Investigating Excess Compensation

An Empirical Study of Board Compensation, CEO Compensation, and Future Firm Performance

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"The most significant problem facing corporate America today is the management-dominated, passive board of directors. A common occurrence in many of our largest corporations is that passive boards are responsible for excessive executive compensation and, more importantly, poor corporate performance"

- **Charles M. Elson**, Director of Center for Corporate Governance at University of Delaware

Abstract

The financial crisis of 2007-2008 ignited the discussion of compensation packages and corporate governance practices in the US. By empirically studying 411 S&P 500 firms from 2010-2015 (2,466 firm-years), we model board compensation, CEO compensation, and future firm performance using a number of corporate governance and firm characteristics. We find that board compensation is positively impacted by the number of directors on the board. However, when the CEO simultaneously is the chairman of the board, this has a negative impact on board compensation. Using a measure for excess board compensation, we find support for a mutual back-scratching relationship, as excess board compensation has a significant positive impact on CEO compensation. We hypothesize that this relationship reflects cronyism, resulting in boards favoring status quo when being overcompensated. Similarly, we find CEO duality to have a positive impact on CEO compensation, while CEO shareholding has a negative impact. Moreover, we find that excess board compensation leads to lower future firm performance. We argue that this could be due to cronyism and poor board culture. Lastly, we unexpectedly find that excess CEO compensation has a positive impact on future firm performance. This could suggest that excessive financial incentives constitute effective mechanisms to align interests between shareholders and the CEO.

Abbreviations

CEO – Chief Executive Officer

CFO – Chief Financial Officer

COO – Chief Operating Officer

GLS – Generalized Least Squares

NYSE – New York Stock Exchange

OLS – Ordinary Least Squares

ROA – Return on Assets

ROE – Return on Equity

SEC – Securities and Exchange Commission

S&P – Standard & Poor's

WRDS – Wharton Research Data Services

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1 Introduction

The implications of the 2007-2008 financial crisis have ignited a renewed interest in reviewing the corporate governance practices and compensation packages among large US firms. It is estimated that the crisis resulted in 8.8 million US job losses and the S&P 500 index experienced its largest-ever recorded yearly loss of 38.5% (US Department of the Treasury, 2012). Partnoy (2014) argues that the severity of the crisis was not only due to failing regulation and unsustainable mortgage loans. It was also due to poor corporate governance and mismanagement of shareholders' wealth. Critics have voiced their concern for the rapid increase in compensation packages for both board of directors[1] and CEOs, and questioned whether the link between compensation and performance existed at all (Lin et al., 2013). Thus, the inevitable question remains what the situation looks like in the aftermath of the 2007-2008 financial crisis, and whether the corporate governance of large firms works as intended.

Prior to the crisis, many boards and CEOs were encouraged through compensation incentives to engage in short-term risky gambles, neglecting the prioritization of long-term plans and sustainable growth rates (Conyon, 2014). Now, in the aftermath, politicians and economists are debating how to prevent future crises, and essentially avoid reaching the damaging scale of the 2007-2008 financial crisis. In addition to a general need for increased transparency, it has been questioned whether the control mechanisms of large firms work optimally. Consequently, it remains important to shed light on the links between board compensation, CEO compensation, and how they impact future firm performance, in order to review whether shareholder wealth is properly managed (Lin & Lin, 2014).

Given the increased media attention, there are four overall reasons why the topic of compensation determinants and firm performance is widely debated (Brick et al., 2006; Conyon, 2014):

i) median CEO compensation growth has by far outpaced the underlying growth of firm value over the past decades,
ii) it has been suspected that the monitoring role of boards did not work as intended,
iii) the role of CEOs during the financial crisis has been debated, and

[1] We use the term "board(s)" when referring to the board of directors as a group, and "directors" when referring to individual board members.

iv) some scholars have suggested evidence of cronyism[2] through a *mutual back-scratching* relationship between highly compensated boards and CEOs.

There are several examples of controversies regarding CEO compensation in the US. In 2009, Chesapeake Energy paid its CEO, Aubrey McClendon, more than $114 million although the firm's share price dropped almost 60% during 2008. However, the main critique was that McClendon's compensation was comprised of more than $75 million (65.8%) stemming from bonuses (Minow, 2012). Similarly, American International Group (AIG) was rewarded a $180 billion government rescue package in late 2008. Yet in March 2009, it was revealed that top management of the most troubled unit of the firm had received bonuses of $165 million (Cho et al., 2009).

There are also examples of extreme consequences from board failure. One of the most famous cases was the collapse of Enron in 2001. Enron's board consisted of profoundly competent directors, including government regulators, former CEOs, and university presidents (Gordon, 2003). Enron's board failed to respect the firm's ethical code of conduct, create proper incentives for management, and critically monitor the direction of the firm (Ibid.). In fact, Enron's board approved the distribution of $320 million in special bonus compensation just 10 months before the bankruptcy (Eichenwald, 2002). Thus, in light of scandals such as these, the role of boards, the growth of CEO compensation, and suspicion of a missing link to future firm performance has led to considerable attention from politicians and academia (Conyon, 2014). While there are examples of compensation controversies all over the world, some of the most notorious cases are found in the US.

US firms are characterized by separation of ownership and control. This creates potential issues of aligning interests between shareholders and CEOs (Fama & Jensen, 1983). *Agency problems* between shareholders and CEOs are not always rooted in the CEO's self-interests. For instance, the level of board compensation may have an impact on the CEO's compensation. Scholars suggest that cronyism is one of the main sources for this problem (Brick et al., 2006; Chung et al., 2015; Lin & Lin, 2014). Brick et al. (2006) argue that overcompensated boards are poor monitors of CEOs. This is because they are less likely to "rock the boat", when being highly compensated. This concept, *mutual back-scratching*, refers to CEOs and directors mutually benefitting from allowing high compensation. Both parties accept status

[2] "Cronyism" is defined as the practice of favoring one's close friends.

quo when being overcompensated, which can undermine the intended governance role. Other motivations favoring status quo relate to the incentive of maintaining a seat in valuable networks obtained from board membership (Ibid.).

