpretation of the information may be wrong, as well as human error when manually registering the large amount of data into a spreadsheet.

2.1.2 The variables included in the model

Thus subsection present the variables used in the model. The justification for including the various variables are discussed earlier throughout Melsom (2015), but are repeated quickly here.

Dependent variable

The total CEO pay of is used as the dependent variable (DV). This includes basic pay, bonuses, option and stock grants and pension provisions. It is assumed that contract negotiations take place every year. Options are calculated as the grant date, risk neutral value of the options to best capture the ability of the CEO to extract rents. Severance pay and start bonus are also included, as these may also be an indication of rents.

Compensation data is well known to be prone to outliers and thus the data sample should be tested for normality. Possible solutions if non-normality is the case is to use ln(compensation) or divide compensation by average salary for an industry worker.

The table below lists the included independent variables (IV) and control variables (CV) used in the model:

Variable	Type of variable	Proxy	Abbrevation	Program used to calucluate	Expected effect
Connectedness (Social capital)	IV	Centrality measures (SNA): Degree, closeness, betweeness, eigenvector and beta centrality	SNA_deg, SNA_clos, SNA_betw, SNA_eig and SNA_beta	VBA and UCINET	+
Board characteristics (Corporate governance)	IV	Fraction of busy directors (3+ membersships) Fraction of current CEOs on board Board size	BOARD_dir BOARD_ceo BOARD_size	Microsoft Excel	+
Ownership power	IV	CEO ownership Biggest owner	OWN_CEO OWN_BIG	-	+ -
CEO characteristics (Human capital)	IV	CEO tenure CEO age	CEO_tenure CEO_age	Microsoft Excel	+
Firm performance	CV	Return of equity (ROA) Total Return (TR)	FIRM_ROA FIRM_TR	Microsoft Excel	No effect
Firm size	CV	Ln(turnover)	FIRM_size	Microsoft Excel	+

Table 2: Variables included in the model. The expected effects are from a managerial power perspective.

Independent variables (IV)

The board characteristics are size of board, fraction of current CEOs serving as director and fraction of busy directors. A busy director is defined as a director serving on three or more boards. These proxies are expected to weaken the boards' ability to monitor the CEO and thus reduce their power relative to the CEO. The CEO characteristics consist of age and tenure**.** Both these variables are proxies that reflect skill/experience and are expected to have a positive association with total pay.

Lastly, centrality measures are used as the measure of connectedness/social capital of the CEO. These measures represent different facets of social capital. Furthermore, a more connected CEO are assumed to increase their position in the managerial labor market, as they are likely to have better access to more details about employers, employees and jobs (Brown et al 2009). The commercial software UCINET (2002) is used to calculate the centrality measurements. However, prior to using UCINET, the board data must be converted into a format that UCINET can understand. This process is done by macros created in VBA. Furthermore, the centrality scores must be normalized, as the networks have different sizes.

Normalized scores may get very low due to the high number of possible connections, but give a reflection of how prominent the actor is compared to a possible maximum.

The appendix is recommended for a deeper understanding of the centrality measures, but a brief summary of the measures are presented in the table below. The beta coefficients for beta centrality are set to be equal to 0,995 / max eigenvector in the network.

Type	Effect	Raw score	Normalized score
Degree	Direct influence	$C_D(i) = \sum_{j=1}^{N} a_{ij}$	$C_D'(i) = \frac{\sum_{j=1}^{N} a_{ij}}{N-1}$
Closeness	Closeness to information	$C_c(i) = \left[\sum_{j=1}^{N} d(i,j)\right]^{-1}$	$C'_c(i) = \frac{C_c(i)}{[(N-1)]}$
Betweeness	Bridge between actors	$C_B(i) = \sum_{j,k} g_{jk}(i)/g_{jk}$	$C'_B(i) = \frac{C_B(i)}{\left[(N-1)\frac{(N-2)}{2}\right]}$
Eigenvector	Connected to powerful actors	-	$C_E(i) = x_i = \lambda^{-1} \sum_j a_{ij} x_j$
Bonacich / Beta	Mix between degree and eigenvector		$C_P(i,\beta) = \alpha(I - \beta a_{ij})^{-1} a_{ij} 1$

Table 3: Centrality measures used in the model

Lastly, the centrality measures and board characteristics are likely to be significantly correlated. If they are, there are several solutions to reduce potential bias. The easiest solution is to omit all but one of the variables. Constructing a new connectedness variable consisting of all centrality measures or utilizing PCA are other solutions. The former solution is suggested in this paper, as the interpretation of the results is easier.

Control variables (CV)

Size of firm: The reasons behind the significance of this variable are complex, as the variable actually captures many different effects, e.g. globalization, firm complexity, firm diversity etc . What the size of firm captures is not the most important aspect, but rather that the variable can help explain variance in pay. Size of firm is the most supported variable in the literature on executive compensation. The number of employees is also a common proxy for firm size, but the data is inadequate, and thus not used.

Firm performance: There are several different measures for firm performance. The most important aspect is to include both accounting-based performance and market-based performance. The difference between the two types of measures is that market based values are founded on economic valuations derived from the capital asset pricing models, while accounting based measures are based on historical performan (Smith, 2009). The following two measures are selected as control variables for performance:

$$\text{Return on assets (ROA)} = \frac{Net\ income\ reported\ on\ income\ statement}{\text{Book value of total assets}} \quad (eq.1)$$

$$\text{Total Return (TR)} = \frac{(Ending\ stock\ price - Initial\ stock\ price) + Dividens}{Initial\ stock\ price} \quad (eq.2)$$

There are also other control variables that may deem valuable and significant, like firm risk or debt. However, most of the variables require additional research or may be somewhat captured by firm size (e.g. geographic location or number of subordinates) and are thus omitted in this paper. Further research may utilize more control variables.

In order to control for industry effects, an **industry dummy** is also included. All firms on Oslo Stock Exchange are categorized within one of the nine sectors.

2.1.3 Generalized estimation equations (GEE)

SPSS is the software used to run the analysis. Ordinary Least Squares (OLS) was initially supposed to be the procedure used to conduct the analysis, but SPSS don't provide OLS regressions, and thus the method of generalized estimation equations (GEE) is used instead. The interpretations of the GEE estimates are similar to OLS, but the method in which the results are conducted is different. A short introduction to GEE is presented below. The technical details regarding the calculations are left out, as all calculations are conducted by SPSS. More information on GEE can be found in papers like Gardiner et al (2009), Schultz et al (2009) and Liang and Zeger (1986)

Generalized estimation equations (GEE) extends generalized linear models (GZLM) by modelling the association between the repeated observations on a subject with a patterned correlation matrix. The structured correlation matrix is used to describe the pattern of association amongst the repeated measurements (data point for every year) on each subject (firm) (Schultz et al, 2009). There are several reasons for GEE being a good fit for this analysis. Firstly, GEE is a very flexible, and allows the DV to be discrete, any of several distributions and even nonlinearly linked to IVs. Furthermore, the procedure estimates the average response over the population (population average effects) rather than subject-specific responses. Hence, for every unit increase in a covariate across the population, the parameter tells how much the average response would change – not the effect on a given subject (firm). Lastly, the estimates arising from longitudinal data are likely to be more efficient and unbiased than OLS regression, particularly when the dependent variable is highly correlated within subjects. However, the GEE estimates are identical to those produced by OLS regression when the response variable is normally distributed and no correlation within response is assumed (Ballinger, 2004).

Correlation structure and goodness of fit

An important aspect of GEE is the correlation structure matrices. The data can be correlated in different ways, and therefore the assumptions about how the data correlated are correlated needs to be specified.

However, the correlation structure in GEE is re-estimated for every iteration and thus making the GEE more robust to misspecification – even if the correlation matrix initially is misspecified.

Unfortunately, the usual goodness of fit statistics can't be calculated for GEE, as the concept of the likelihood function does not apply to the procedure. There are however, other measures that capture the error. Lower error scores are better. The first measure is Quasi-likelihood under Independence Model Criterion (QIC), which rates the correlation matrix structures given a set of model terms. Hence, this measure identifies the most suitable correlation structure given the terms included in the model. The other measure is the Corrected Quasi-likelihood under Independence Model Criterion (QICC), which rates the sets of model terms, given a correlation structure. Hence, given that the correlation structure is the same in both models, QICC will identify which of the terms provides the best fit. The results presented in this paper will only present results with the lowest QIC, i.e. results with non-ideal correlation matrices are not included in the results.

2.2 Sample construction and description

This subchapter presents limitations and issues when collecting numerous types of data required to investigate the managerial power hypothesis, in additions to all the data sources. A further elaboration regarding the data on executive compensation and board data are also presented in this subchapter, as there are important implications that should be highlighted.

2.2.1 Sample construction

Type of firm

The recommended type of firm is obviously public limited liability companies (PLCs). There are several reasons for this. Firstly, CEOs are more powerful and the managerial power theory is based on and tested on large companies with dispersed ownership. Secondly, primarily listed companies have experienced a significant growth in compensation (Randøy and Skalpe, 2010). Furthermore, the consequences of managerial power are expected to be more dire for large companies due to the potential of a larger absolute loss in shareholder value. Lastly, the most essential information is available from annual reports and they are required to document more detailed information on executive compensation.

Type of source

Annual reports is chosen as the source of data, as annual accounts extracted by data providers as Proff Forvalt display a severe lack of valid data. Executive compensation is posted, but what elements are included in the pay packages is vague. The value of pension funds, severance pay and stocks and options granted are not necessarily included. The reason is for instance that prior to 2005 (see subsection 1.5.2), the values of options were not mandatory to account, which lead to rather vague descriptions regarding options granted to executives. Svalund (2008) highlights that pensions grants in the data set suddenly increased from one year to another. This may be interpreted as an increase in pension grants, but he

concluded that the change in pension grants actually reflects that the data wasn't posted in the annual accountings up until this point. There are several possible reasons why the quality of reporting is low. For instance, companies may deliberately omit information, either because of fear of public outrage or the fear that this will play into the cooperation and negotiation climate in the labor movement. This may skew the data, as companies that are aware of excessive pay may camouflage these rents, while firms that have nothing to hide reports all elements of the compensation package. Hence, data on executive pay must be collected from annual reports. Lastly, annual reports also ensure high reliability, as the data are collected from publically available information.

The time period selected in the sample

Subsection 1.5.2 highlighted laws that are expected to have some influence on executive compensation or managerial power, and hence the years under investigation are recommended to be within a time period with similar laws regarding the transparency of compensation arrangement and taxation on options. Especially 2005 act as a shift in transparency. To ensure that the compensation data is as valid as possible, 2006 is selected as the first year of investigation. The span of the sample period is depending on data availability of all variables. As the board data collected spans to longer than 2010, this is selected to be the last year in the sample period.

2.2.2 Sources

Most of the data used in this paper are collected from annual reports. However, the data collecting from annual reports are mostly conducted by KLP (2013) and Hagen and Weltz (2014), as they have shared their data with the author of this paper. Some notable differences between the two papers are that the latter paper uses realized pay in their calculation of executive compensation and excludes pension grants from the total pay. KLP (2013) on the other hand, includes only total pay (i.e. no compensation structure) and use grant day pay as their method of valuation. The samples, which consist of the 25-30 biggest companies at Oslo Stock Exchange, are mostly the same. The firms used in this paper are the ones present in both papers. As grant pay is the method that best explains the ability to extract rents during the bargaining process, the compensation data of KLP is the one that is used in this paper.

Brønnøysundregisteret have provided the board data which spans from 1999 to 2010. Only observations with data for all variables are included in the regression, and thus this paper only used the data from KLP (2013) and Hagen and Weltz (2014) spanning from 2006 to 2010.

The table below lists the various sources of data. The second column tells whether the data are collected by one of the two papers. H&W refers to Hagen and Weltz (2014), while KLP refers to KLP (2013). The third column (years) tells for which years the data have been collected.

Type of Data	Paper	Years	Source
Board Data	-	1999 - 2010	Brønnøysundregisteret (BRREG)
Additional board not captured by BRREG	-	2006 - 2010	Annual reports
Average salaries	-	2006 - 2010	Norway's central institution for producing official statistics (SSB)
Total compensation	KLP	2004 - 2012	Annual reports
All types of compensation	H&W	2004 - 2012	Annual reports
Financial data	KLP	2004 - 2012	Bloomberg
Sector	H&W	2004 - 2012	Oslo Stock Exchange
Market Data	H&W	2004 - 2012	Datastream
Biggest owner	KLP	2004 - 2012	Annual reports
CEO attributes	H&W / KLP	2004 - 2012	Annual reports
Exercised options	H&W	2004 - 2012	Newsweb
Historic exchange rates	H&W	2004 - 2012	The central bank of Norway

Table 4 Data Sources

The firms used and their number of observations are listed below.

	Firm	Number of years with compensation data 2006 - 2010	Number of years with data for all main variables 2006 - 2010
1.	AKER SOLUTIONS (AKER KVÆRNER, 06-07)	5	5
2.	ALGETA	5	3
3.	CERMAQ	5	5
4.	DNB NOR	5	5
5.	DNO INTERATIONAL	5	5
6.	FRED OLSEN ENERGY	5	5
7.	GJENSIDIGE (GJENSIDIGE KONSERN, 06-09)	5	1
8.	GOLDEN OCEAN	5	0
9.	KONGSBERG AUTOMOTIVE HOLDING	5	5
10.	LERØY	5	5
11.	MARINE HARVEST (PAN FISH, 06)	5	4
12.	NORSK HYDRO	5	5
13.	NORWEGIAN	5	5
14.	ORKLA	5	5
15.	PGS	5	5
16.	PROSAFE	5	5
17.	REC	5	5
18.	SCHIBSTED	5	5
19.	SEVAN MARINE	5	4
20.	SONGA OFFSHORE	5	4
21.	STATOIL (STATOILHYDRO, 07-08)	5	5
22.	STATOIL FUEL&RETAIL	1	0
23.	STOREBRAND	5	5
24.	SUBSEA 7	5	1
25.	TELENOR	5	5
26.	TGS NOPEC	5	5
27.	YARA	5	5
		131	**112**

Table 5 Firms included in model

As you can see from the table, there are some missing variables from 19 of the observations. These are excluded from the analysis, as each observation require all variables. For each year the numbers of observations containing all main variables are 20, 22, 23, 23 and 24 in 2006, 2007, 2008, 2009 and 2010 respectively.

2.2.3 Compensation data

Finding the best DV for total pay

To ensure less biased results in the empirical analysis, it is preferable that the dependent variable is normally distributed. GEE can still run if the DV is non-normally distributed, but the results are expected to be less biased if the DV is normally distributed. Extreme observations, which may skew the results, are common in compensation data. Three different variants of DV are tested: The total pay, ln(total pay) and total pay / average industry salary. The average industry salary in a given year is collected from SSB (2016).

The table below compares the three different DVs:

	Compensation	Ln(compensation)	$\frac{\text{Compensation}}{\text{Average industry salary}}$
N	130	130	130
Mean	7 216 910	15,57	17,82
Median	5 618 950	15,54	14,47
Std. Deviation	5 888 164	0,64	14,76
Variance	34 670 470 007 394	0,41	217,97
Skewness	3,45	0,23	3,66
Std. Error of Skewness	0,21	0,21	0,21
Kurtosis	17,59	0,44	20,06
Std. Error of Kurtosis	0,42	0,42	0,42
Kolmogorov-Smirnov	0,116 (0,000)	0,039 (0,200*)	0,180 (0,000)
Shapiro-Wilk	0,700 (0,000)	0,989 (0,429*)	684 (0,000)
Minimum	1 413 000	14,16	3,64
Maximum	46 563 000	17,66	121,32

Table 6 Descriptive statistics for each type of DV

Without going into too much detail, ln(compensation) stands out as the best choice. Both Kolmogorov-Smirnov and Shapiro-Wilk are tests for normality (sig > 0,05 indicates normality), in which ln(comp) is found to be normal while the two other variables were not. By looking at the skewness and especially the kurtosis, it is evident that the two other variables are not normally distributed. This is also reflected in the big difference between the median and mean values.