Previous research has defined excess compensation[3] (Brick et al., 2006; Core et al., 1999; Lin & Lin, 2014) as the extent to which a board or CEO is compensated higher (or lower) relative to peers when taking corporate governance and firm characteristics into account. Zero excess compensation would thereby represent a compensation equal to the predicted level, while positive excess compensation could indicate overcompensation, and negative excess compensation could indicate undercompensation (Ibid.). Acknowledging that cases of excess compensation may be a product of unobserved firm characteristics (omitted variables), this relatively new concept within *agency theory* provides an interesting way of researching corporate governance practices and determinants of compensation.

From an investor perspective, it can be difficult to assess whether boards are overcompensated or undercompensated. Advocates of using financial compensation as a motivational tool argue that compensation is a practice used to attract the necessary skills among boards as well as the CEO (Conyon, 2014). Yet, in the aftermath of the 2007-2008 financial crisis, suspicion of weak corporate governance links between compensation and performance underlines the need for reviewing compensation packages of both boards and CEOs. This is particularly relevant among larger US firms, such as those in the S&P 500 index, as their size amplifies the magnitude of how stakeholders are affected. The S&P 500 index is also widely used as a proxy for the state of US equity markets (Standard & Poor's, 2018). Hence, this study intends to contribute to the existing literature by providing a post-crisis perspective on S&P 500 firms' links between determinants of board compensation and CEO compensation, and how these relate to future firm performance.

1.1 Thesis motivation

We seek to contribute to the literature covering the relationships and interplay between board compensation, CEO compensation, and future firm performance. Specifically, this paper aims to set itself apart by providing an after-crisis investigation of the links between excess board compensation, excess

[3] We choose to follow the terminology of "excess compensation", in line with previous scholars. The term and use of "excess" is in this context comparable to the term "excess stock returns", meaning it can be both positive and negative.

CEO compensation, and future firm performance. While much existing literature has covered determinants of particularly CEO compensation and its link to firm performance, fewer scholars look into board compensation (e.g. Core et al., 1999; Lin & Lin, 2014; Ozkan, 2007). And even fewer study the interplay of excess compensation in relation to future firm performance (Brick et al., 2006; Chung et al., 2015; Core et al., 1999). Thus, we aim to contribute with a recent study on the matter, and thereby get an understanding of the situation after the crisis. Besides applying insights from *agency theory*, we intend to assess results by applying multiple theoretical perspectives, including *stewardship theory* and *resource dependence theory*.

This paper is relevant not only to academics and investors seeking insights to understanding compensation determinants and the impacts of excess compensation, but also to policy makers in attempts to construct new regulation. We thereby consider this paper a value-adding scholarly contribution to existing literature.

1.2 Research questions

To investigate the relationships between board compensation, CEO compensation, and future firm performance, this paper revolves around the following three research questions:

1. How does corporate governance characteristics impact board compensation?
2. How does corporate governance characteristics impact CEO compensation, and how does excess board compensation impact CEO compensation?
3. How does excess board compensation and excess CEO compensation impact future firm performance?

In order to answer the three proposed research questions, we formulate a number of hypotheses based on existing literature. Subsequently, we test these hypotheses following a hypothetic-deductive research approach, using a sample of 411 firms from the S&P 500 index for the period 2010-2015. In total, this corresponds to a sample of 2,466 firm-years. Thus, we seek to answer the research questions through hypothesis-testing and by applying existing theoretical concepts and literature to the results.

1.3 Structure of this paper

To comprehensively answer the proposed research questions, this thesis is structured as follows: i) theory and background, ii) literature review and hypothesis development, iii) data and methodology, iv) empirical findings, v) conclusion, and vi) suggestions for future research.

The structure is intended to provide the reader with an overview of the theory used to interpret the empirical findings. Subsequently, we scrutinize existing literature to develop hypotheses. These hypotheses are then analyzed and tested in order to answer the proposed research questions.

2 Theory and background

In the following subsections, we will introduce theoretical concepts within *agency theory*, *stewardship theory*, *resource dependence theory*, and corporate governance practices that are utilized in addressing the proposed research questions. The theoretical overview of *agency* and corporate governance theory is intended to summarize the key elements setting the foundation for the analysis of this paper. Hence, this paper seeks to outline the aspects of *agency theory* in general and describe corporate governance practices as tools that can be applied in dealing with *agency problems*. Acknowledging that *agency theory* is unable to explain all perspectives of corporate governance, we will introduce *stewardship theory* and *resource dependence theory* as theoretical alternatives to *agency theory*. This will enable a deeper and better-rounded interpretation of empirical findings, with multiple theoretical concepts in mind.

2.1 Agency theory

For decades, *agency theory* has been a cornerstone within management theories and remain a fundamental aspect of business and corporate governance (Wasserman, 2006). Some of the most influential papers on *agency theory* were published by Fama & Jensen (1983), Jensen & Meckling (1976), Mitnick (1973), and Ross (1973). *Agency theory* describes the relationship between two (or more) parties, the *principal* and the *agent*, from a behavioral and structural perspective (Jensen & Meckling, 1976; Mitnick, 1973; Ross, 1973). In this paper, we consider shareholders of S&P 500 firms to be the *principals*, whereas the CEO is considered the *agent*. As for the directors, we argue that they act as *agents* on behalf of the shareholders, given their contractual relationship. However, in their relationship with the CEO, directors are perceived as *principals* due to their supervising and monitoring role.

Fundamental elements of *agency theory* are the separation of ownership and control as well as a contractual relationship between the parties (Jensen & Meckling, 1976; Ross, 1973). Ross (1973, p. 134) viewed *agency theory* as universally applicable within contractual relationships:

> *"We will say that an agency relationship has arisen between two (or more) parties when one, designated as the agent, acts for, on behalf of, or as representative for the other, designated the principal, in a particular domain of decision problem. Examples of agency are universal."*

Furthermore, Jensen & Meckling (1976) assume both *principals* and *agents* to be self-interested and risk-averse. Although the *agent* acts on behalf of the *principal*, the *agent's* self-interests may conflict with the interests of the *principal* (Jensen & Meckling, 1976). *Agency problems* arise due to misalignment of interests and *information asymmetry* (Eisenhardt, 1989). While *principals* are interested in maximizing firm value, *agents* are interested in maximizing their own gains. Thereby, according to *agency theory*, managers will not behave in a way that maximizes shareholder returns unless adequate corporate governance practices are implemented (Jensen & Meckling, 1976). As decisions made by managers affect both *principals* and *agents*, this relationship is characterized by an element of risk sharing. As such, the attitudes towards risk affect the actions of both managers and shareholders (Eisenhardt, 1989; Fama & Jensen, 1983). Moreover, a fundamental assumption within *agency theory* is the concept of *bounded rationality*, which acknowledges that human decisions are often based on limited information, limited time, and limited computational capacity (Eisenhardt, 1989; Simon, 1982). An overview of key concepts within *agency theory* can be found in Table 1.

Table 1: Agency theory overview

Agency theory overview	
Key idea	• Principal-agent relationships should reflect efficient organization of information and risk-bearing costs
Unit of analysis	• Contract between principal and agent
Human assumptions	• Self-interest • Bounded rationality • Risk aversion
Organizational assumptions	• Partially deviating interests between principals and agents • Information asymmetry between principal and agent
Information assumptions	• Information as a purchasable commodity
Contracting problems	• Information asymmetry problems (moral hazard and adverse selection) • Risk sharing
Problem domain	• Relationships where principals and agents have partially deviating interests (e.g. compensation, corporate strategy, leadership)

Source: Table constructed by the authors (2018) based on Eisenhardt (1989).

2.1.1 Types of agency problems

As Thomsen & Conyon (2012) outline in their book on corporate governance, *agency problems* can be divided into three different types: i) *Type 1* between shareholders and managers, ii) *Type 2* between majority shareholders and minority shareholders, and iii) *Type 3* between shareholders and firm stakeholders. However, for this paper, we mainly deal with *Type 1 agency problems*. *Type 1 agency problems* relate to conflicts between firm owners and the hired managers of these firms.

Andreas et al. (2012) and Kumar & Sivaramakrishnan (2008) further elaborate on the *Type 1 agency problem* between shareholders and managers. They argue that the traditional two-dimensional *agency problem* between the board and the management does not sufficiently explain the behavior of boards. While the two-level hierarchy is designed to mitigate *agency problems*, it creates another *agency problem* of its own (Andreas et al., 2012). A three-level hierarchy of shareholder-board-management will therefore better explain the behavior of boards and CEOs, since boards are employed by shareholders to act on behalf of them. According to this view, the board is assumed to pursue own interests, and board compensation is seen as the result of the bargaining process between shareholders and the board. Thus, according to this view, the board adds another layer in the *agency problem*, although often the directors are shareholders themselves (Ibid.).

2.1.2 Agency cost

In order to reduce the misalignment of interests, *principals* will construct mechanisms that seek to monitor and incentivize the behavior of *agents* (Eisenhardt, 1989; Fama & Jensen, 1983; Jensen & Meckling, 1976). *Principals* can optimize *agency* relationships by establishing incentive mechanisms for the *agent*. However, doing so can be costly (Fama & Jensen, 1983). The cost of these efforts has been conceptualized as *agency costs* (Jensen & Meckling, 1976). *Agency costs* arise in all situations involving cooperative efforts such as managing a firm. Jensen & Meckling (1976) define *agency cost* as the sum of three underlying costs: *monitoring costs*, *bonding costs*, and *residual loss*. *Monitoring costs* are costs incurred by the *principal* in order to observe, measure, and control the behavior of the *agent*. That includes audits and compensation contracts for managers and directors. *Principals* can moreover control the behavior of *agents* by limiting the *agent's* decision-making authorities. *Bonding cost* is the potential drawback of such restrictions since the *agent* might be constrained from making decisions that would

maximize the utility of the *principal*. *Residual loss* captures the dollar-equivalent reduction in welfare experienced by the *principal* as a result of the *agency* relationship (Ibid.).

2.1.3 Information asymmetry problems

In *agency* relationships, problems of *information asymmetry* are expected to occur (Thomsen & Conyon, 2012). *Information asymmetry* is present when one party possesses more or better information than the other party. This can be exemplified by an *agent* having more accurate information on their behavior than the *principal*. Moreover, one can think of information as a purchasable commodity (Eisenhardt, 1989). Thus, it is possible to obtain additional information by committing increased resources.

There are two distinctive *information asymmetry* problems, both relevant to corporate governance: *adverse selection* (hidden knowledge) and *moral hazard* (hidden action) (Thomsen & Conyon, 2012). *Adverse selection* is an issue related to a selection process, e.g. hiring managers or selecting projects. Thus, *adverse selection* poses a problem ex ante of the contractual agreement. Akerlof (1970) has been one of the most significant contributors within this field, exemplifying *adverse selection* with his allegory of the "market for lemons" and quality uncertainty in the car industry.