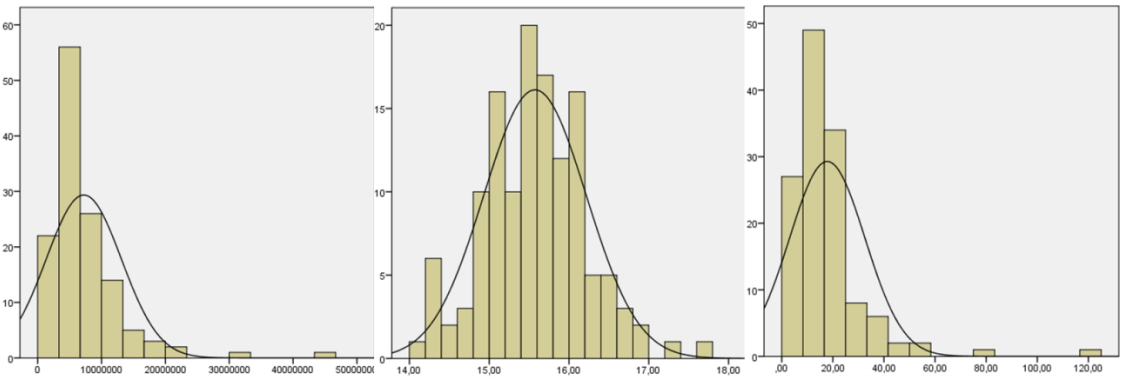

Figure 1 Histogram for each type of DV

The same conclusion is drawn when looking at the histograms of each variable. The y-axis in each graph is frequency, while the x-axises are respectively compensation, ln(compensation) and compensation divided by the average industry salary that year. Ln(compensation) is the variable that clearly is the most similar to the normal distribution and hence should provide the least biased results. Consequently, ln(compensation) is used as the DV.

Compensation development

A long assessment of the compensation data is excluded from this paper, as there are several other papers on that topic. However, an overview of how the total compensation developed during the sample period is presented in the graph below.

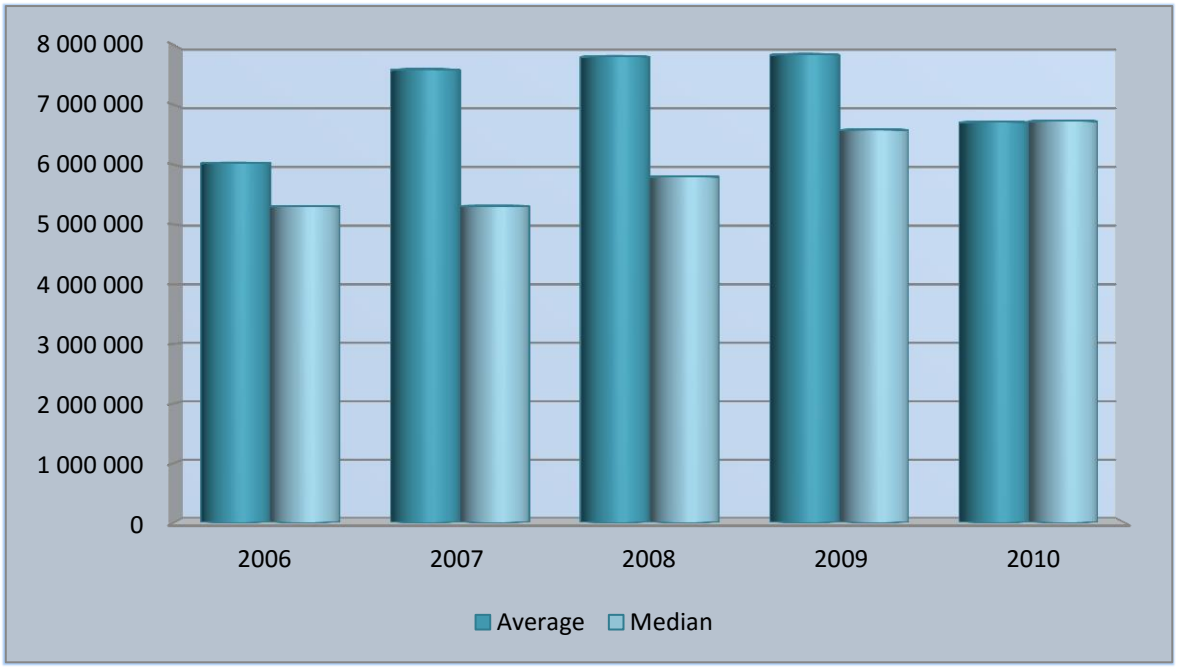

Figure 2 Compensation data

The big difference between the average and median indicate that there are some extreme observations pushing the average up. This is indeed true for the period, with the most notable outliers being Norsk

Hydro in 2007 (46 563 000 NOK) and 2009 (33 307 000 NOK). Options stand out as the main reason for most of the extreme observations. The compensation during the financial crisis may be somewhat surprising considering the value of options plummeted. However, if the compensation structure were included in the data, the results would have revealed that the base salary was increased during this period Hagen and Weltz (2014). The increase in base salary during the financial crisis is consistent with the findings of Murphy (2012). Hence, the pay-for-performance ratio was drastically changed even though the total pay didn't change as much. This highlights a weakness with the data provided by KLP (2013), as the pay-for-performance sensitivity is not properly captured.

2.2.4 Board data

Assumptions

The centrality measures are constructed from a one-mode undirected network based on board data. Ties between actors are dichotomized as 1 (present) or 0 (not present), and all ties are weighted equally. These simplifications are obviously not a perfect representation of the real life network, but taken into consideration constraints in time, possible workload and data availability, certain simplifications and assumptions are required. Furthermore, board data doesn't provide the user with additional tie attributes like tie strength direction and magnitude of information, and thus the model assumes positive and reciprocal relationships. This may not always be the case (e.g. conflicts or alliances within the board), but the assumption is necessary in order to calculate connectedness. Moreover, the CEO is assumed to form ties with all of the board members in their own firm, as the board also serves as a counsel. Only the structure is captured, i.e. the actual flow of information or power exerted is unknown.

Data description

Board data are collected from Brønnøysundregisteret (BRREG), and the data are used to calculate both board characteristics and centrality measures. Annual reports are used to add board data for firms included in the dataset by KLP, but not included in the data set provided by BRREG. These are typical firms that are re-registered in other countries. The data set from BRREG spans from 1999 to 2010 and includes all Norwegian registered public limited liability firms during that period. As 2006 is chosen to be the first year of investigation, no prior years are included in the analysis. Below are some overall data on the networks constructed by the board data:

	2006	2007	2008	2009	2010
Firms (Events)	508	487	419	365	342
Actors (Nodes)	2443	2372	2131	1887	1802
Density	0,003	0,003	0,003	0,004	0,004
Average degree	6,797	6,759	6,878	6,835	7,022
Components	150	150	136	127	112

Table 7 Network descriptions

The most notably change over the sample period is the drastic reduction in number of firms, which is mostly due to companies converting from PLC to LC. Aftenposten (2011) and Vårt land (2010) highlight that the drastic change happened after gender quota law took effect. They claim that many companies want to decide who they elect as directors and that they don't want to be dictated by a quota law. The newspapers also point to research finding that 60 percent of the companies that converted from PLC to LC state that the requirements to be a PLC are too extensive, while 36 percent reported that they are not required to be a PLC anymore after the changes to the Securities Trading Act. Regardless of the reason, the smaller networks in the latter part of the sample lead the network representing a gradually smaller fraction of the actual total network in Norway. Thus, important interlocks may be lost. Normalized network scores are necessary to account for the difference in network sizes.

Logically, as the number of firms was reduced, the number of actors also drastically fell. The number of components also reflects the decrease in number of firms, as each isolated firms act as a component. The density and average degree remain mostly the same, which indicate that the board size and the average number of interlocks haven't change drastically. As expected (not shown here), the numbers of female directors have increased since the gender quota law has been announced. The number of female directors serving on several boards has increased even more. This can be expected, as the pool of qualified female directors remained the same after the law took effect, while the demand for qualified female directors drastically increased. One of the implications of more powerful female directors serving on several boards is that social capital is shifted more towards women. This paper makes no distinction between the genders of the directors or CEOs, as the data doesn't provide it. Moreover, there is only one female CEO in the sample: Åse Michelet (Marine Havest 2007-08).

Correlation between SNA measures and board characteristics

As SNA measures and board characteristics are expected to somewhat overlap, a correlation matrix is required to determine whether there is an issue not:

		BOARD_CEO	BOARD_DIR	BOARD_size	SNA_cloc	SNA_eig	SNA_betw	SNA_beta	SNA_deg
BOARD_CEO	Correlation	1	**,210***	-,020	,055	**,183***	-,015	,049	-,011
	Sig. (2-tailed)		,017	,825	,540	,038	,862	,579	,905
BOARD_DIR	Correlation	**,210***	1	-,165	**,359****	**,239****	-,103	,020	**-,224***
	Sig. (2-tailed)	,017		,061	,000	,006	,247	,826	,011
BOARD_size	Correlation	-,020	-,165	1	**,363****	**,371****	,167	**,554****	**,613****
	Sig. (2-tailed)	,825	,061		,000	,000	,059	,000	,000
SNA_cloc	Correlation	,055	**,359****	**,363****	1	**,310****	**,222***	**,391****	**,263****
	Sig. (2-tailed)	,540	,000	,000		,000	,011	,000	,003
SNA_eig	Correlation	**,183***	**,239****	**,371****	**,310****	1	**,193***	**,665****	**,318****
	Sig. (2-tailed)	,038	,006	,000	,000		,028	,000	,000
SNA_betw	Correlation	-,015	-,103	,167	**,222***	**,193***	1	**,436****	**,617****
	Sig. (2-tailed)	,862	,247	,059	,011	,028		,000	,000
SNA_beta	Correlation	,049	,020	**,554****	**,391****	**,665****	**,436****	1	**,751****
	Sig. (2-tailed)	,579	,826	,000	,000	,000	,000		,000
SNA_deg	Correlation	-,011	**-,224***	**,613****	**,263****	**,318****	**,617****	**,751****	1
	Sig. (2-tailed)	,905	,011	,000	,003	,000	,000	,000	

Table 8 Correlation between board characteristics and SNA measures

In short, the table shows that there is a significant correlation between all SNA measures bar betweeness and at least one of the board characteristics. Hence, there is potential issue of variables capturing the same effects. Consequently, initially only one of these variables is included in the model at a time.

The complexity of board networks

To get a brief overview of the complexity of the data, the total director network including CEOs is presented below. The network is visualized using Gephi.

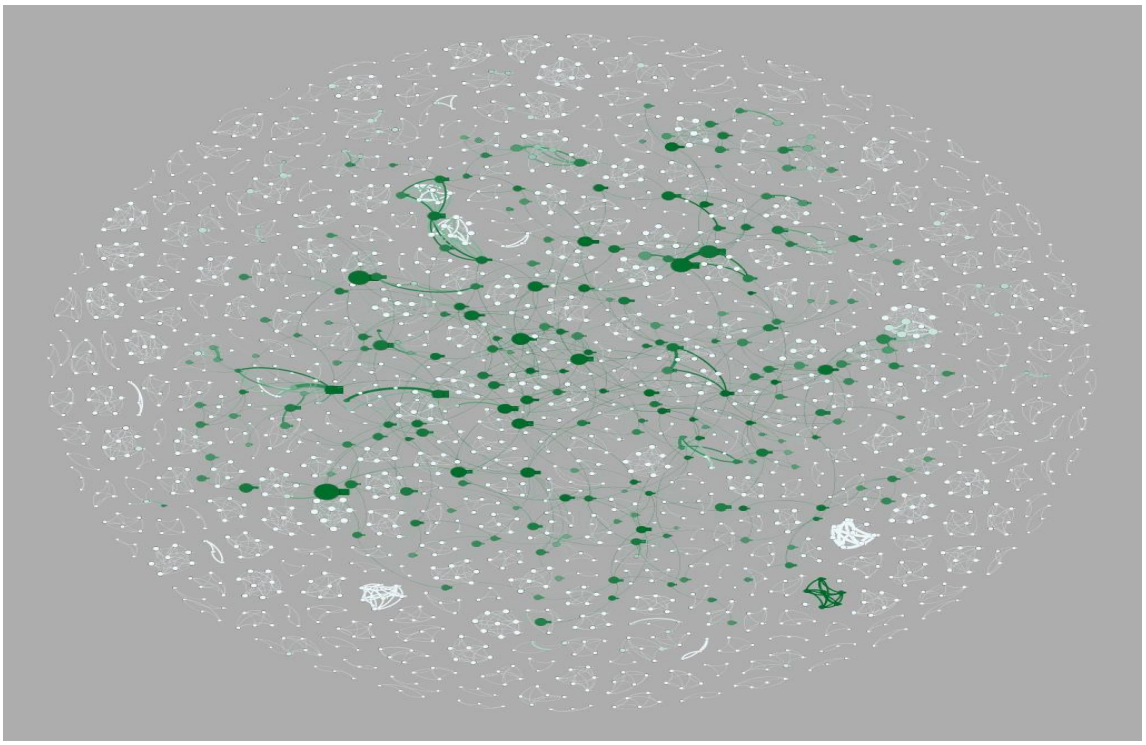

Figure 3 Complete Director/CEO network, 2006.

As can be seen from the figure, the total director network is rather large with a lot of isolated boards. All boards are clustered together as a separate subgroup in which everyone is connected to each other (clique). The sizes of the nodes reflect the number of connections (degree) the nodes have, while the size of the green colored edges reflects the betweeness of the node. Hence, a green edge indicate a director or CEO serving on another board. Most of the nodes colored green are connected within the same giant component.

3.0 EMPIRICAL ANALYSIS

In this chapter the descriptive statistics of the dataset are presented, followed by an overview of the regression results. Then follows an interpretation of the results, as well as an assessment on whether the hypotheses are rejected or not. Robustness tests are also conducted in the latter part of this chapter.

3.1 Descriptive statistics

The descriptive statistics for each variable included in one the models are displayed in the table below. The abbreviations for each variable (first column) are similar to those presented in subsection 2.1.2. Standard errors for kurtosis and skewness are dependent on N, and are all approximately 0,423 for kurtosis and 0,212 for skewness.

	N	Mean	Median	Std. Deviation	Skewness	Kurtosis	Minimum	Maximum	Percentiles		
									25	50	75
Ln(Compensation)	130	15,5735	15,5417	,64347	,225	,446	14,16	17,66	15,1481	15,5417	16,0003
YEAR	131	2008,04	2008,00	1,416	-,035	-1,300	2006	2010	2007,00	2008,00	2009,00
Industry	131	2,44	2,00	2,484	,630	-,760	0	8	0,00	2,00	4,00
OWN_CEO	122	,0155414	,0001847	,05880353	4,273	18,157	0,00000	,37160	,0000264	,0001847	,0007644
OWN_BIG	126	,291101	,267100	,1665485	,633	-,145	,0405	,7493	,158550	,267100	,401900
FIRM_SIZE	121	23,152460	23,008884	2,1003738	-1,693	8,437	11,0509	27,2095	22,091013	23,008884	24,780060
FIRM_ROA	124	,0523028	,0601850	,13056091	-2,907	15,771	-,79056	,34709	,0049175	,0601850	,1294725
FIRM_TR	123	,3481794	,2016500	1,02549203	3,464	22,229	-,93317	7,80938	-,2745600	,2016500	,7122200
BOARD_CEO	130	,0260	0,0000	,06188	2,510	6,152	0,00	,33	0,0000	0,0000	0,0000
BOARD_DIR	130	,1278	,1300	,12908	1,103	1,495	0,00	,60	0,0000	,1300	,2000
BOARD_size	130	7,78	8,00	2,185	,036	-,998	4	12	6,00	8,00	10,00
CEO_AGE	131	52,23	51,00	5,667	,343	-,376	37	65	48,00	51,00	56,00
CEO_TENURE	130	6,02	5,00	4,908	1,243	1,218	1	22	2,00	5,00	8,25
SNA_clos	129	,098225	,101000	,0125070	-1,896	3,886	,0590	,1150	,095000	,101000	,105500
SNA_eig	129	,022326	,004000	,0475378	3,586	15,180	0,0000	,3210	0,000000	,004000	,019500
SNA_betw	129	,002256	0,000000	,0051725	3,463	14,242	0,0000	,0340	0,000000	0,000000	,002000
SNA_beta	129	,971783	,651000	,9449853	2,060	4,272	,1110	4,6790	,351500	,651000	1,197500
SNA_deg	129	,005372	,005000	,0024624	,958	,281	,0020	,0130	,003500	,005000	,007000

Table 9 Descriptive statistics

There is a lot of information compressed into the table, but only the most important or unusual statistics are highlighted in this section. The mean, median, minimum and maximum values for **ln(compensation)** are 15,5735, 15,5417, 14,16 and 17,66 respectively, which translates into 5 801 022, 5 618 920, 1 411 269 and 46 562 218. By using ln(compensation), the effects of the outliers are drastically reduced.

The five lowest observations of compensation are all Bjørn Kjos (Norwegian), which can be explained by his high **ownership** (37%-23%) which are the highest observations in the sample. Ole Eirik Lerøy (Lerøy (06-07) has also a high ownership (19% and 16%), but relatively low compensation. Most other CEOs have an ownership of 2% or lower, and the majority has less than 1% ownership which is reflected in the median. The ownership fractions of the biggest owner are on the other hand very high. The threshold for

being considered a blockholder according to the managerial power hypothesis is as low as 5%. In this dataset, the lowest observation is still as high as 4%, while the 25th percentile is almost at 16%. This clearly shows that the firms have a far less dispersed ownership than US firms. Several of these companies are also owned by the state. According to the managerial power hypothesis, this would predict that the overall total CEO compensation is lower in Norway.

The **board** size spans from 4 to 12, while the average is almost 8. This is expected, as most firms prefer to have a certain number of board members, but too many can have a negative impact on different aspects of governance, for instance the board's ability to monitor the CEO. The fraction of busy directors and especially current CEOs are rather low. This may skew the results, especially for the latter as the 75th percentile is 0,0000. Furthermore, the table shows that the **CEOs** are a rather homogenous group. Most CEOs have a rather low tenure (median at 5 years), while a large proportion is around 50 years old. Climbing the corporate ladder takes several years, so it is no surprise that there are few young CEOs in the biggest companies.

The **SNA measures** all have low absolute values, but that is due to the variables being normalized. There are still some concerns. There are relatively few betweeness scores above 0,0000 as this score also is the median. CEOs serving on other boards are the driver of this variable, and reflect that few CEOs are serving on other boards. Hence, the SNA scores will to a large extent be a reflection of the board characteristics. For instance, the degree is to a large extent a reflection of the board size. The SNA measures are still included, but the interpretations of the variables must consider that the scores are heavily influenced by the board the CEO is serving on. The associations between the variables are also reflected in the correlation matrix.

The firm specific control variables (**size and performance)** have all quite high kurtosis and skewness, which may lead to skewed results. It should be noticed, though, that theoretical minimum total return is -100%, which means that the variable is likely to be positively skewed. Both industry and year **dummies** have an unbalanced set of observations. The industry dummy has most observations for industry 0 (energy, 40%) and industry 3 (consumer market, 17%), which is reflected in the average. Still, this shouldn't cause problems, as all industries are represented. The dummy for year is almost balanced, but have a few more observations in the latter years.

3.2 Results

As formerly mentioned, due to variables possibly capturing the same effect, only one board characteristic or SNA measure is included at a time. Hence there are numerous possible model variations, which are both time consuming and tedious to conduct, but also harder to interpret. Hence, only a sample of the results is shown. The problem with this approach is that the results can differ drastically depending on variables, correlation matrix and especially factors included. This makes the procedure potentially prone to p-hacking. However, some variables are more frequently significant, and these variables are the ones that

are highlighted in the results. Hence, the results presented are representative for a large fraction of the various combinations. The directions of the parameters are also consistent regardless of included variables. Lastly, if a specific variable is only significant under very specific combination, it is more likely to be a false positive /significant result that is due to chance. Existing literature and logically sound relationships also aid in determining which results are chosen to be presented.

The commercial software SPSS is utilized to conduct the results using GEE. The parameters of significant values are highlighted in bold. The year and industry dummies are initially included in both models, but excluded if it is found to be insignificant. Moreover, the coefficients for the dummies are not included in the results, as they both have several coefficients and are not as interesting as the other variables.

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)
N	*112*	*112*	*112*	*112*	*112*	*112*	*112*	*112*	*112*
QIC	*56,000*	*56,217*	*53,501*	*55,515*	*51,491*	*55,521*	*56,909*	*64,773*	*54,067*
Correlation Structure	*AR(1)*	*AR(1)*	*Independent*	*Exchangable*	*AR(1)*	*AR(1)*	*AR(1)*	*AR(1)*	*Independent*
QICC	*51,033*	*51,253*	*48,594*	*51,235*	*50,069*	*51,267*	*51,292*	*58,320*	*50,270*
Intercept	**13,680**	**13,361**	**14,412**	**13,458**	**13,209**	**13,461**	**13,462**	**13,587**	**14,098**
	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Year dummy	-	-	-	-	-	-	-	-	-
	0,086	0,077	0,593	0,217	0,223	0,076	0,074	0,049	0,632
Industry dummy	-	-	-	-	-	-	-	-	-
	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
OWN_CEO	**-2,113**	-2,109	**-3,708**	**-3,013**	-1,926	-2,200	-2,099	-0,951	**-3,409**
	0,025	*0,069*	*0,003*	*0,033*	*0,077*	*0,053*	*0,074*	*0,412*	*0,007*
OWN_BIG	**-0,743**	**-0,803**	**-0,816**	-0,674	-0,660	**-0,808**	**-0,796**	-0,623	**-0,755**
	0,033	*0,039*	*0,005*	*0,080*	*0,062*	*0,040*	*0,047*	*0,088*	*0,011*
FIRM_size	**0,114**	**0,159**	**0,135**	**0,147**	**0,161**	**0,150**	**0,151**	**0,140**	**0,148**
	0,000	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*
FIRM_ROA	0,360	0,271	0,641	0,134	0,272	0,294	0,302	0,639	0,573
	0,392	*0,515*	*0,189*	*0,743*	*0,515*	*0,463*	*0,460*	*0,242*	*0,249*
FIRM_TR	0,003	0,000	-0,150	-0,021	0,000	0,005	0,002	0,003	-0,014
	0,919	*0,999*	*0,650*	*0,525*	*0,997*	*0,862*	*0,951*	*0,832*	*0,666*
CEO_age	-0,016	-0,150	**-0,260**	-0,006	-0,140	-0,140	-0,015	-0,011	-0,025
	0,195	*0,230*	*0,036*	*0,520*	*0,262*	*0,254*	*0,219*	*0,371*	*0,054*
CEO_tenure	0,003	0,003	0,180	0,006	0,003	0,004	0,003	-0,001	0,160
	0,788	*0,797*	*0,175*	*0,617*	*0,781*	*0,758*	*0,823*	*0,167*	*0,245*
BOARD_size		-0,140							
		0,688							
BOARD_dir			**-1,140**						**-0,974**
			0,006						*0,034*
BOARD_ceo	-0,460								
	0,540								
SNA_eig					**-2,151**				**-1,326**
					0,000				*0,049*
SNA_clos				-3,884					
				0,225					
SNA_betw						0,182			
						0,574			
SNA_beta								-0,075	
								0,167	
SNA_deg							-2,526		
							0,920		

Table 10 Summarized results of the empirical analysis

3.2.1 Significant variables

There are two variables that are significant in all models: The intercept and size of firm. The former variable makes up a large portion of the explained variation with parameter estimates ranging from 13,209 (545 250) to 14,412 (1 815 733). Furthermore, ownership of the CEO and the biggest owner are both found to be significant in several models. The parameter estimates are always negative, which indicate a negative relationship between ownership and executive pay. Lastly, the fraction of busy directors and the eigenvector centrality are the only two variables for connectedness or board characteristics that frequently were found to be significant. Both of these variables were found to have a negative relationship with executive pay. There are also a few instances not shown in the results in which the fraction of current CEOs and closeness centrality were significant, but that may very well be by chance and are thus assumed to be insignificant.

3.2.2 Insignificant variables

Both performance measures were found to be insignificantly correlated with executive pay. CEO tenure was found to be insignificant in all models, while CEO age was insignificant in all models apart from the one model. Lastly, the remaining centrality measures and board characteristics not mentioned in the last subsection were found to be insignificant. These measures were also consistently found to be insignificant when testing other model terms than those presented in the results. Lastly, the dummy for year was found to be insignificant in all but one model. The variable was barely significant at a 5% level, and when looking closer it was to a large extent due to 2006 being significant, while the other years where quite far from being significant.

3.2.3 Correlation matrix:

AR(1) is most frequent the best fitting correlation matrix, which makes sense as it assumes autoregressive first structure between repeated observations within the same subject (firm). However, it is not always the best fit, which may reflect why the dummy for year rarely is significant. Furthermore, there are some results in which the correlation structures almost returned the same QIP value, but the two different correlation structures lead to vastly different results. This indicates that some variables only are significant when the correlation between time points is assumed to be independent.

3.3 Discussion

In this subchapter the interpretation of the results are presented. The results are also compared to previous research and theories. After that follows an assessment on whether the main hypotheses can be rejected or not. The latter part of the subchapter presents robustness tests to verify whether the results are robust.

One aspect that is important to consider, is the context during the sample period. For instance, the financial crisis in 2008 and gender quota law in 2006 may have affected some of the variables.

3.3.1 Board characteristics

The fraction of busy directors was found to have a significantly negative association with executive compensation. This is somewhat surprising, as managerial power hypothesis and other theories suggest that more busy directors lead to a weaker board due to less time to monitor the CEO. A possible explanation is that busy directors have more power, as they have more social capital from serving on several boards. Hence, the social capital compared to the CEO is increased and thus the CEO has less power over the board. Furthermore, a director may be specifically hired on several boards due to reputation of being able to reduce the executive compensation. A lower overall compensation level in the managerial labor market would also help reduce ratcheting. Lastly, if more busy directors lead to decreased performance, the compensation of the CEO will be decreased if the compensation is connected to the performance.

The fraction of current CEOs on the board was to a large extent found to be insignificant. Most observations of this variable is 0,0000, which may skew the results. Board size being non-significant can reflect that the variable is somewhat capture by the size of the firm, as the board size is significantly correlated with firm size (sig = 0,000) with a positive correlation of 0,534.

3.3.2 Centrality measures

Centrality measures are the most unique measures included in this paper, and thus require a longer discussion. The results were a big surprising. Only eigenvector centrality was found to be significant, and the results even show a negative relationship with executive pay. This is in contrast with other studies like, Renneboog and Zhao (2011) and Brown et al (2009) who found a significant positive relationship between the connectedness of the CEOs' network and their compensation. The results are also in conflict with the managerial power hypothesis, as a CEO with a higher social capital is expected to be able to extract more rents.

A likely explanation is this: The centrality measures are largely a reflection of the board characteristics. Both closeness and eigenvector centrality are largely dependent on the actors they are connected to, meaning that these measures are highly dependent on the connectedness of the directors, as few CEOs in the sample have connections on other boards. This can be supported by looking at the betweeness scores, because it primarily measures the effect of CEO serving on other boards. The measure is not significant, and most CEOs have a low score. Hence most of the centrality measures are likely to only reflect the board characteristics. For instance, degree is to a large extent only a reflection of the board size, which can explain why degree is insignificant when the same is true for board size. Lastly, the correlation matrix also shows a positive significant relationship eigenvector and board characteristics, which indicate that the two variables are connected.

The negative parameter of the eigenvector centrality makes sense, given that the explanation in the last paragraph is true. If the CEO's main source of social capital arises from the power of the directors, then the CEO has a low power compared to the board.

Incomplete network

The problem may not be the variable or measures in itself, but rather the data it is based on. The network constructed by the board may not be large enough to capture the effects the different measures represent. If so this could be an even bigger problem in the latter years, as there are fewer PLC s relative to LCs and thus numerous boards not captured by the board data.

When looking at the raw (non-normalized) scores for closeness in 2006, actors have closeness scores below 1 if they're not among the directors connected in the biggest component. The directors that are connected to the biggest component, on the other hand, roughly have a value between 100 and 1100. Hence, the score is drastically increased if an actor is connected to the biggest component, which only requires a single connection to one of the directors in the component. That may be an issue, as the network included in this paper only is a sample of real total director network, as only public limited liability companies are included. In reality, several firms not connected to the biggest component are actually connected to the at least one director that are connected to the biggest component.

One example that perfectly illustrates the problem with the incomplete network, is that all of Cecilie Fredriksen's (26) centrality scores are larger than her father's, John Fredriksen (65) scores in 2009 and 2010. The latter is one of the richest businessmen ever born in Norway, has invested in several Norwegian companies and has obviously a larger social capital in Norway than his talented, but far younger daughter.

The conclusion is that centrality measures should be based on more data than PLCs, and possibly capture past ties as well. As of now, the SNA measures are likely to be invalid, as they are more a reflection of the board characteristics than the social capital of the CEO. The board is indeed a part of the CEOs' social capital, but it's likely to not be representative of their true social capital.

3.3.3 Ownership

CEO ownership

The results show that the ownership of the CEO is negatively associated with executive pay. This is in contrast to managerial power theory, but consistent with agency theory. One possible interpretation is that increased ownership in itself doesn't provide the CEO with enough power to influence the board, as a big ownership is required in order to influence decisions that are not aligned with the other shareholders. Another reason may be that the CEOs incentives are better aligned with the shareholders' and thus they extract less rent.

CEOs may have incentives to keep their compensation low if their ownerships are high. The reason is that their compensation may have a dripple down effect, which would increase the compensation of all other

executives or even employees. Hence, the lower compensation may lead to bigger profits and thus bigger dividends.

Biggest owner

The ownership of the biggest shareholder is also negatively associated with executive pay. This result, however, is consistent with managerial power hypothesis, as shareholders with at least 5% ownership have incentives to lower the executive compensation. In a large portion of the observations, the biggest owners have an ownership fraction higher than 5%.

3.3.4 CEO characteristics

Both age and tenure was overall found to be not significant. This is in contrast to human capital theory and managerial power hypothesis. However, the results are not so surprising considering both age and tenure have been found to be insignificant in several other studies. For instance, Randøy and Skalpe (2007) found no correlation between tenure and executive compensation.

The results can be interpreted as power arising from human capital not affecting the control over the board, or that more skills are not significantly rewarded. Another interpretation may be that CEOs that are hired from outside the firm are rewarded higher compensation as the companies require a higher compensation to attract the best talents. This effect may be even stronger if contract negotiations are started after the CEO has been chosen, and thus giving the CEO a great bargaining position.

Another reason may be that the variables arising from the homogenous pool of CEOs lead to variables that are hard to get significant. For instance, using months instead of years may be a better variable for tenure. There is not a lot of difference whether tenure is 200 months or 210 months. For a new CEO, however, there actually may be a significant difference between 5 months and 15 months.