Contrarily, *moral hazard* is a problem ex post contractual agreement as it captures actions made by the *agent* that cannot be observed by the *principal*. Firms and their shareholders must contemplate both *information asymmetry* problems and consider how to minimize the risks and consequences. Proper screening and monitoring processes as well as appropriate incentive structures are applicable corporate governance tools in dealing with this problem (Thomsen & Conyon, 2012). *Moral hazard* can take numerous forms, including making managerial decisions that benefit the manager rather than shareholders, such as empire building or excessive use of firm perks (Ibid.). For example, in 2007 Contrywide Financial's controversial CEO, Angelo Mozilo, took advantage of firm perks and used corporate jets for his wife's personal travels. The exploitation of firm perks and mismanagement of shareholders' wealth, eventually led to the dismissal of Mozilo, and a lifetime ban from serving any management position at any listed firm by the SEC (Minow, 2012). As such, in severe cases, *moral hazard* can be fraudulent behavior leading to significant shareholder wealth loses and criminal charges. Nonetheless, as Thomsen & Conyon (2012) argue, performance-based compensation is a useful incentive in dealing with the risk of managers engaging in *moral hazard*. Compensation elements such as

performance bonuses and stock options are ways for shareholders to better align interests of shareholders and managers (Jensen & Murphy, 1999; Thomsen & Conyon, 2012.).

2.1.4 Mutual back-scratching

The concept of *mutual back-scratching* has been touched upon by papers such as Brick et al. (2006), Chung et al. (2015), and Lin & Lin (2014) as an extension of Jensen's (1993) paper regarding *agency theory* and problems in board culture. Jensen's (1993) argument is that a poor board culture is likely to be associated with board failure. The hypothesis is that boards with poor culture will result in passivity and willingness to maintain status quo over critical monitoring. Jensen (1993, p. 863) further argues:

"Board culture is an important component of board failure. The great emphasis on politeness and courtesy at the expense of truth and frankness in boardrooms is both symptom and cause of failure in the control systems. CEOs have the same insecurities and defense mechanisms as other human beings; few will accept, much less seek, the monitoring and criticism of an active and attentive board."

Both directors and CEOs are perceived as self-interested, motivated by financial compensation, and they benefit from vouching for the other party's compensation. Hence, *mutual back-scratching* creates an *agency problem* where both boards and CEOs do not necessarily act strictly in the interest of shareholders. Brick et al. (2006) suggest that as the CEO and the board work closely together, the independence is limited, and this can facilitate cronyism.

Brick et al. (2006) argue that problems in board culture are linked to board compensation, because well-compensated boards may have an incentive to favor the maintenance of status quo, at the expense of critical monitoring. In other words, highly compensated boards are less likely to "rock the boat" (Ibid., p. 404). This can end up fostering cronyism because highly compensated boards, who are in charge of setting the CEO compensation, may have a self-interest in preserving the current state of board compensation. The argument is that this problem may be related to *mutual back-scratching*, and can be a product of cronyism that eventually leads to lower future firm performance (Brick et al., 2006; Lin & Lin, 2014).

Both Brick et al. (2006) and Lin & Lin (2014) claim that the extent of board undercompensation or overcompensation can be measured in terms of excess compensation, i.e. how much more (or less) boards are compensated relative to peers, when taking corporate governance and firm characteristics into

account. Brick et al. (2006) and Lin & Lin (2014) find a positive relationship between excess board compensation and CEO compensation. Hence, the theoretical concept of *mutual back-scratching* can increase the understanding of how excess board compensation impacts CEO compensation.

2.2 Stewardship theory

For a long time, *agency theory* has been one of the dominant perspectives within corporate governance. However, *stewardship theory* provides an alternative view on corporate governance and the *principal-agent* relationship between shareholders and CEOs (Donaldson & Davis, 1991). While *agency* theorists assume *agents* to be opportunistic and self-serving, *stewardship theory* depicts *agents* as *"being collectivist, pro-organizational, and trustworthy"* (Davis et al., 1997). Thus, *stewardship theory* provides a fundamentally different perspective on corporate governance. Contrary to *agency theory*, *stewardship theory* identifies notable benefits for *principals* from the empowerment of *agents*. For example, Donaldson & Davis (1991) find a positive relationship between CEO duality (role of CEO and chairman held by the same person) and ROE. These findings provide support of the *stewardship theory* perspective that shareholders (*principals*) benefit from empowering *agents* (managers), rather than imposing control mechanisms restricting their actions. Therefore, contrary to *agency theory*, *stewardship theory* assumes directors and CEOs to be intrinsically motivated and to act in the best interest of the organization:

> *"(…) organizational role-holders are conceived as being motivated by a need to achieve, to gain intrinsic satisfaction through successfully performing inherently challenging work, to exercise responsibility and authority, and thereby to gain recognition from peers and bosses. Thus, there are non-financial motivators"* (Donaldson & Davis, 1991, p. 51).