3.3.5 Size of firm

As expected, size of firm was significant. Not only was it significant, but also the most consistently significant variable. The results are consistent with both managerial power hypothesis and theories like agency theory. There is no reason to believe that the consistent results are wrong, as the significance of the variable is strongly supported in the literature.

3.3.6 Firm performance

ROA and TR were both found to be not significant with total compensation. This is consistent with the finding of KLP (2013). No significant relationship between performance and executive pay is also consistent with managerial power theory, as the Bebchuk et al (2002) claim that CEOs are trying to decoupled their pay from performance. Agency theory would predict a significant relationship between performance and pay, which means that managerial power can in this case explain an aspect of executive pay that agency theory can't.

Other possible explanations may be that firms want to keep their CEO during troublesome times, as the results may be even worse if the CEO isn't as highly skilled. Several CEOs where changed after the financial crisis, which may indicate that this theory is not true. Another possible explanation for the result may be that the impact of the financial crisis and the new guidelines from 2007 that encouraged a larger fraction of fixed pay and no exercise of new options may also influence the results. Hence, the increase in fixed salary may not be due to managerial power, but due to government guidelines. KLP (2013) conducted the research over a longer sample period, hence reducing the relative influence of the financial crisis. As the performance also was found to not have a significant relationship with pay, the results in this paper may be representative for years prior or after the years included in the sample.

3.3.7 Dummy variables

The industry dummy was as expected significant. Different industries may have different capital structures and guidelines when it comes to executive compensation. A further discussion regarding this variable is not that interesting, as it can represent many different factors.

The dummy for years was overall found to not be significant. The impact of the financial crisis as well as public outrage regarding executive compensation can explain reasons for the dummy variable not being significant.

3.4 Reject or accept the hypotheses?

This subchapter assess whether the hypotheses should be rejected or not.

3.4.1 First hypothesis

$H_{0,1}$: Measures of connectedness have no significant impact on executive compensation.
$H_{1,1}$: At least one of the measures of connectedness have a significant impact on executive compensation in the direction proposed by managerial power hypothesis.

One of the centrality measures has a significant effect, but not in the direction proposed by managerial power hypothesis. Hence, as of now there is not enough evidence to reject the null hypothesis, but further investigation with better network data is required and encouraged.

3.4.2 Second hypothesis

$H_{0,2}$: Proxies for the power have no significant effect on executive compensation.
$H_{1,2}$: At least one of the proxies for the power have significant effects on executive compensation in the direction proposed by managerial power hypothesis.

There are several proxies for power that have a significant effect on executive compensation in the direction proposed by managerial power hypothesis. The most important result that rejects this hypothesis

is that firm performance is found to be insignificant, as this results is not explained by agency theory. The impact of the biggest owner is another important proxy.

3.5 Robustness tests

This subchapter introduces various tests to increase the robustness of the results. The tables for results conducted in this subchapter are enclosed in the appendix.

Other variables: One way to test whether the results for firm performance are correct is to use ROE as a new proxy for firm performance. The conclusion is that ROE provides the same results, i.e. insignificant, and thus the results concerning the link between performance and pay is more robust.

Other method: Linear mixed models with fixed effects are utilized to control the results. The linear mixed model returns results that are consistent with the main analysis.

Trim sample: There are few observations that may skew the CEO ownership variable. For instance, there are a few observations with a very high ownership (Bjørn Kjøs for all year and Ole Eirik Lerøy in 2006 and 2007). Even when excluding these observations, the results remain the same. The results are also consistent with the main analysis when possible outliers for compensation are removed.

Internal validity: The dataset from KLP (2013) is compared to data from Hagen and Weltz (2014), and the data that are comparable are similar. The SNA measures were also checked. For instance the adjacency matrix was found to have a total of each row (the total number of boards all actors are serving on) that is equal to the total of each column (sum the number of members all board have). Moreover, the number of actors are the same as before the transformation from 2-mode to 1-mode. The number of actors after the centrality measures have been calculated is also the same.

4.0 CONCLUSION

The chapter concluded the findings in the paper. The weaknesses of this study and suggested topics for further research are also presented.

4.1 Conclusion

This thesis has evaluated the managerial power hypothesis in a Norwegian context. General estimation equations (GEE) is used a sample of the biggest firms on Oslo Stock Exchange. The sample spans over 5 years and consist of 112 complete observations.

One of the measures of managerial power is using social network theory where the extent of the CEO's social network is represented by measures of the degree of connections through board positions. These measures are called centrality measures. However, these measures were not found to be significantly associated with executive compensation. Other proxies for managerial power, like ownership fraction of the biggest owner and the non-existing relationship between firm performance and executive pay, were found to be significantly associated with executive pay. The robustness tests were also consistent with the main analysis.

The various factors influencing executive compensation is complex, and one model is not sufficient to fully explain all – especially across different countries in which there are different laws and cultures. However, as this paper finds, managerial power hypothesis contribute to explaining some aspects of the executive compensation. The conclusion is that managerial power should be taken into consideration when analyzing and constructing pay contracts, but used as a supplement to other preexisting theories, as the theory can't explain all aspect of executive compensation.

This thesis has several contributions. SNA is introduced to corporate governance, and despite the results were inconclusive, the method of SNA opens up a broad number of interesting topics (see further research). This thesis also contributes by merging different field by being in the intersection between corporate governance (economics and law) with sociology (social network analysis). There are other papers that indirectly or partially test the managerial power hypothesis in Norway, but this is first paper that exclusively and more thoroughly tests the theory.

Due to limited sample the results cannot be reliably generalized.

4.2 Weaknesses of this study

There are some weaknesses of this study that should be highlighted:

- When reading through annual reports to add board data not present in the data from BRREG, it was evident that a large portion of the directors also served as directors at other AS. Hence, in a further study, AS should also be taken into consideration.

- Pay-for-performance is an important aspect of managerial power, but is not thoroughly captured in this thesis. Other weaknesses are that interaction terms are omitted, as well as no test regarding a possible simultaneous causality between power and pay. There is also no control for the difference between private and government-owned companies.

- The sample and time period is rather small compared to most other studies on managerial power hypothesis. The study should be replicated on a larger sample over a longer time span to validate the results.

4.3 Further research

The implications of this paper lead to several possible topics that can be examined. This subchapter is only intended as a brief overview of possible further research.

4.3.1 Research related to SNA

- Further research should **expand the CEO network**. There are especially two areas in which the CEO network should be improved: Taking ties from former years into consideration and including all types of corporation, not just public limited companies. This approach however, would significantly increase the time required to calculate both the adjacency matrices and centrality measures.

- Further research should dig deeper into research question related to **communities**, especially large components. In the context of managerial power, a possible perspective could be to identify communities emerging between firms that are connected through interlocked boards. Another topic of interest might be to investigate whether subgroups of connected firms overpay their CEOs.

- **Tie strength** is omitted from this paper, but can be implemented in further studies by including more attributes to each actor. This additional data can be utilized to investigate aspects that, according to the theory of homophily, positively affect the likelihood of two actors having a stronger tie. The more similar attributes, the higher likelihood of strong tie. Such attributes may include similar university background, city, age, social background, political preferences, military background, type of degree, common club memberships or other spare time activities, race and gender. Geographical proximity, frequency of communication and costs/benefits of forming and maintaining the tie are also factors that influence the strength of bonds. Moreover, mutual ties between actors (embeddedness) and cliques can indicate a stronger bond between the actors, but it is not certain.

The approach doesn't capture that some actors may be better at forming stronger bounds, and it is also likely that actors with more bounds have less opportunity to devote energy and time to maintain and

strengthen each bond. Moreover, some of the attributes may rather capture attributes that make actors more valuable (e.g. same industry) – not that they have a stronger bond. Still, the approach should provide researchers with valuable results – even if the shortcomings are not addressed.

- Identify the direction of the correlations between connectedness and executive compensation. This would indicate whether managerial power actually reflects that the **power is regarded as a resource and thus rewarded.** One suggested approach to research this topic would be to measure whether redundant ties are rewarded or not.

- This paper assumes the CEO to form links with directors at their own firm. Creating networks without this assumption, i.e. the only network that is captured are the network derived by outside directorships. Another interesting approach would be the assumption that the CEO require at least in one year of tenure in order to properly form links with directors at their own firm.

- Linear combinations of centrality measure could give interesting insight, e.g. degree*(λ-1) + eigenvector*λ. Although centrality measures somewhat overlap, they capture different aspect of power, and thus linear combinations of these measures can capture the total effect of the CEO network.

4.3.2 Research related to data and variables

- **Pay for performance sensitivity** is an important aspect in the managerial power hypothesis. There are numerous ways to review this topic. Kim and Lu (2011, p. 503) utilize a pay-for-performance model which includes both a proxy for executive power and an interaction term between CEO power and the increase in shareholder value (performance). The model is excellent as a foundation for further studies (eq. 16):

$$\begin{aligned}\Delta \text{ Total compensation}_{it} = {} & \beta + \beta_1 \Delta \text{ Shareholder value}_{it} \\ & + \beta_2 \Delta \text{ Shareholder value}_{it} \text{ x CEO\_Poweri}_{t-1} \\ & + \beta_3 \text{CEO\_Power}_{it-1} \\ & + \beta_{24} \Delta \text{ Shareholder value}_{it} \text{ x Control variables}_{ijt-1} \\ & + \beta_{25} \Delta \text{ Shareholder value}_{it} \text{ x Control variables}_{ijt-1} \\ & + \beta_6 \Delta \text{ Shareholder value}_{it} \text{ x Control variables}_{ijt-1} \\ & + \beta_7 \text{ control variables}_{ijt-1} + \beta_8 \text{ control variables}_{ijt-1} + + \beta_9 \text{ control variables}_{ijt-1} \\ & + \text{Firm}_i \text{ or (Industry}_i) + \text{Year}_t + \varepsilon_{it}\end{aligned}$$

- The transparency of pay schemes can be expected to increase in the future. This will provide access to better data quality on compensation packages, which can be utilized to collect data on executive compensation faster. This will allow researcher to include more variables. Another interesting topic would be to **compare the performance of CEOs with less restricted options to CEO with restricted or no options at all**. Problem med å bruke opsjoner…In general it is fair to expect a larger premium given the higher risk, but unrestricted options is a piotensial issue::: Every option is not the same. Even though managerial power theory reveal issue with options in general, it options in itself that is the biggest issue.

The issue is for instance no roof, repricing and that options should be indexed or compared to peer firms. Hence,

- A possible problem with tenure variable used in this paper is that there is little variation in tenure. A solution may be to include the exact number of months instead of years or some kind of **transformation** of the data. The same problem be highlighted about age, as the CEOs are a rather homogeneous group.

- Test **different samples size**. So far, collecting reliable data on executive compensation is time consuming, and hence smaller samples are often utilized. … On the other side, testing more unrealiable data could still provide valuebale information if tested on a large sample over a large time period. Executive accounting data can be extracted from data providers as Proff Forvalt, and thus a larger dataset can more quickly be constructed. More transparency is expected in a future, as well as better services for extracting large samples with different type of relevant data (ownership, market data, options). One way to include more time consuming proxies, is to use a smaller sample size in order to reduce the time to collect data. The opposite can also be suggest, large sample only with included proxies that are quick to collect.. The most interesting results would be significant results more unusual proxies like connectedness or antitakeover protection.

- **Experimenting with variables and data not included** in this or other paper would lead to new insights. For instance, antitakeover protection, for instance, is rarely even mentioned in papers discussing managerial power. It would be interesting to investigate this issue further, and finding one or more proper proxies would help the investigation of the managerial power approach. Furthermore, risk adjusted pay and realized value of options (see Murphy, 2012) would provide a different perspective and maybe even drastically different results.

- The ideal (though unrealistic) situation would be to **measure the combined synergy effects** of all (or at least most) of the power proxies. However, interpreting the result would prove difficult, and possibly hundreds - if not thousands - of observations would be required to avoid overfitting the model. Still, even interaction between only two power proxies should give some new insights - especially if the power proxies are found to be significant when the interaction term is not included.

- Including more power variables that capture **relative power** would prove valuable**.** One suggested proxy would be the difference or ratio between the connectedness of the CEO in relation to the chairman. Comparing ownership fractions is another proxy that should be investigated.

- Related to the last three paragraphs is the task to thoroughly test, derive and include all variable that **captures all relevant types of power.** Proponent of managerial power have been criticize for not accepting results conflicting with the theory, and often the proponent of the theory argue that other variables not included in the model (for instance antitakeover protection) affected the outcome (Winter and Michels', 2012). Hence, the theory is almost unfalsifiable. But by included all types of power, that

argument can't be made. Collecting the data and finding may be very difficult and time consuming, though. Other relevant effects, like competition to land the best talents should also be controlled for. One way to estimate the latter effect is by analyzing the differences in executive among CEOs that are hired from within the firm versus CEOs hired from outside the firm.

- Measure how proxies for power and pay-for-performance sensitivity are **affected by amendments**. One recent study utilizing this method is Raaholt and Lines (2015). They compare executive salaries 3 years prior to and 3 years after the gender equality law.

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6.0 APPENDIX I: POWER

How power is to be measured in empirical literature on managerial power is disputed. This chapter suggests how to measure power in terms of managerial power. Because power is a broad concept that initially is immeasurable, proxy variables (variables that are assumed to be closely correlated to the variable of interest) are needed to estimate power. The proxies presented are either common in literature on power, like the power measures presented by Hengartner (2006), or proxies based on factors Bebchuk et al. (2002) acknowledge as sources for power (subsection 1.1.5). As most of the suggested proxies have advantages and disadvantages, a short discussion is necessary to explain whether or not a proxy is included in the panel data model. Many proxies that otherwise are suited in the analysis of managerial power, are omitted from the panel data model due to a time consuming data collecting process or a lack of available data. Moreover, proxies (or variables) that may seem to have a small effect on managerial power due to few observations may still have a compounded effect. The reason is that a few companies can drive the salaries up, and thus other companies will follow.

A whole subchapter is devoted to this topic, as there are several aspects of the social networks, like assumptions, simplifications and properties, that need elaboration. This subchapter represents the most unique contribution of this paper, and thus a more comprehensive presentation of SNA is required. Moreover, the subchapter presents the measures utilized to measure the power arising from holding advantageous position in the network. A subchapter is also devoted to the value of interlocked boards.

6.1.1 How to measure managerial power

A deeper understanding of the concept of power is crucial in order to properly measure managerial power. This subchapter forms the foundation for creating proxies utilized to measure different aspects of managerial power. First, an appropriate definition of power in the context of this paper is presented. Then, short discussions regarding how to measure power and how to account for power exertion is presented. With these assumptions in mind, sources for power derived from literature on power or managerial power theory are presented. These sources of power are utilized to create proxies.

Definition of power

Defining power is not a straightforward task, as there is no universally appropriate definition:

"[…]*researchers on power theory agree that there is no single definition or conceptual approach to power that is universally appropriate and that the sources and uses of power are fundamentally shaped by the general context and particular features of the setting in which those power sources accumulate" (Pettigrew and McNulty, 1998, rendered in Hengratner 2006, p. 94).*

A source of power in one context may not matter in other contexts. Therefore the concept of power presented in this paper is tailored to the specific situation of executive power. Emerson (1962) conveys that power is not so much a property of an individual as it is a property of a relation between two

individuals. Thus it makes more sense to study the conditions under which one person has power over another, rather than simply asserting that a particular person is powerful. There are, however, some general definitions of power that are used as a basis for further discussion. Max Weber (1978, p. 53) defined power as *"the probability that one actor within a social relationship will be in a position to carry out his own will despite resistance"*. Quite similar, Dahl (1957, p. 202) defines power as *"A has power over B to the extent that he can get B to do something that B would not otherwise do."* Lastly, Finkelstein (1992) defines power more specifically in managerial power context as *"capacity of individual actors to exert their will" (Finkelstein, 1992 p. 506)*. The latter definition is chosen as appropriate in the context of this paper.

Note the distinction that power is the opportunity (potential) someone has to exert their will – not how much influence they exert. Power can be exerted from or upon a group, community or even larger groups/systems. This context concerns the power struggle between the CEO and the board of directors.

6.1.2 Quantifying power in managerial power context

Power is multifaceted, which makes no proxy likely to entirely capture all dimensions of power. Moreover, it is difficult to account for all factors that may influence the level of power a CEO has. Another important factor may also be synergy effects when the CEO holds different sources of power. Hence, possible important variables that are not included in the panel data model must ideally be found to be negligible (not significant). That is, however, impossible to research in projects with the same scope as the panel data model, and is a weakness that must be accepted. Most important is that the unobservable variables are captured by the error term and not as a bias.

6.1.3 Accounting for power exertion

The model presented in this paper doesn't capture the amount of power exerted, as there are obviously no data available on power exertion in the bargaining process. However, power exertion can still be somewhat accounted for. Under stewardship theory, CEOs' primarily desires are to do a good job and, when left on their own, act responsible regarding the corporate assets they control (Donaldson, 1990; Donaldson and Davis, 1994). In contrast to agency theory, there is no inherent, general problem of executive motivation, as they are motivated by intrinsic rewards. Also, the authors argue that agency costs naturally would be minimized, as managers desire to protect their reputations and thus wouldn't want to risk losing face by abusing their power at the expense of the shareholders.

However, the stewardship theory "[…] *has never been tested empirically to directly explain executive compensation or been used as an underlying theory"* (Hengartner, 2006 p. 35). These arguments are not enough to reject the theory, but give reasons to assume that managers are not fully self-motivated. Also, even though there are likely to be instances of self-motivated CEOs, there would be considerably less presence of large monetary incentives (external motivation) in the industry if CEOs generally were self-driven (intrinsic motivated) and more motivated by other less costly incentives. The managers' behavior and moral compasses are more complex than agent theory predicts, but the problem is that the compensation practices encourage

opportunistic behavior. Hence, it is reasonable to assume that actors on average exert some power – i.e. the power exertion variable is positive. How or how much power is exerted isn't accounted for, only that some power is assumed to be exerted. Thus, quantifying exactly how much rents managerial power can extract won't be possible due to the uncertainty of the exertion variable. However, this paper only seeks to capture if the managerial power theory holds – not how powerful it is - and thus the simplification is acceptable.

6.1.4 Bases and types of power

There are different resources A can employ to influence B. French and Raven (1959) defined five general bases of power:

Base of power	Description
Reward power	Ability to reward others for compliance. A typical reward is money.
Coercive power	Ability to punish for non-compliance.
Legitimate power	A formal right to demand compliance, for instance due to social hierarchy, cultural norm or organizational structure.
Expert power	Ability to influence others based on knowledge, skills and experience.
Referent power	Influencing followers by being well liked, admired, trusted, respected and/or others identifying with that person. The follower may desire to gain approval.

Table: The five bases of power - French and Raven (1959)

Power can be overt (not hidden) or covert (others being influenced subconsciously). The three former sources of power arise from position (i.e. formal power) and are **overt**, while the two latter sources are more **covert** and arise from the actor (i.e. personal power). Legitimate power, and to some extent reward and coercive power, can be lost, whereas referent and expert power are more individual characteristics that stay with the actor no matter context or position. How much power B perceives A to hold, is what determines A's ability to influence B. Perceived willingness to exert power is equally important.

In a later paper, Raven (1965) also introduced a sixth source of power: **Information**. This source of power can also be lost, as some information is only valuable if kept as a secret. However, new information can alter behavior, and thus can represent power even if it is not kept secret. Being able to control, manipulate or access important information are such sources of power.

The recipient, the one that the power is acted upon, may allow for more or less power exertion, which in the context of managerial power is an important factor. The relative power of CEO vis-à-vis the board must be considered. A less powerful CEO may extract more rents than a more powerful CEO if the relative power of the CEO compared to the board is larger in the first case. This aspect is often overlooked, as only the absolute power – not the relative power – of the CEO is measured.

Similarly with the definition of power, general sources and types of power are not designed specifically to the managerial power context. However, some inferences concerning managerial power can be drawn from the theory present by French and Raven (1959) and Raven (1965):
- Legitimate power: The actors gain legitimate power from the formal positions they hold within the firm. Standing on top of the organizational hierarchy, the CEO will be the single actor that holds most legitimate power within the firm.
- Reward and coercive power: The CEO has little power to reward or punish board members without substantial support or being a major shareholder (see subchapter 1.5.2). Major shareholders have the power to exert control over decisions and management - either through their voting power, representation on the board, or both. Higher ownership levels of others than the CEO increase the pressure to monitor the CEO, and thus increasing the probability to punish the CEO if performance is not up to par. Hence, ownership fractions can indicate relative power of the CEO compared to the board (shareholders).
- Expert power: Experience, skills and knowledge is highly related to human capital. Factors possibly include education, tenure and age.
- Referent power: Interpersonal relationships determine referent power. Sources of power are personal characteristics as integrity and charisma, which are currently impossible to measure in a large network. Actors with a large social network can indicate charisma and likeability, but is likely to be implausible as popularity is also caused by other factors than sources of referent power. For instance, popularity can arise from being able to provide others with benefits or rewards, and does not measure the quality (strength) of the connections – only the quantity and thus only perceived popularity (Cillessen and Rose, 2005).
- Information power: All CEOs have the ability to withhold and manipulate information, only constrained by the board's ability to monitor the CEO. Also, the ability to gain/spread information from/to other outside sources increases the power of the manager.

Finkelstein (1992) emphasize that even though the understanding of power has evolved, the frameworks for analysis of power were not specifically developed for the context of managers. Even more important, research on power also lacks a proper way to measure the concept. Finkelstein narrows down the concept of power to a managerial perspective, and proposes four power dimensions that capture the multidimensional nature of power. Each dimension includes objective indicators of power that can be empirical tested. Hengartner (2006) builds upon the work of Finkelstein (1992) by omitting and including proxies that are best supported in recent studies on managerial power. He proposes five dimensions of power, each with a set of unique proxies:

Power Dimension	**Proxies**
Ownership power	- Executive and non-executive ownership fractions - Shareholder concentration
Strcutural power	- Presence of CEO duality - Board composition - independent and non-executive directors

	- Presence and composition of compensation committee - Board size
Tenure power	- CEO tenure - Directors appointed during the current CEO's tenure - interdependent directors
Network power	- Interlocking directorships - Outside board memberships
Credibility power	- Prior performance - Education - CEO celebrity status

Table: Conceptual model of executive power and compensation - Hengartner (2006)

These dimension are consistent with the view presented in subsection 1.1.5 , as the proxies also involve factors influencing the boards' ability to monitor the CEO or shareholders' power and incentives to influence the managers' rent extraction. Not all proxies and dimension are possible to be included in the panel data model, but can be tested in further studies.

6.2 Proxies for power

With the discussions of the last subchapter in mind, common proxies for power are evaluated in this subchapter. Including all proxies presented in the model is assumed to require too much effort, and thus only a handful of the proxies are suggested to be included. The included proxies must utilize data that can be easily collected and implemented in panel data model, but at the same time be supported in literature regarding managerial power. Furthermore, the validity and reliability of the proxies are important. Hence, data must be collected from sources that are reliable, and the proxies chosen must be regarded as valid. If the model is tested in other countries than Norway, the recommended proxies are likely to be changed.

6.2.1 Proxies that are intuitively neglected

CEO duality: By having a position as a CEO and chair of board of CEO duality, the CEO may have considerable power over his or her board. However, as was mentioned in subchapter 1.6, CEO duality is not allowed in Norway, and thus, other types measurements have to be used.

The number of subordinates: Eriksson (2012) uses the number of subordinates as a measure for power, but the number of subordinates is likely to be too correlated with the size of the firm, and thus influenced by the positive correlation between CEO pay and size of firm.

6.2.2 Proxies that lack data, are hard to measure or time consuming to collect

These proxies are not included in the panel data model, but some of them are highlighted as important and thus should be controlled for later. Education and social ties not derived from board data are example

of such data. Some of the data are even impossible to acquire, like a complete overview over the shareholders. These proxies could, and arguably should, be implemented in a further work if possible, as these proxies either have been proposed by the managerial power hypothesis or have been found to be significant in different studies.

Antitakeover protection: Also a power factor proposed by Bebchuk et al (2002), protection by antitakeover arrangements could have been a suitable proxy. How to control for, find or even measure antitakeover protection is difficult, and thus literature on managerial power has yet to properly test empirically for this factor.

Independence of the board: Independent directors are important in order to ensure that the board makes decisions that are in the shareholders' and firm's best interests. Less independent directors may be swayed by executives, and are more likely to experience situations in which they have a direct or indirect interest which conflicts with the interests of the company. However, independency is not necessarily essential in order to maximize the shareholders' value. *"Social connections with members of a board can allow for better evaluation of the members' abilities"* (Subrahmanyam, 2008, p 1). Thus, recruiting directors from the CEO's and directors' professional networks may provide the board with a better evaluation of the candidates. Furthermore, firm specific tasks and responsibilities besides contracting are often best fulfilled by executive (inside) directors (Core, Guay and Thomas, 2005). Hence, if boards are optimized for designing compensation packages, the total shareholder value may actually decrease due to bad decisions on other more essential tasks. Finally, Smith (2009) presents a survey on the inconclusive findings in existing literature regarding the association between board independence and firm performance. Still, a majority of the board is preferred to be independent.

Outside directors - directors who don't serve as executives in the firm - are considered more objective, and the norm is that these directors provide CEOs with more reasonable compensation. They are less likely to have a social bond with the CEO, and they are less likely to be affected by the outcomes of their decisions. Hengartner (2006), among others, have found that board consisting of only non-executive directors decrease the CEO pay. However, list of executive directors are not available without additional research and thus must be omitted. Moreover, outside directors appointed during the current CEO's tenure (interdependent directors) are omitted for the same reason.

Even with access to data on executive directors, proper board independence is hard to measure. Huse (2010) provides insight on the independence of directorships in Norway: *"In accordance with Norwegian traditions and Norwegian corporate law, all board members are initially obliged to be independent."* However, the author emphasize that the independence of board members are vaguely defined, and identifying whether an actor is physically and financially independent of another actor is difficult. He state that *"[t]here are many examples of both family members and staff being more independent of management than people who do not have a clear relationship to management" (*Huse, 2010 Moreover, the author suggest that "*[i]ndependence is linked to individual characteristics*

and integrity more than formal relationships." Integrity and individual characteristics are even harder to measure and account for, and thus measuring true independence requires more comprehensive data.

Furthermore, with whom the director identifies himself or herself with also influence independence (Huse, 2010). The person or group that recruited the director often determines who the actor identifies with and works on behalf of. Considering half of the new directors in PLCs are still recruited on the basis of the CEO's and directors' professional network (Huse 2007, p. 106), it is evident that independence is a misleading term. This is supported by Hwang and Kim (2009) who presented a more comprehensive way to measure board independence, and concluded that fewer directors should be considered as independent when social ties (e.g. similar education or background) are taken into account. The socially dependent boards, i.e. boards with outside directors that share social ties with the CEO, offer higher pay levels to their CEOs. Thus, a measure of board independence by looking at outside directors is likely to be inadequate when only utilizing board data.

Double independence (directors also being independent of individual shareholders, especially major shareholders) is another dimension of independence that shouldn't be overlooked. Although, not required by the Norwegian Public Limited Liability Companies Act, Oslo stock exchange (Oslo stock exchange, 2011) required from 2011 that "*[a]t least two of the shareholder-elected directors shall be independent of the company's executive management, major business associations and major shareholders.*" Hence, the lack of double independence may be an issue during the years investigated. Moreover, with no data to connect major shareholders to directors, yet another facet of independence is lost. If a proxy for board independence is to be utilized, the variable must be valid and reliable. As the last paragraphs have revealed, this may very well not be the case with the most common proxies. Board independence is therefore omitted, due to lack of data on outside or inside directors, and uncertainty regarding the validity and reliability of the proxies.

Human capital: The pay is expected to be positively associated with human capital, as an increased human capital is expected to increase the firm performance. Skills and abilities are hard to objectively capture. Education at the best universities may also gain access to alumni groups and other benefits, but the effect is assumed to be less prevalent in Norway than in the US with its highly prestigious elite universities that focus on networking and status. However, some aspects of human capital can be captured by other proxies: *"Human capital is converted, at least in part, into social capital"* (Horton et al., 2012 p. 7). Furthermore, the authors emphasize that *[…] by focusing on the social networks in which people are embedded at given points in time, we capture the social capital manifestation of both human and social dimensions."* Thus, by including social capital, human capital is captured to some degree, although they are not identical. Longer tenure and higher age can also indicate a higher human capital.

Foreign directors: Used to the compensations landscape from their own country, foreign directors are said to be more willingly to accept a high CEO compensation. Especially Anglo-American board members have been shown (Oxelheim and Randøy (2005); Hengartner (2006)) to be of interest. Randoey and

Skalpe (2007) found a positive correlation between the presence of at least one Anglo-Americans and higher CEO pay. However, directors with names that seem foreign don't necessarily mean that the directors aren't Norwegian, which will lead to additional research. There are a small number of foreign directors, and thus this factor is ignored as of now.

Presence and composition of compensation committees: According to managerial power hypothesis, compensation committees are utilized as a justification for CEO pay. 76% of listed companies in Norway use compensation committee (Randøy and Skalpe, 2010). The compensation committee is a subgroup of the board of directors, but may also consist of other outside directors that may specialize in compensation. Statoil states that: *"The committee shall consist of up to four directors who each have no links that the board considers may affect member independent assessment." (Statoil, 2013 p. 2).* Other firms may have other rules. The independent directors in the compensation committees should contribute to better governance, and may reduce rent extraction.

Conyon and He (2004) found no evidence that insiders or CEOs of other firms serving on the compensation committee raise the level of CEO pay or lower CEO incentives. In a later study, Conyon (2007) found that compensations committees help reduce the growth in executive compensation. Renneboog and Zhao (2011), however, find that compensation consultants with sizeable client networks lead to higher CEO compensation - especially for larger firms. The composition of the compensation committee is also relevant (e.g one or more members of the compensation committee also serves as a CEO in another company). Either way, both of these factors need additional research, and are thus not suited for this paper. Still, they are important, and should be considered, if possible, in a further study.

Other proxies: There are other proxies proposed by *Hengartner (2006)* that are omitted. CEO celebrity status is a vague term and hard to measure, and is thus omitted. Furthermore, prior performance is intuitively an important proxy, but too time consuming to collect and measure.

6.2.3 Proxies that are likely to be less important, but still are included

Some sources of power that Bebchuk et al. (2002) mention are likely to be less prevalent in Norway due to Norwegian board characteristics or restrictions, but may still be significant. These variables are quickly implemented in the model due data availability and thus included.

Size of board: Larger boards may be harder to influence for outside directors, and high coordination costs associated with larger boards are arguments for why the size of the board must be limited for effective decision-making. Jensen (1993) claims that when the board size goes beyond seven or eight directors, the board is less likely to function effectively and is easier for the CEO to control. Directors feel less individual responsibility when the board size increase (Golden and Zajac, 2001). Larger boards also give actors less time for individual contribution during meetings. Thus free riding behavior is more likely in larger boards (Golden and Zajac, 2001).