According to this theoretical perspective, the traditional oversight role of boards may not be as crucial. Davis et al. (1997) argue that *principal-agent* relationships are affected by whether managers' primary motivation stems from intrinsic motivation (e.g. responsibility and recognition) or extrinsic motivation (e.g. financial reward or punishment). Managers who are primarily motivated by achievement and self-actualization will gain higher utility from acting in the interest of the organization, which is in sharp contrast to what is assumed in *agency theory* (Ibid.). For instance, *agency* theorists would argue that CEO duality limits the boards' ability to safeguard shareholder interests of achieving higher returns, unless long-term compensation structures are implemented (Donaldson & Davis, 1991). On the other hand,

stewardship theory argues that from a strategic management perspective, the presence of CEO duality can be an organizational structure that benefits shareholder interests, as this will allow the CEO to *"take effective action"* (Ibid.). Additionally, *stewardship theory* suggests that strict corporate governance mechanisms can at best be needless, but at worst be counterproductive (Davis et al., 1997). Davis et al. (1997) argue that significant monitoring and incentives can diminish the *steward's* intrinsic motivation and undermine the "pro-organizational" behavior of the *steward*. Accordingly, *stewardship theory* argues that empowering and trusting managers is in the best interest of shareholders, as this will provide the structure for managers to perform optimally (Ibid.).

2.3 Resource dependence theory

Pfeffer & Salancik (1978) have been highly influential within strategic management and organizational theory through their contribution to *resource dependence theory* (Davis & Cobb, 2015; Hillman et al., 2009). *Resource dependence theory* can be summarized as firms facing resource scarcities, and consequently seeking to minimize dependencies on such factors (Andreas et al., 2012). In relation to the fields of board compensation, CEO compensation, and future firm performance, *resource dependence theory* perceives the board as a tool used to obtain necessary resources (Boyd, 1990).

Resource dependencies can be managed by firms by creating board connections and/or ownership ties (Thomsen & Conyon, 2012). Hence, boards can provide firms with valuable resources such as knowledge and access to external resources. This could be through access to critical information via board interlocks, multiple directorships, or specific expertise from previous experiences (Andreas et al., 2012). Moreover, in relation to the theory of corporate governance, *resource dependence theory* suggests that board size and board composition are not arbitrary (Hillman et al., 2009). Instead, board compositions reflect the resource dependencies of the firm, which can change over time. As Boyd (1996) argues, the resource richness of the board is one of the main factors affecting board compensation. Following this argument, board compensation can be viewed as a product of each director's experience, networks, other directorships, competences etc. Hence, advocates of r*esource dependence theory* argue that board compensation, CEO compensation, and future firm performance is linked to the valuable resources attributed to directors and the CEO.

2.4 Corporate governance practices

The existence of corporate governance problems is no recent revelation. Adam Smith addressed this issue in his famous publication "The Wealth of Nations" from 1776 (p. 37):

"The directors of such companies, however, being the managers rather of other people's money than of their own, it cannot well be expected that they should watch over it with the same anxious vigilance with which the partners in a private copartnery frequently watch over their own."

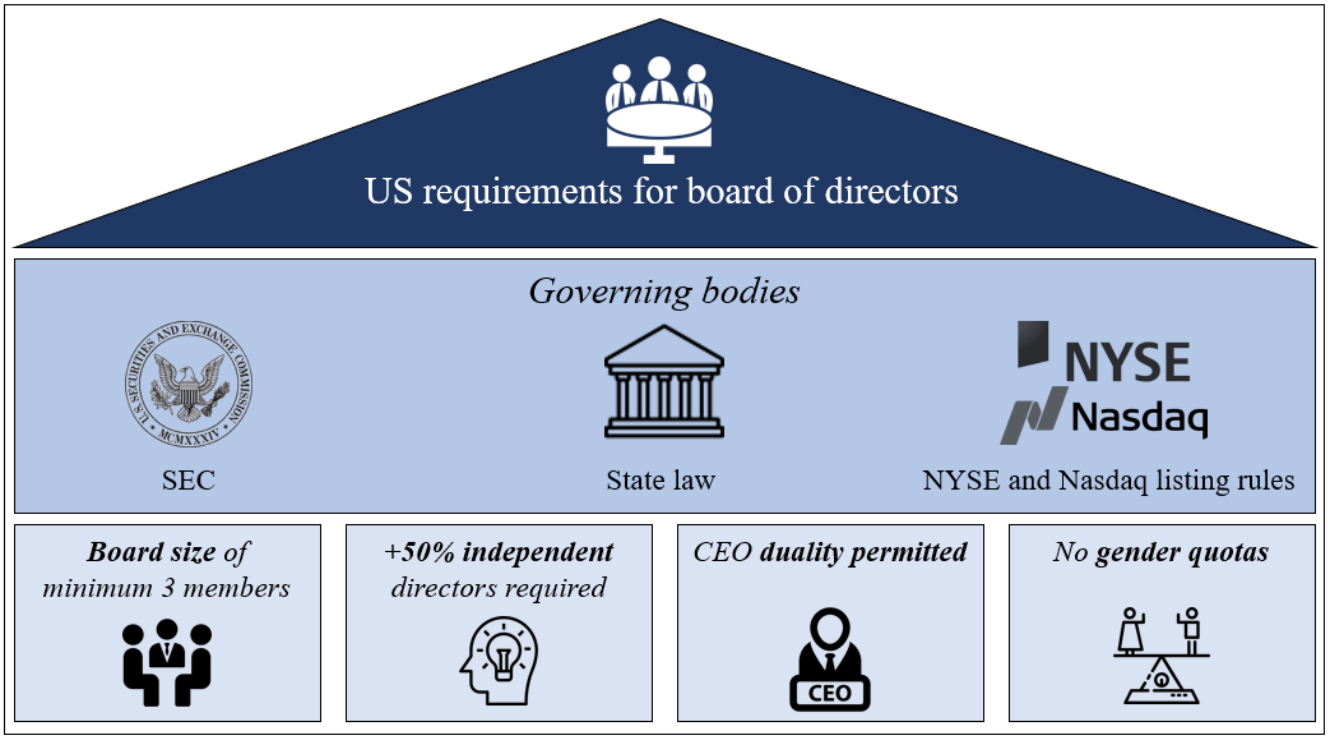
The following subsections will be devoted to outlining the theory of corporate governance practices as means to mitigating *agency problems*. Specifically, we will adopt an *agency theory* perspective on how corporate governance practices may be implemented to minimize *agency problems* and the cost derived from these. However, there are varying definitions of corporate governance. In this study, we consider the definition similar to the ones proposed by Cadbury (1992) and Thomsen & Conyon (2012), who define corporate governance as *"the control and direction of companies by ownership, boards, incentives, company law and other mechanisms"* (Thomsen & Conyon, 2012, p. 4). In particular, this paper focuses on board characteristics, CEO characteristics, and incentives for boards as well as CEOs. Moreover, we consider corporate governance characteristics (hereunder board and CEO characteristics), to be part of the overall characteristics of the firm. Given the focus on S&P 500 firms exclusively, this paper does not assess corporate governance requirements in other countries than the US.