Boards in Norway are generally smaller. The average board size in The U.S. in 2005 was 9,33 actors (Subrhamanan, 2008), but only 5,22 actors on Norwegian publicly limited companies the same year (Brønnøysundregisteret, 2013). Thus the effect of size of board is likely to be less important in Norway. However, as the variable is swiftly calculated from the available data, it is included. Even more important is that the variable may be highly correlated with some of the network measures: If a CEO doesn't serve on other boards, the number of direct links this actor has equals the size of the board minus one. As a consequence, the variable must be controlled for this potential issue. If the variables are too highly correlated, one of the variables needs to be omitted - most likely. Number of direct connections should then be omitted, as there are several other measures of connectedness

Directors serving on other boards (busy directors): Boards with directors who serve on three or more other boards—giving them less time and energy to devote to the problems of any one company—have CEOs with higher pay, all other things being equal (Core et. al, 1999). Serving on other boards may also lead to access to actors in the CEOs' social circle, and thus the directors can have a disinclination to monitor CEOs because they wish to preserve their social capital.

While there definitely are some directors in the data set that serve on at least three boards, it is likely that the effect is not as significant as in other the US. In the dataset for 2012, there were 58 directors that served on at least three other PLC boards. There were a total of 338 publicly listed companies that year. However, as this variable is quite easy to implement in the model, it is included.

Active CEOs serving as directors on outside boards: O'Reilly et al (1988) and Fahlenbrach et al (2010) suggest that active CEOs serving as directors might lead to increased CEO compensation. Firstly, being a CEO consumes a lot of time and effort, thus being fully committed to the work as a director is not always possible. Moreover, an executive director may benefit from the CEO being granted a higher pay, as a higher average executive pay in the industry may positively affect the pay of executive director in his or her own firm due to compensation benchmarking. Also, the executive director has been in a similar negotiation process and may sympathize with the CEO (social comparison). The database on Norwegian companies for 2012 lists 37 CEOs as serving on other boards. One consideration that must be controlled for is that some of the 37 CEOs may serve on boards in firms that are subsidiaries of the firms they manage.

Age of the CEO: Due to a greater expected number of years employed, increased age suggests that the director or CEO is more knowledgeable and experienced. Tenure is a better proxy for determining the specific human capital, as it measures number of years in the same role and industry, but age as a proxy is easier to collect and thus included. Several studies link CEO age to the level of compensation (David et al., 1998; Conyon and Murphy, 2000; Hallock, 1997), which indicates that the proxy can be useful.

6.2.4 Main proxy

This last proxy is regarded as the main proxy in the panel data model, due to its uniqueness and thus contribution to the field of research. It has support in literature, but is less researched. One drawback is that collecting observations to the proxy is more time consuming than the other included proxies in the panel data model. Hence, the proxy should only be excluded from the panel data model if collecting as many observations in the shortest amount of time is the top priority.

Social capital: Most proxies don't capture that actors are interdependent of each other, i.e. how a system or actors may influence an actor and how an actor may influence a system or other actors. Social capital, defined in this paper as resources and benefits deriving from social connections and network structure, captures this effect. Brown et al. (2009) find that the size of the CEO network is positively associated to the level of CEO pay and inversely correlated to its performance sensitivity. Moreover, Hengartner (2006, p. 94) claim that *"[…] potentially important sources of power such as interlocking directorates have received very little attention."*

Another source of power arising from social capital is related to the famous article by Granovetter (1973) on the strength of weak ties. According to the author, an actor is more likely to get job offers from acquaintances (weak ties) – not from close friends. The reason is that acquaintances have access to other parts of the network and thus receive information that is more unique. Hence, a CEO with a diverse and big network has potentially a better bargaining position due to the option to resign (other job offers).

There are several possible ways of capturing social capital. This paper will primarily focus on the most recommended methodology called social network analysis (SNA), as it is superior to capture different aspects of social capital. The biggest advantage of SNA is that it also captures the underlying structure of a social network. Previous literature on managerial power using social network as a proxy for power, fixate mostly on the number of network ties or the number of ties linked to a specified subgroup, e.g. university contacts. Social network analysis can measure the number of ties, but also allows for a much more complex analysis that captures the power of an individual in terms of connectedness. Connectedness tells how important a given actor is in the network – which is not necessarily the actors with the most direct links. The value of being connected to central actors is taken into account, which is a more precise representation of the real world. Lastly, SNA can also indicate if a director is likely to actually be independent of the CEO or not by looking at triadic closures. However, such type of analysis requires data that capture tie strength, and is thus not going to be addressed in this paper.

6.3 Social network analysis (SNA)

This subchapter presents the methodical framework of social network analysis (SNA). The methodology is not so common in literature, and thus more information is required to highlight the limitations and opportunities of SNA. This subchapter also To provide some context, SNA is introduced by a more general introduction to social network theory. The next subsection is devoted to discuss the implication of choosing board data as the data source for measuring social capital, as this is the recommended source.

The choice of data source also dictates the network properties and the type (mode) of network, and is thus addressed in the next two subsequent subsections. Finally, after highlighting the necessary assumptions, limitations and properties, measures of connectedness (centrality measures) are presented. These measures capture the social capital of actors by capturing different sources of power arising from holding unique positions in the network. Lastly, in order to capture more context and information regarding the whole network, global and community measures and methods are also presented.

Sources for subchapter 2.3 are Wassermann and Faust (1994), Jackson (2013) or Hahnemann and Riddle (2005) if no other sources are cited. As the reader is assumed to have some prior knowledge on SNA, a few of the most basic concepts have been moved to Appendix A.

6.3.1 Introduction

Over the past two decades research on networks in economics has grown exponentially - from a handful of papers by the late 1990s to thousands today (Jackson 2014). Granovetter (1985) and Uzzi (1996) expressed the importance of including how social influence impact decisions. According to the two authors, literature have the tendency to be either over- or under socialized, i.e. making actors too much or not at all dependent on social influence or social structure. By including social influence, decisions or actions that may not be rational according to traditional theory on economics, become rational or justified. Social network theory can be utilized on many network levels: actor (ego), dyadic (ties among two actors), triadic (ties among three actors), subgroup (community) and global (network) levels.

This paper will focus on actors' potential power and flow of information (actor and dyadic level), and how that power is compared to the rest of the network (mainly global level). In network analysis, identifying the actors with most connections is not the only important aspect, but also where the links lead to and how they connect. Some concepts in SNA not covered in this paper involves random graph models, which can help predict whether a network has emerged by chance, and game theoretic social network analysis that focus on costs and benefits when forming links.

6.3.2 Characteristics of social networks

Although complex, most social networks have typical characteristics. Even though there are a lot of randomness involved when people form ties, humans socialize in ways that form identifiable patterns. These patterns induce the network characteristics listed in this subchapter.

People tend to form communities or cliques, i.e. **high clustering** compared to networks where links are formed uniformly at random (e.g. Poisson networks). One of the reasons high clustering will be present in a network is low costs on a local level. The cost of maintaining and forming new relationships can be said to depend on the actor's proximity. Proximity isn't necessarily geographic, but can refer to any kind of closeness according to some attribute. Thus, two people are relatively more likely to form a friendship when they attend the same school or share some other kind of activity.

Another reason for high clustering is **homophily**. Actors in social network have a strong tendency to connect and form links with whom they perceive themselves as being similar in some kind of way, e.g. values, interests or race. An example is a national survey from the US (Marsden 1987) which showed that only 8% of people have any people of another race that they discuss important matters with. Even more revealing is the research of Fryer (2007) who found that only 1% of married white people in the U.S. were in an interracial marriage. One reason for homophily is opportunity. How you meet people can be biased, as change of meeting someone of same type increase if you seek out activates that are associated with your type. Many communities (like neighborhoods) are to some extent more homogeneous and therefore increase the possibility that you meet similar people. Cost and benefits also plays an important role. For example, common culture or language will make communication easier. Other factors are social pressure and social competition.

The minimum distance (steps) between two actors – given that they can be reached through other nodes – is on average short. This is known a **short average path length**, or low average geocide distance. Given that the costs are related to proximity, small clusters with tightly connected individuals are likely to form. Links that are not close are more costly, and thus is less likely to form. However, when links across groups provide access to a numerous new nodes due the high clustering, the benefits of forming a link offset the costs. Hence, a single tie can substantially reduce the distance to a large number of agents at once, and the cost associated with forming the link will be offset by the benefits. The costs of forming a second shortcut link next to an existing one often outweighs the benefits, and thus a big complete cluster is less likely to be formed.

A consequence of a high clustering and a small average path length is that most nodes can be reached from every other node by a small number of steps. This is called **small world phenomena**, in which a few ties can drastically reduce the diameter of the graph (or component) by acting as a bridge to other cliques. As a concrete example, in the social network of the world any person turns out to be linked to any other person by roughly six steps. This is known as the six degrees of separation.

Another common characteristic for social networks is **preferential attachment**, also known as the rich-get-richer and cumulative advantage: The probability that the actor experiences an increase in popularity (or any other quantity that is being measured) is directly proportional to the actors' current popularity. While many go through life known mostly people in their immediate proximity, a few people achieve wide visibility, like celebrities. Such networks exhibit fat/long tails, i.e. the extremes are over represented. Long tails are for instance manifested in book sales, as Amazon gets over half its sales from books outside its 130.000 top titles, i.e. niche titles (Kresh 2007 p. 133). This tendency can give rise to power law distributions - usually with exponent values between -2 and -3. Though, networks usually display a degree of preferential attachment that lies between the two extremes of poison networks (links only formed uniformly at random) and power law networks (Jackson et al, 2015)). Reasons for preferential attachment are suggested to be that people want to associate with popular actors, and that people who provide higher

value (quality) attracts more attention. There is also an element of randomness, as those who reach critical mass first will enjoy stardom (halo effect). Lastly, an actor with a greater number of direct connections meets more people through friends – given that each connection on average introduce you to an equal number of new people.

6.3.3 Collecting data on CEO networks

Due to the number of potential combinations, social networks increase rapidly in complexity with addition of new nodes or attributes. Not only is added complexity possibly harder to analyze, but the social networks are constructed manually using data software and will thus be more time consuming to create and more prone to errors. Consequently, utilizing data that capture enough information without multiplying the complexity is essential. At the same time, collecting data on social networks can be difficult, as access to such information is valuable and often tedious to properly collect.

Most studies on executive pay and networks use some measure of board interlocks as their proxy of social capital (Brown et al, 2009). The authors also find evidences in literature for a positive relationship between interlocked boards and pay levels. This is also the case in this paper, as board data is recommended as the source of data to estimate the CEOs' network and social capital. Recommending board data as the proxy for social capital is primarily due to data on directorships being easy to work with, publically available and adequate in estimating the CEOs' network. In a most projects, collecting too complex data is simply not possible. Hence, board data is the most suitable proxy in most cases. However, a discussion regarding the advantages and possible drawbacks by choosing this approach is necessary to ensure that the reader understands the limitations and complexity of the analysis.

Less biased sample

Board data is less biased compared to other data concerning active and valuable ties. All ties can be assumed to be active, because actors that are directly connected are bound to communicate at least a set number of times (.e.g. meetings with the board). Other ties used to estimate social capital (e.g. former colleagues, serving at the military or a university at the same time) can weaken and in some cases fade away. Also, being member at the same club or any other affiliation at the same time doesn't ensure that there is a connection between two actors - even less a tie that is strong enough to provide benefits. The same argument applies for proxies involving possible connections from university, military etc.

Jacnson (2005) emphasize the different utilities of ties: *"Each type of link might be active or useful under different circumstances, and might involve different costs and benefits (Jackson 2005)."* Thus the value of each link can be different depending on the context. As all ties in the board data set are directors or CEOs, utilizing only board data involve links that have more similar costs and benefits and thus are likely more equally important compared to other networks. If all connections are measured (e.g. utilizing Facebook), the network is likely to include many actors that don't give the CEO networking power related to extracting rents. Horton et al (2012) state that […]*"we believe these social or grey ties add noise to our network estimates*

potentially biasing downwards the network effect we document." Moreover, Smith (2009) finds formal ties (directors) to be a stronger predictor of performance than social (club memberships) and formal ties combined.

The data is publically available and easier to work with

Compared to other types of data, board data is easy to collect from publically available databases. This is important in a project of this scope, as collecting the data and constructing the networks can be time consuming. Data providers grant researchers access to the complete network of directorships and thus provide an overview of important actors. Also, working with board data is easier, as the network is smaller than other alternatives (e.g. less actors and relative few ties per actor) and thus takes less time to manually construct in a commercial software. Finally, as the data is collected from publically available information, they represent an objective and replicable data source. The data is correct and not prone to misinterpretations as the definitions of terms and units of measurement are listed.

With the emergence of social networking services as Facebook and LinkedIn, there is a potential to collect information from such services to estimate the total CEO network. LinkedIn stands out as the preferred choice, as the site is presented as a business-oriented social networking service, and thus more suited in order to display professional and valuable connections. However, there are some barriers that prevent researchers from using LinkedIn. Firstly, users can only see other peoples' network if they are linked by a first degree connection (direct link). Additionally, users can deny other user, first degree connections included, access to view their network. This drastically reduces the amount of network ties LinkedIn can provide the researcher. Also, at what time the actor formed relationships with their contacts are unknown. Hence, the data can be biased, as links formed after the compensation package was designed give the illusion that the social capital was bigger than it actually was during the bargaining process. Lastly, if extracting complete contact lists from LinkedIn were possible for all relevant CEOs, the total CEO network would be too large for a project of this scope if the network were to be constructed manually.

The impact of indirect ties is taken into account

Properly measuring the strength and value of indirect ties (friends of friends) are needed to avoid under- or overestimating the network (Brown et al, 2009). This is not a problem when utilizing social network analysis, as indirect ties are taken into account in some of the included measures. When the number of ties is the only measure of social capital, indirect ties are not taken into account at all.

Actors with identical names are not a problem

Actors with identical names, which are not the same individual, are potentially a problem in social networks. These actors' centrality will be overestimated, as two different actors with different connection will be merged into one actor with their combined connections. That is not an issue with this dataset, though, as date of birth is also listed, and therefore individuals with the same name are easily distinguishable – given that the highly unlikely scenario of two people with identical names and date of birth won't occur.

An incomplete network

While board data is adequate in estimating the social network power of the CEO, it is far from perfect. As in most large scale social network studies, the CEO network is incomplete and utilize a sample of their actual network (i.e. board data) to estimate their actual network power. In this case, board data only includes formals ties. Although director interlocks have been found to reflect social ties (e.g. Hwang and Kim, 2009), relationships outside the boards are ignored, and past ties are not captured. There are other avenues through which a director can obtain an information advantage or form powerful connections. Examples are golf club memberships, political affiliations, university alumni clubs or even exclusive network groups and elite events. Especially in a small country like Norway the pool of suitable candidates for top positions are more limited. This suggests that top executives and board members build an exclusive elite group that knows each other from shared board memberships (Keller, 2003). Moreover, family ties and former board members or collages may also be especially important bonds. Hence, the most important ties of some actor are outside the board room. A recent example of an important tie that wouldn't be captured by board data is Statoil director Catherine Hughes' romantic relationship with chairman of BG, Andrew Gould (e24.no, 2015). The proxy is foremost a proxy of social power arising from board memberships, but can still be regarded as an estimation of social capital.

However, the issue of an incomplete network applies for all CEOs when using only board data. Also, it must be noted that even though two actors attend the same events or school doesn't mean they have a tie. Still, the approach utilized in this paper underestimates the connectedness for all actors - some more than others. Having said that, if actors are well connected in the networks emerging from this paper, their actual connectedness are obviously also very large. The network represent the minimum number of actual connection the CEO has, as the links induced from serving at boards are links that are certain.