Corporate governance practices can have several purposes in dealing with *agency problems*, depending on the nature of the problem. Nevertheless, corporate governance theory fundamentally revolves around checks and balance mechanisms that are implemented to ensure that interests of the firm, and ultimately of the shareholders, are upheld (Thomsen & Conyon, 2012). Gompers et al. (2003) study the impact of shareholder protection and find a positive correlation between the level of shareholder protection and firm valuation. This is achieved through a range of mechanisms including allocation of shareholder rights, firm transparency to shareholders and the remaining public, as well as monitoring and incentivization of firm management. Other studies have considered corporate governance characteristics such as board independence (Bhagat & Black, 2002) and CEO duality (Brickley et al., 1997) as significant elements within corporate governance.

2.4.1 Corporate governance requirements for US listed firms

The corporate governance requirements of US-listed firms are regulated by the US Securities and Exchange Commission (referred to as "SEC") and corporate state laws (OECD, 2017). Following the financial crises of the previous decades, the SEC has imposed new regulations. These include the Sarbanes-Oxley Act of 2002 (referred to as "Sarbanes-Oxley Act") and the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (referred to as "Dodd-Frank Act") (Rosenbaum & Hoang, 2017). While the Sarbanes-Oxley Act focused on more transparent financial reporting, the Dodd-Frank Act required additional disclosure of CEO compensation (Ibid.). This legislative development reflects a stronger focus on increased transparency and good corporate governance among US-listed firms. Figure 1 displays an overview of relevant US requirements for boards.

Figure 1: Overview of US requirements for boards



Source: Figure constructed by the authors (2018).

Moreover, the national stock exchanges such as New York Stock Exchange (referred to as "NYSE") and Nasdaq Stock Market (referred to as "Nasdaq") require firms to comply with their listing standards in order to be listed. These listing standards include requirements on the firm's corporate governance

structures and policies (Rosenbaum & Hoang, 2017; US Securities and Exchange Commission, 2013). Even though there are strong similarities between the listing standards of NYSE and Nasdaq, the US does not have one single set of corporate governance guidelines or requirements. This is in contrast to countries such as the UK, which has one national corporate governance code (Foley, 2017; OECD, 2017). Nevertheless, US firms listed on either NYSE or Nasdaq are bound by listing standards involving requirements regarding firms' corporate governance structures (OECD, 2017). This includes the requirements for the composition of boards as well as the disclosure of the compensation of directors and CEOs (OECD, 2017). Boards in the US are characterized by a one-tier system with a size requirement of minimum 3 directors (OECD, 2017). Additionally, according to Nasdaq and NYSE listing standards, boards must have a majority of *independent*[4] directors within one year of the listing date (Conyon, 2014; NYSE, 2014; Weil, 2015). Moreover, three distinct board committees must be composed exclusively of independent directors: i) audit committee, ii) compensation committee, and iii) nominating committee (OECD, 2017; Rosenbaum & Hoang, 2017). While the corporate governance code in a number of countries require the role of CEO and chairman of the board to be separated, this is decided by the US-listed firms themselves (OECD, 2017). Additionally, there are no requirement in the US regarding board gender diversity, i.e. no requirement for both genders to be represented on the board.

2.4.2 Boards

The board acts as the intermediary between shareholders and management (Thomsen & Conyon, 2012). The board consists of a certain number of individuals, who must be elected by shareholders and have significant decision-making power over firm assets, of which some decisions need explicit shareholder approval. Determination of board compensation takes place in a compensation committee consisting of independent directors appointed by the board. Additionally, the compensation committee's role usually includes recommending any changes to the compensation package of directors and the CEO, although it is subject to approval by the entire board. In order to design the compensation package, the compensation committee may also select and employ professional assistance such as legal counseling, accounting support, and contribution from compensation consultants (Compensation Resources Inc, 2015). The structure of board compensation typically includes substantial benefits in addition to cash compensation,

[4] Note: Listed firms where an individual hold more than 50% of the voting power are not required to comply with the requirement of the majority of directors being independent (OECD, 2017).

such as pension plans, health and life insurance, as well as donations to organizations of the director's choice. The intention, and general belief, is that various kinds of compensation is necessary to attract directors (Hoi & Robin, 2004). As such, the compensation to the directors is a multifaceted package, which contains one or more of the following elements (Ibid.):

i) annual retainer, plus supplements for chairing board committees,
ii) fees for attending board and committee meetings,
iii) defined benefit retirement arrangements,
iv) life insurance/medical insurance,
v) charitable contribution arrangement, and
vi) stock options or stock grants.

Boards serve different functions, which, according to Thomsen & Conyon (2012), can be summarized as *Control*, *Consulting*, and *Contact* (see Table 2). These functions are not mutually exclusive, but the functions represent different perspectives on corporate governance theory, namely *agency theory*, *stewardship theory*, and *resource dependence theory* (Ibid.). However, besides the board functions outlined by Thomsen & Conyon (2012), other duties include recruitment of the CEO, as well as determining the compensation to him/her (Boland & Hofstrand, 2009).

Table 2: Overview of board functions

Function	Basic idea	Theory
Control	• Minimize shareholders' information asymmetry • Ensure that the CEO acts in shareholders' interests • Monitor behavior of CEO • Ratify corporate decisions	• Agency theory
Consulting	• Develop corporate decisions in collaboration with the CEO • Boards are seen as a knowledge resource composed in order to meet the needs of the firm	• Stewardship theory • Resource dependence theory
Contact	• Provide the firm with access to valuable networks and contacts	• Resource dependence theory

Source: Table constructed by the authors (2018), based on: Adams (2005); Davis et al. (1997); Donaldson & Davis (1991); Fama & Jensen (1983); Huse (2007); Jensen & Meckling (1976); Thomsen & Conyon (2012); Westphal (1999).

According to Adams (2005), while boards have several responsibilities, the *agency theory*-inspired task of controlling/monitoring remains the function to which boards devote the most efforts. Adams (2005)

examine the role of boards and find that boards appear to allocate the majority of their time to the control and monitoring role. Adams (2005) further argues that the variation of board behavior can be explained through factors such as firm size and the amount of uncertainty that the firm faces. Particularly, large firms that are facing relatively more uncertainty devote less effort to monitoring management, while boards of very diversified firms spend relatively more time overseeing management (Ibid.).

2.4.2.1 Control function

According to *agency theory*, when ownership and control are separated, boards are needed as a monitoring tool to ensure that management act in the interest of shareholders (Fama & Jensen, 1983). Therefore, the *Control* function is one of the key roles of the board. This means that boards are to monitor the behavior of CEOs due to the presence of *information asymmetry*, particularly *moral hazard* (hidden action). Some scholars have argued that shareholders can avoid the issue of *information asymmetry* through contractual design, such as performance-based rewards. However, as identified in *incomplete contract theory* (Grossman & Hart, 1986), there are significant limitations to *principals'* ability to write contracts that take all possible contingencies into consideration. Acknowledging the limitations of contracting, the board's role is to monitor the efforts and performance of management. Furthermore, boards are involved in the corporate strategic decision-making process consisting of the following steps: i) initiation, ii) ratification, iii) implementation, and iv) monitoring (Fama & Jensen, 1983). According to Fama & Jensen (1983), the most efficient division of labor is when management is responsible of initiation and implementation, while boards perform the ratification and monitoring of corporate decisions. Thus, managers' role is to develop decision proposals that are either ratified or rejected by the board. If ratified, management must implement these decisions while the board subsequently monitors the workings of the management (Thomsen & Conyon, 2012).

2.4.2.2 Consulting function

The *stewardship* perspective perceives managers as intrinsically motivated. Thus, strict corporate governance mechanisms can have a negative effect on managers' performance as it can deter their intrinsic motivation to perform in the interest of the organization (Davis et al., 1997; Donaldson & Davis 1991). In terms of the decision-making process described by Fama & Jensen (1983), the *stewardship* perspective suggests that boards create more value by engaging in the development of initiatives in

addition to ratifying management proposals (Huse, 2007). This is conceptualized through the *Consulting* function of the board (Thomsen & Conyon, 2012).

From a *stewardship* perspective, rather than monitoring the actions of management, the board should collaborate with management and provide them with valuable inputs (Thomsen & Conyon, 2012; Westphal, 1999). The *collaborative board model*, proposed by Westphal (1999), suggests that social ties and interdependence between management and the board are facilitators of knowledge sharing. Managers sharing knowledge with the board will reduce *information asymmetry* with the benefit of improved board performance. Mutual trust between managers and boards is fundamental for the *collaborative board model* to be successful (Ibid.). The attributes of the individual directors may be perceived as their *human capital* (Huse, 2007). This includes the directors' particular knowledge or subject matter expertise. Depending on the knowledge or skillsets needed by the firm, the board composition can change, for instance through the mix of insiders and outsiders on the board. In addition to their *human capital*, directors add value though their *social capital*, i.e. the directors' network and social relations, as suggested by *resource dependence theory* (Ibid.).

2.4.2.3 Contact function

In addition to the *Control* and *Consulting* functions, the board provides the firm with valuable network contacts that may be utilized to the firm's advantage. The *Contact* function is rooted in *resource dependence theory*, emphasizing the dependence and benefit of having well-connected directors (Thomsen & Conyon, 2012). The directors' networks and social links constitute their *social capital* from which the firm can benefit (Huse, 2007). The *social capital* can be leveraged by directors as well as the firm, to gain knowledge of specific areas, to provide firms with legitimacy, and to improve relationships between the firm and other organizations (e.g. firms, regulators). As Huse (2007, p. 58) argues: "*Often who you know really is more important than what you know."* According to *resource dependence theory*, larger boards can improve firm performance as larger boards provide the firm with access to a larger network. Nevertheless, the quality of the board as a whole is affected by its composition, which must be adapted to the needs of the firm.

2.4.3 The CEO

The CEO role is the ultimate leadership position within the firm. The CEO is responsible for leading the development and execution of the firm's strategy, with the essential goal of creating shareholder value

(Brealey et al., 2007). In summary, the CEO's responsibilities generally include (Sterling Resources, 2018):

i) leading the development and implementation of the firm's strategy,
ii) ensuring that the firm is properly organized and staffed, including the obligation to hire and terminate employees necessary to achieve the firm's strategy,
iii) acting as a liaison between other managers and the board,
iv) communicating effectively with shareholders, employees, and other stakeholders, and
v) ensuring that the board is properly informed to enable each director to form appropriate judgements.