The influence several board memberships and board size have on connectedness

The connectedness of a CEO is heavily influenced by the number of boards the actors serve on, as board memberships grant actors ties to all the other directors within the same board. With a set board size of minimum three (see subsection 1.5.2), serving at other boards grants the actor with at least two ties per board. Hence, actors that serve on many boards may get their connectedness overestimated. However, by serving on several boards these actors also hold some kind of power (e.g. human capital), due to the requirements to be elected as a director, and thus the connectedness reflect this power. Moreover, serving on several boards will grant the CEOs access to other parts of the network. Acting as a bridge between groups is potentially very valuable, and thus this power is captured.

Actors that serve on no more than one board, on the other hand, have a number of direct connections that is dictated by board size. As mentioned in subchapter 2.2.3, the board size may be highly correlated with some of the network measure, especially the number of direct connection. If a CEO doesn't serve on other boards, the number of direct links this actor has equals the size of the board minus one. This may be a problem as long as the board size doesn't increase with power of the firm. Bonacich (1991) claims: *"For*

example, the size of a board of directors may reflect nothing about the position of the firm but simply be in conformity with some arbitrary rule (Bonacich, 1991, p. 61)." Huse (2010) support this argument by emphasizing that smaller firms should have larger boards to compensate for a lack of resources in the firm, while larger firms have access to a lot of resources from within the firm. Directors can be viewed as cost-effective resources, and thus variations in the board size may be either meaningful or arbitrary. However, from another perspective, aggregating more connections grants the actor more social capital, regardless of whether the board size being reflects the power (size) of the firm or not. Hence, the number of connections directors gain from serving at boards may be random, but the all the links still represent valuable connection. As mentioned earlier in this chapter, randomness is a major factor determining how links are formed, so the validity of the data isn't undermined by the somewhat random nature of board sizes. Also, board sizes in Norway are not that large (see subsection 2.2.3), so the effect of arbitrary board sizes may not be significant. The findings of Gronmø and Løyning (2003, p. 207) suggest that this is the case in Norway. They used board data and SNA, and find a positive association between the biggest (and arguable most powerful) firms in Norway and how connected the companies are.

The discrete stairwise steps in connectedness deriving from the board structure cause more heavy tails. Heavy tails are indeed common in social networks, but CEOs at large firm are likely to be well connected, and some CEOs at large companies only serve at one board. That is why it is important to look at the relative values – not the absolute values of connectedness. Furthermore, when utilizing social network analysis, the number of direct ties is not the only factor when identifying connectedness, and hence this problem will probably not be significant when also utilizing measures that capture indirect connections.

Tie attributes relevant to power are omitted

Data on directorships provide researchers only with binary information, i.e. whether there is a tie between two actors. Hence, a lot of information (e.g. tie strength, frequency of interactions and information flow) are not captured. The dichotomy of labeling ties as either present or non-existent is obviously not a perfect representation of the real world, as there are many factors that distinguish different relationships between actors and the strength of the ties. However, it is not realistic to be able collect this kind of information in a large and complex network as this paper will include. As the next paragraphs will reveal, board data is sufficient to capture the social capital despite excluding potentially important tie attributes.

Firstly, the **values of each actor are initially set as equal**, i.e. personal qualities, knowledge, experience and which companies the directors serve on are not taken into account. The value in terms of connectedness is the only type of value that is measured in the network. As all nodes initially are set as equally important, it is crucial, in order to avoid bias, that most ties can provide benefits related to power. With connectedness being the only variable that is being measured, a group of less powerful actors can be very well connected within a subgroup, and thus seem powerful. Likewise, a powerful actor serving at a prestigious board may seem less powerful if his network is small. Being well connected doesn't necessarily make you powerful, but being powerful and successful make people want to connect to you. Thus, a big

network with the right type of connection, in most cases, indicates the importance of a node - even without taking into account the importance of an actor independent of the network. This is consistent with the findings of Gronmø and Løyning (2003). Also, the measures of connectedness take the global network – not only the local subgroup - into account, and thus the most prominent actors are revealed by the measures.

Secondly, data on **information flow** (direction, frequency or magnitude) are omitted. Consequently, only the network structure is captured - not how information flows or power is exerted. If the data also included the direction or magnitude of information flow, the estimation of power would be even more accurate, as there are measures created exactly for this purpose. For instance, directed ties can reveal a power relationship due to dependency. A node that has more inward than outward directed ties indicates popularity. Undirected ties, on the other hand, exclude this information, and thus all ties are treated as symmetric relationships. This also means that reciprocal is assumed, which may not always be the case. However, the assumption is necessary when dealing with undirected data.

Thirdly, **tie strength** is another attribute that is not captured. Strong ties are bonds actors typical have with close friends, family members and partners, and are characterized by loyalty, trust, reciprocity and similar values and attitudes. Such features are important in terms of managerial power, and thus stronger bonds may allow for more rent extraction. However, tie strength is hard to capture, as many of the factors determining tie strength are difficult to collect: In a social network, the weight of a tie is generally determined by duration, emotional intensity, intimacy and exchange of services (Granovetter, 1973). As a result, tie strength is often omitted from large scale networks due to its complex nature and lack of valid proxies. For instance, strong ties often involve frequent contact, but frequent contact doesn't alone ensure a strong tie.

Groenmo and Loeyning (2012) consider all board interlocks as weak links, while Renneboog and Zhao (2011) don't make a distinction between the strength of ties in interlocks. This paper takes the same approach as the latter. The idea is that whether the ties are labeled weak, medium or strong is not the most important, as all ties no matter tie strength are likely to prove valuable in terms of social capital. Being a more homogeneous group, the actors are more likely to increase the bond due to homophily. Still, homophily alone can't ensure that ties on a personal level are strong, and will thus vary. However, board members are legally and morally obliged to co-operate, and as they spend time together their bonds are likely to strengthen. The effort levels may not always be optimal or efficient (e.g. due to conflicts or alliances within the board), but the CEO is expected to be granted access to board members' knowledge, skills and social networks. Ties can also be negative on a personal level, but they are assumed to be positive – as even when actors dislike each other, they often have an incentive (e.g. being re-elected) to co-operate and thus can be regarded as positive in terms of social capital. Also, even though two actors don't like each other on a personal level, they can still maintain a good professional relationship. Smith (2009)

emphasize that directors form a common frame of understanding or reference (referred to as cognitive social capital) which maintains the trustworthiness of others, and thereby increases social capital.

Finally, non-verbal communication, charisma, bargaining skills, persuasion and other **interpersonal skills** that influence referent power between actors are not captured. Data on these factors are practically impossible to collect in large networks, and thus must be captured by the error term. However, it's reasonable to assume that CEOs for large companies possess interpersonal skills, as the position requires the CEO to be socially skilled.

Despite the information that is lost by utilizing binary data, tie attributes are not fundamental for the analysis to be correct. The bonds are assumed to be strong enough that they present a significant value in terms of social capital (e.g.. they provide information and are assumed to provide a net positive contribution) even though the ties may not be categorized as strong. Moreover, as mentioned in subchapter 2.1, power is defined as the potential someone has to exert their will, and thus only capturing the structure of the network power is sufficient information to measure power induced from social capital.

Main takeaways

Binary tie values are the most commonly used data in SNA, and even though the method has its shortcoming as described in this subchapter, it usually provides the researcher with sufficient results: "*Very often, the additional power and simplicity of analysis of binary data is "worth" the cost in information lost." (Hanneman and Riddle, 2005, p. 12).* Also, modeling strength of tie, which would take much more time and effort, is not properly developed (Jackson, 2003), and thus may not give a better estimation.

6.3.4 Network properties deriving from board data

The type and complexity of data dictates the network properties. As this and last subsection reveal, using board data to estimate the CEO networks sets some limitation to the social network analysis, but also makes it easier to grasp.

Node/actor - n_i: Nodes in this network will represent the actors listed in the board data, i.e. CEOs and board members.

Tie/link/edge - n_{ij}: Ties in this network represent links between the actors, i.e. they serve at the same board. CEOs are assumed to have ties with the directors in their own firm. The data only assess whether there is a social relationship or not, i.e. a tie is valued as either 1 (present) or 0 (not present). Ties are set as undirected and thus assume reciprocal and symmetric relationships.

Degree – $d(n_i)$: In an undirected network, the degree is the sum of edges connected to the actor.

6.3.5 Type of network

The type of network needs to be chosen. **One-mode network** is the most common network type. In these types of networks actors are connected to other actors by ties, i.e. Actor A is connected to actor B and C. On the contrary, **two-mode networks** (commonly referred to as affiliation network) connect actors to events, i.e. Actor A and B both affiliate (are connected) through event A. Events in this context are boards that directors serve on.

The networks in this paper are constructed manually in computer software, and thus require a lot of time and carefulness when entering data into the adjacency matrices. One-mode networks require an n-x-n matrix (actor-x-actor), which can be hard to comprehend when the number of actors is large. The ties in this paper are symmetric and undirected, and thus, if there is a tie from actor A to B, there must also be a tie from B to A. This is difficult and tedious to control for in a large network. Two-mode networks, on the other hand, require only an n-x-m matrix (actor-x-event). Actors are associated with each other through the events, and thus only need a common event in order to have a tie. Consequently, as there are far less firms than actors, constructing affiliations network are faster. They are also easier to review. Commercial software allows for converting a two-mode network into a 1-mode network, and thus the networks in this paper is chosen to be created as a two-mode network. Thus, both types of networks will be applied in the analysis. The subsequent paragraphs present advantages and disadvantages of each type of network.

<u>One-mode is the most developed network</u>

Methods for studying two-mode affiliation-network are less well developed than methods for studying one-mode networks. As a consequence, most literature on two-mode networks are concentrated with representing affiliation networks using graph theoretic and related ideas, rather than with analyzing those networks. Also, measurements from affiliation networks are more prone to misinterpretations due to the more complex nature of the data. Lastly, some measures of connectedness (e.g. Beta centrality, see next subchapter 2.3.6) utilized in this paper are only available for one-mode networks.

<u>Two-mode networks capture more information</u>

Compared to one-mode network, the two-mode networks capture more information, and thus some complexity is lost when converting a two-mode network into a one-mode network. However, the added complexity is negligible within this analysis, as there are only few instances where the complexity is present.

Firstly, two-mode network naturally highlight subgroups emerging from the events. With one-mode networks, it is normally not possible to directly tell which actors belong to each event. However, in this context, every member of the events (boards) have a tie, and thus form a clique that is easily distinguished.

Secondly, only two-mode networks capture overlapping ties. If directors have more than one membership in common, the tie value will still remain the same when utilizing one-mode network. Intuitionally actors might have stronger bonds with whom they share more common membership. However, tie strength is not considered in this paper, and thus this information if irrelevant here. There are few, if any, pairs of

actors that serve together on more than one board that aren't subsidiaries, and thus won't represent a big weakness.

Finally, in one-mode networks, a clique can't be distinguished from the same number of separate pairwise ties (Borgatti et al. 2014). In the context of managerial power, a board consisting of three members won't be distinguished from three actors that pairwise all share a tie, but don't serve on the same board. Sociologically there is a difference between those two situations. However, all cliques in the data set also form a separate board of directors, as the board size is too large and the density in the network is too low that actors pairwise create a clique without everyone serving at the same board. Still, even if there were instances of many pairwise ties that falsely was interpreted as a board, the connectedness of the actors would remain the same.

Different approaches to group connectedness

When using two-mode network, the connectedness of the events (boards) are easily measured. One-mode have separate measures (group centrality) that can measure the centrality of groups, but these are more tedious to construct in larger networks and may give different results. Both may be used, but are not an important aspect of this paper. This task is considering the social network of the CEO - not the connectedness of the boards. To know which boards (firms) are most central is not initially essential in order to evaluate the managerial power hypothesis. Also, there is a duality between the most central events and actors in two-mode networks. Actors are more central due to attending the most central events, and events are more central if the central actors attend the event.

6.3.6 Measures of connectedness: Centrality measures

There are numerous ways to measure how connected a node is in a network. The methods used are commonly referred to as centrality measures, and identify different facets of a node's role in a network. Power arises from covering advantageous positions in the network, and centrality measures capture different sources of power. However, the current understanding of which measure is most appropriate in which context are not fully developed yet (Jackson, 2013). Hence, all types have to be considered. The centrality measures can be split into five categories: Degree, betweeness, closeness, eigenvector and beta-centrality. The three former measures are the most common ones, but they are not always the best choice. The commercial software UCINET (2002) is available to aid in calculations of these measurements.

Scores must be normalized. Normalized scores may get very low due to the high number of possible connections, but give a reflection of how prominent the actor is compared to a possible maximum. The use of normalization also is also necessary when comparing different years. Lastly, researchers have also derived centrality measures for groups of people (group centrality) and affiliation networks (two-mode). This chapter only addresses individual centrality, as all levels of centrality measurements follow the same principles and ideas. The only different is that they are utilized on different levels and that individual centrality is easier to understand due to less complex formulas.

Degree centrality

Degree centrality is the same measure as degree mentioned in subchapter 2.2.3. Degree centrality is a power measurement because an actor with more links has more opportunities and alternatives than other actors with a smaller degree. A node with a high degree has opportunity to directly influence many other nodes, but is also prone to be influenced by others.

However, degree is the least complex centrality measure, and need complementary measures in order to sufficiently describe a network. Degree doesn't take into account the structure of the network and won't separate between being connected important node and less important node, but highlights the magnitude of an actors' direct network. Empirical papers that measure social network often only consider actors' degree centrality, and therefore only reveal a facet of the useful information contained in the social network. For instance, degree centrality suggest that a CEO serving on one large board is more connected than a CEO that has fewer direct connections despite serving on several small boards. Serving on different boards may prove more valuable, as the CEO can get access to other parts of the network.

The degree centrality is easily calculated by aggregating the number of ties a node has:

$$C_D(\mathrm{i}) = \sum_{j=1}^{N} a_{ij} \qquad (eq.3)$$

$$\text{Normalized: } C_D'(\mathrm{i}) = \frac{\sum_{j=1}^{N} a_{ij}}{N-1} \qquad (eq.4)$$

a_{ij}= adjacency matrix which equals 1 if there is a tie between node i and j. The diagonal contains only zeros.
N = number of nodes

Closeness centrality

Closeness centrality is an inverse measure of centrality that measures how close an individual is to all other nodes in the network. The higher the closeness centrality, the closer the node is expected on average to be to every other node. Closeness tells how fast information (or whatever is flowing through the network) can reach other parts of the network and expected time until arrival for a given node. In the case of information flow, when passing through fewer steps to reach the node, the information is expected to be more accurate and of higher detail due to the information deterioration. Another way to look at closeness centrality is how far a node can reach in one, two or more steps. This type of closeness centrality is referred to as reach centrality.

If the graph isn't fully connected (i.e. presence of isolates) some distances are undefined. This problem can be solved by removing isolated nodes when calculating closeness, counting the number of nodes reached or substitute zeros whenever a distance is undefined.

Closeness centrality of a node is calculated by aggregating the number of edges in shortest path connecting two nodes:

$$C_c(\mathrm{i}) = \left[\sum_{j=1}^{N} \mathrm{d(i,j)}\right]^{-1} \qquad (eq.5)$$

$$\text{Normalized: } C'_c(i) = \frac{C_c(i)}{[(N-1)]} \qquad (eq.6)$$

d(i,j) = geodesic distances from node i to node j

N = number of nodes

Betweeness centrality

Betweeness quantifies an actor's ability to connect (bridge) two or more otherwise disconnected or loosely disconnected subgroups. This is also referred to as filling structural holes. The gatekeeper node therefore gets power because of its power to control the flow and outcome of certain parts of the network. Moreover, a node in this position can get information earlier from other subgroups, merge groups and can control or withheld information. By being in a brokerage position, they gain the benefits from information flow without knowing their position, but in order to control or exerting the power, the actor has to know and act upon it. Lastly, the more subgroup an actor is connected to, the wider the diversity of information.

A network is vulnerable where certain nodes are dependent on one actor in order to access other parts of the network. A tie between node A and node B is a *bridge* if deleting that edge would cause A and B to lie in two different components. More common is local bridges, that means if deleting the edge between A and B would increase the distance between A and B to a value strictly more than 2

In this dataset, a betweeness score higher than 0 tells that a CEO is present on at least one other board.

There are different ways to measure betweeness. The most common one is aggregating the number of shortest path the node is lying on:

$$C_B(i) = \sum_{j,k} g_{jk}(i) / g_{jk} \qquad (eq.7)$$

$$\text{Normalized: } C'_B(i) = \frac{C_B(i)}{\left[(N-1)\frac{(N-2)}{2}\right]} \qquad (eq.8)$$

g_{jk} = number of shortest paths connecting j and k

$g_{jk}(i)$ = number of paths that actor *i* is on

N = number of actors

Eigenvector centrality

Eigenvector centrality measures how central neighbor nodes are. It captures the notion that it's not important how many you know, but who you know. In short, eigenvalue is a recursive measure that is determined by the degree of all other nodes that a node is connected to.

The diffusion (e.g. spread of information or diseases) from starting a node (entry point) have been found to correlates significantly with eigenvector centrality (Banerjee et al 2012). PageRank, the algorithm Google uses to rank websites in their search results, is based on the principles of eigenvector centrality. Despite being considered an important centrality measure, eigenvector centrality is often overlooked when measuring connectedness in CEOs networks. The centrality measure may also capture an important aspect that is often overlooked: Too many second order couplings (i.e. indirect connections) may have a negative impact. The problems to those around you may also affect you. Even though actors may never meet most of their indirect connections, these links still represent a value that is captured by this measure. For instance, indirect links can provide or send information that directly or indirectly benefits the actor.

Eigenvector centrality is obtained from the eigenvector associated with the highest eigenvalue of a matrix of links between directors:

$$C_E(i) = x_i = \lambda^{-1} \sum_j a_{ij} x_j \qquad (eq. 9)$$

x_j = eigenvector of node j

λ = eigenvalue. This parameter makes sure that the centrality score gives a nontrivial solution by converging after several iterations.

a_{ij}= adjacency matrix which equals 1 if there is a tie between node i and j. The diagonal contains only zeros.

The normalized eigenvector centrality is the eigenvector centrality divided by the maximum difference possible. There will be many different eigenvalues, but only the greatest nonzero eigenvalue results in the desired centrality measure. The measure requires symmetric (undirected) data.

Beta (Bonacich power) centrality

Phillip Bonacich (1987) developed a new and more dynamic centrality measure to account for context. This measure is named Bonacich power centrality, but is also referred to as beta centrality. According to him, a more central node doesn't necessarily mean more powerful, as more peripheral nodes can turn out to be the most powerful ones. Bonacich argued that being connected to other actors that are not that well connected makes one more powerful because they are more depended upon the more connected actor.

The unique and dynamic feature of the beta centrality is the beta (β) parameter which can be chosen by the user. This parameter reflects to which extent power is linked to other nodes' degree:

- $\beta \geq 1 / \lambda$: The ties of ties are considered, i.e. the same measure as eigenvector centrality. λ is the largest eigenvalue of the adjacency matrix.
- $\beta > 0$: Bonacich centrality increases if an actors' connections have many connections.
- $\beta = 0$: Only direct connections are considered, i.e. the same as degree centrality
- $\beta < 0$: Bonacich centrality increases if an actor's links are less connected, because these connections are more likely to depend on the actor. Another way to interpret a negative beta is that an actor's' power is reduced when he or she is connected to other powerful nodes. Using a negative beta will probably be less effective in this dataset. The reason is that all actors, due to being connection to all the other directors on at least one board, have at least some ties. Thus, there are fewer actors that are very dependent on others. However, as all relevant types of centrality measures need to be considered, beta centrality can't be ignored.

The feasible values of β are determined by the largest degree in the network:

$$- [1/\max(\sum_{j=1}^{N} a_{ij}) \text{ for all i}] < \beta < [1/\max(\sum_{j=1}^{N} a_{ij}) \text{ for all i}]$$

For example, if the largest degree measure in the network is 12, β can only obtain value in the interval

$$- (1/12) < \beta < (1/12)$$

The magnitude of β reflects the radius of power - i.e. small values weight local structures, while larger value weight global structure. UCINET, the commercial program that is used to calculate the centrality measure, can calculate the optimal beta.

$$\sum_{j}^{\infty} \beta^{k-1} {a_{ij}}^{k} 1 \; = \; \sum_{k=0}^{\infty} \beta^{k} {a_{ij}}^{k+1} 1 = \; C_P(1, \beta) \qquad (eq. 10)$$

$$C_P\,(i, \beta) = \sum_{j} (\alpha + \beta c_j) a_{ij} \qquad (eq. 11)$$

$$C_P\,(i, \beta) = \alpha \left(I - \beta a_{ij}\right)^{-1} a_{ij} 1 \qquad (eq. 12)$$

α = scaling parameter to normalize the score. The normalization parameter is chosen so that the square root of the sum of squares of the vertex centralities is the size of the graph (Bonacich (1987).
β = beta-parameter. Reflects to what extent power is linked to other nodes' degree.
a_{ij}= adjacency matrix which equals 1 if there is a tie between node i and j. The diagonal contains only zeros.
I = identity matrix, i.e. n × n matrix with ones on the main diagonal and zeros elsewhere.
1 = matrix of all ones.

Comparison between centrality measures

In simple structures (e.g. star formation, circle or line), the most central positions tend to be consistent over the different measures. In more complex and larger networks, the characteristic of a position is more diverse – i.e. a position may be advantageous in some ways, and disadvantageous in others.

Generally, the centrality measures will be positively correlated, but in instances where they are not, there are some reoccurring explanations:

	Low degree	**Low closeness**	**Low betweenness**
High degree	-	The node is located in a cluster that is far away from the rest of the network.	The node's connections are redundant. Communication bypasses the actor.
High closeness	Few ties, but close to important actors.	-	Multiple paths in the network. The actor is near many other node, but so are many other nodes.
High betweenness	The actor's few ties are crucial for network flow.	Rarely occurs. The actor monopolize the ties from a small number of people to many others	-

Table: Possible explanations for negatively correlated centrality measure.

- Degree, betweeness and closeness centralities only considers the structure of the current node's status, whereas eigenvector and beta centrality also takes friends' structural status into account.

- Degree centrality is the only measure that only considers direct ties on a local level. All other centrality measure also consider indirect ties on a global level. Moreover, only degree centrality can be controlled by the focal node, i.e. actors can decide whom they reach out to (outdegree), but they can't control whom their friends or other actors in the network are linked with.

Limitations and other relevant concepts

- Closeness and betweeness centrality depend only on the shortest paths, which excludes all other paths. This may be a problem, because what flows through the network will follow the path of least resistance. The structural shortest paths are not always the preferred path, as there may be longer, but functionally more efficient paths.

- Centrality measures may underestimate the power of nodes with lower centrality scores, and is dependent on the topology of the network. The measures are specifically designed to produce a ranking to identify the most important (central) nodes, and are great at identifying these nodes. However, ranking nodes leads to two problems. Firstly, the ranking only orders vertices by importance. This means that the

difference in importance between different levels of the ranking is not quantified (i.e. the relative utility of each score is not quantified). The second, and probably bigger issue, is that the ranking of remaining nodes (i.e. not the most central nodes) do not necessarily reflect their true centrality. This issue is manifested in a Google image search where usually only the first couple of results appear in a reasonable correct order. A solution to the problem can be to suggest the relative utility of each score, but that method would likely involve a trial and error approach.

Papers utilizing centrality measures are to a large degree not concerned with these limitations, and this may suggest that problem isn't prominent in most cases. In fact, the weaknesses of centrality measures may be an even smaller issue within the applications they are used in this paper. CEOs serving on other boards are likely to be identified as the most central nodes. These actors are the ones that are the most interesting, as the managerial power is expected to be larger for such actors. The other CEOs (i.e. likely to be nodes with direct ties only to one board) have only a set minimum number of connections due to the size of the board they are connected to. Hence, the data may lead to over- or underestimation of their social capitals, while the centrality measures also may lead to underestimation of their social capitals. This means that some of the errors in data maybe offset by some of the errors in methodology. Another argument is that even though some CEO will have underestimated social capital, they are still probably less powerful than the more prominent CEOs. Consequently they may not even have enough power to be able to extract rents.

- Individual centrality measures are node-level, not group-level concepts. The optimal set of players is not the same as the set of players that is individually optimal. For instance, when trying to spread ideas into a network, a set of two entry nodes that are not connected to each others may be the best solution. This may even be the case despite presence of other sets of two nodes that individually are more optimal (higher individual centrality). The reason is that the two latter actors can have mutual ties, and thus those ties are redundant if more connections to the same actors don't provide additional value.

- New measure can also be constructed by linear combining different types of centralities, e.g. degree*(λ-1) + eigenvector*λ. These are not considered in this paper. A further work may look at linear combinations of centrality measure if the results indicate that centrality is significantly correlated with executive pay.

- Centrality scores may be highly correlated (Valente et al. 2008) which may cause a multicollinearity issues. One solution to this problem is to utilize factor analysis or PCA to merge the correlated centrality variables into one single variable. This may cause another problem, which is that the new variable might be difficult to interpret, i.e. what component(s) of the variable that actually is significant. However, the variable would still represent social capital and thus be sufficient to be included in the model.

- Other centrality measures that are not relevant (e.g. lack of required data) or less common are Hubbell, Katz, Taylor, Stephenson and Zelen influence measures, percolation centrality, alpha centrality, cross-

clique centrality, information centrality and flow centrality. As these measures are not mentioned or used later in this paper, no further elaborations are needed.

6.3.7 Global and community measures and methods

While the focus of this paper is primarily concerned with analyzing the network on an individual (micro) level, measures on group (meso) and global (macro) levels are important in order to capture important contextual information. Global measures capture general trends in the network and are important in order to compare different networks and how individual nodes in the network compare to other nodes in the graph. Group level (communities) can be useful by simplifying a complex network into smaller networks. Moreover, the composition of subgroups can suggest the likely behavior of the network as a whole. Isolated from outside influence, communities can act as echo chambers where attitudes propagate and converge over time. This subsection covers measures and methods that are useful in the context of this paper.

Global measures

Density: The network density calculates what the overall connectivity in graphs or subpopulations are. The measure is calculated as the number of present ties divided by the maximum number of possible connections. For an undirected graph, the formula is:

$$d = \frac{L}{N\frac{(N-1)}{2}} \qquad (eq.14)$$

d = density
L = number of ties
N = number of actors

A complete graph (all actors directly connected to each other) takes on a value of 1, while an empty graph returns the value of 0. Mathematically, the density is also the average of all the normalized degrees. Hence, by multiplying the density with (N – 1), the average degree is obtained.

The density of a graph indicates many important properties. For instance, the density of connections in a network is regarded as the critical determinant of the contagion of communicable diseases and of the diffusion of a new product (Jackson et al 2015, p. 18). Lastly, if the density of the graph is large, the more central actors are even more powerful, as they reach more nodes and thus are more influential.

One notably shortcoming with this measure is that density in social networks are negatively and nonlinearly associated with the size of the network, as actors only can form and maintain a limited number of ties (Friedkin, 1981). Utilizing board data is prone to this error, due to a relative large size of network and a limited number of possible ties compared to the size. However, the networks compared in this paper are of almost identical sizes and density is only utilized to generally compare different networks – not to make any bold interpretations. Furthermore, density is an average, and thus excludes information

like whether the values are dispersed or not. Also, important subgroups can be clustered while the graph as a whole appears dispersed. Hence, other measures are also needed in order to form a more correct picture.

Degree distribution: The degree distribution shows how the nodal degrees are distributed, and indicates whether the ties are connected by random or not. As mentioned in the subchapter on social network characteristics, heavy tails are likely to emerge. However, as only directorships are considered, this phenomenon may not be present, as each CEO will be connected to at least one set of board members. Also, CEOs can only serve on a limited number of other boards due to time and energy constraints, thus drastically reducing the maximum number of connections. The degree distribution can also indicate the relative power of an actor by comparing it to the average degree.

Diameter: Largest geodesic distance between any pair of nodes. Related to diameter is average geodesic distance. The measures indicate how fast information gets transmitted. While the average geodesic distances is usually small, the largest geodesic distance can be large.

Identifying communities (cohesive subgroups)

"A community structure is a partitioning of the nodes of a network into groups or communities with the idea that the nodes in the same community are somehow similar or equivalent according to some criterion (Jackson, 2005, p. 40)".

Centrality measures for each board are efficiently calculated by UCINET, as the networks initially are constructed as two-mode networks. The global measures can also be utilized on a group level. Hence, the measures are sufficient to capture relevant information on a group level. Although some of the formulas for group level measures are more complex, group (board) centrality is essentially the equivalent of individual centrality only on a group level. Thus no further elaboration is needed. As a result, this subsection only briefly addresses methods to identify subgroups.

There are two main approaches when identifying subgroups: Bottom-up and top-down approaches. The former approach is built up from dyads and triads that extend into bigger clusters. The approach is useful to see how the network as a whole emerges out if smaller clusters of actors. Conversely, the top-down approach looks at the whole network as the frame of reference. Typically, top down approaches identifies sub-structures by spotting segments that are locally denser than the networks as a whole. In other words, top-down approaches can be utilized to identify weak spots or holes in the network as a whole.

The most obvious and easy-to-spot subgroups from a bottom-up approach are cliques, which are maximal complete subgraphs - i.e. every node is directly connected to everyone else in the group. As a consequence of these strict properties, the distance, diameter and density within cliques all equal 1. With board data, every board will form a clique, and this characteristic can be applied to display the different boards despite only using a one-mode network. Boards with no interlocked board memberships will be isolated cliques, while directors with more than one board membership will act as a bridge between cliques.

There are also other bottom-up approaches that capture subgroups with less strict properties (i.e. not all actors need to be individually connected in order to form a subgroup). Methods such as n-clans, k-plexes, k-cores could provide useful in order to identify groups of firms that are somewhat tightly connected. For instance, identifying subgroups where every node can reach all others within two steps may reveal powerful subgroups of actors. This type of analysis is, however, a more advanced topic.

The only top-down approach considering in this paper is also the most common, components. Components are parts of the network that are directly or indirectly connected within (i.e. reachable), but disconnected from other parts of the network. Hence, all actors can reach all other actors within the component, but are isolated from the other nodes. Isolated nodes each form a component with a single node. These single-node components are often excluded from the analysis, as the largest components usually are more interesting to analyze. Analyzing components is especially interesting if large components divide the network into separate parts. The most central actors in the network are expected to be prominent nodes in the largest component, especially if the largest component encloses a significant fraction of the graph and thus is regarded as a giant component.

6.3.8 Basic glossary

Clique: A clique is a subset of nodes, where an edge connects every pair of nodes in the subset.

Components: Sub-graphs that are connected within, but disconnected between sub-graphs. If a graph contains one or more isolates, these actors are also a component.

Diameter: The maximum distancse between any two nodes.

Dyads A tie between two actors

Geocide (shortest path length): The number of relations (steps) in the shortest possible walk from one actor to another. Many algorithms in network analysis assume that actors will use the geodesic path when alternatives are available

Network/Graph: A graph (network) consists of a finite set of points (actors) and a set of lines (ties) describing the relations connecting pairs of points.

Triads: A subset of three actors and the tie(s) among them

6.3.9 Synonyms

- Graph, Network.
- Points, vertices, nodes, sites, actors.
- Lines, edges, arcs, links, bonds, ties, relations.
- Geocide distance, shortest path length, distance.