Due to the proliferation of *agency theory* (Jensen & Meckling, 1976; Mitnick, 1973; Ross, 1973) and the implications of *agency problems* for major firms, dealing with *agency problems* has become a common research topic within strategic management and corporate governance. Several scholars have discussed the performance-based compensation incentive structures for CEOs as well as directors as a feasible way of minimizing *agency problems* (Brick et al., 2006; Fama & Jensen, 1983; Lin & Lin, 2014).

2.4.3.1 CEO compensation structure

The topic of CEO compensation has attracted vast attention from both policy makers and academic studies following the recent financial crisis. There are several reasons why CEO compensation, particularly among larger US firms, has become a topic of discussion (Conyon, 2014).

Firstly, the levels of CEO compensation have increased tremendously in recent decades. For instance, the inflation-adjusted median CEO compensation among S&P 500 firms has increased from $2.9 million in 1992 to about $9.0 million in 2011 (Conyon, 2014).

Secondly, there is a widely held perception that CEO compensation links insufficiently to firm performance (Conyon, 2014). While S&P 500 CEOs have seen compensation increases of 940% between 1978-2015, the S&P 500 index has increased "merely" 543% over the same period (Matthews, 2016).

Thirdly, CEO compensation levels have grown at a much higher rate than the average US household income, which has ignited the debate on social inequality (Conyon, 2014). For instance, Kaplan (2008) finds that US CEOs earned approximately 100 times the median household income in 1993, whereas the ratio in 2006 had increased to more than 200 times the median household income.

Fourthly, as suggested by Conyon (2014) and Lin et al. (2013), there is a notion that corporate governance mechanisms have failed. Even boards and their compensation committees have been criticized for allowing the rapid increase in CEO compensation, exemplified by this statement from Warren Buffett, chairman of Berkshire Hathaway: *"The typical large company has a compensation committee. They don't look for Dobermans on that committee, they look for Chihuahuas – Chihuahuas that have been sedated"* (Conyon, 2014, p. 61). Thus, Conyon (2014) and Lin et al. (2013) question whether boards consistently safeguard the interests of shareholders, and in instances where the CEO has too much bargaining power, it may even lead to excessive CEO compensation despite poor firm performance (Ibid.).

As Jensen & Meckling (1976) argue, providing managers with equity ownership may lead to better alignment of interests for agents and principals. Making CEO compensation largely dependent on firm performance should thereby incentivize CEOs to increase firm value. Moreover, in order to ensure that managers are properly incentivized and that the financial interests of managers are aligned with the interest of shareholders, both short-term and long-term, managers' compensation should include a wide range of compensation elements (Murphy, 1999). The components of CEO compensation are typically (Wharton Research Data Services, 2018):

i) base salary,
ii) bonus,
iii) stock awards,
iv) option awards,
v) non-equity incentive plans,
vi) change in pension value, and
vii) other compensation.

The base salary is a fixed amount that the CEO receives monthly or annually, while the remaining compensation elements depend on various firm performance factors. These include accounting measures, development in the firm stock price, as well as individual performance metrics (Murphy, 1999). "Other compensation" typically include restricted stocks, long-term incentive plan (LTIP), and retirement plans.

Stock options are most commonly valued using the Black-Scholes formula (Murphy, 1999; Wharton Research Data Services, 2018). Stock options create a direct link between share price development and CEO compensation, since increase in firm share price will increase the compensation of the CEO (Murphy, 1999). However, stock options do not reflect the same incentives as stock ownership would. For instance, as options do not pay dividends, they do not reward the owner with total shareholder return. Instead, the owner merely benefits from share price appreciation and will thereby have incentives to favor share repurchase over dividend payouts (Murphy, 1999). Furthermore, Murphy (1999, p. 2510) explains that:

"(…) since the value of options increase with stock-price volatility, executives with options have incentives to engage in riskier investments. Finally, options lose incentive value once the stock price falls sufficiently below the exercise price that the executive perceives little chance of exercising: this 'loss of incentives' is a common justification for option repricings following share-price declines."

2.4.3.2 Perspectives on CEO compensation

There are different perspectives on compensation levels and the amount of influence that the CEO is supposed to have (Thomsen & Conyon, 2012). The o*ptimal contracting view* perceives the compensation structure of CEOs as a way for shareholders to minimize *agency problems* and deter managers from engaging in *moral hazard*. This perspective has assumptions similar to *agency theory*, that *agents* are risk-averse, self-interested, and utility maximizing. As discussed in *agency theory*, the problem of *moral hazard* is present in *Type 1 principal-agent* problems. In order to minimize the *moral hazard* problem, shareholders can construct the contracts in a way that makes management compensation contingent on firm performance in the short-term as well as long-term (Thomsen & Conyon, 2012). It is worth noting that performance-based contracts do not completely eliminate *agency cost*, as firms have costs associated with writing, implementing, and verifying the contracts (Ibid.). These costs must be weighed against the predicted benefits of constructing the contract and aligning *principal-agent* interests.

Dobson (2011) supports the *optimal contracting view* and claim that any critique of the levels of CEO compensation is unjustifiable. Dobson's (2011) argument is that CEO compensation is a subcomponent of the shareholder model, in which the primary objective of the firm is to maximize shareholder wealth. Thereby, critique of CEO compensation levels is by default a critique of the shareholder model. As such, Dobson's (2011) main point is that CEO compensation is a consequence created by the attempt to

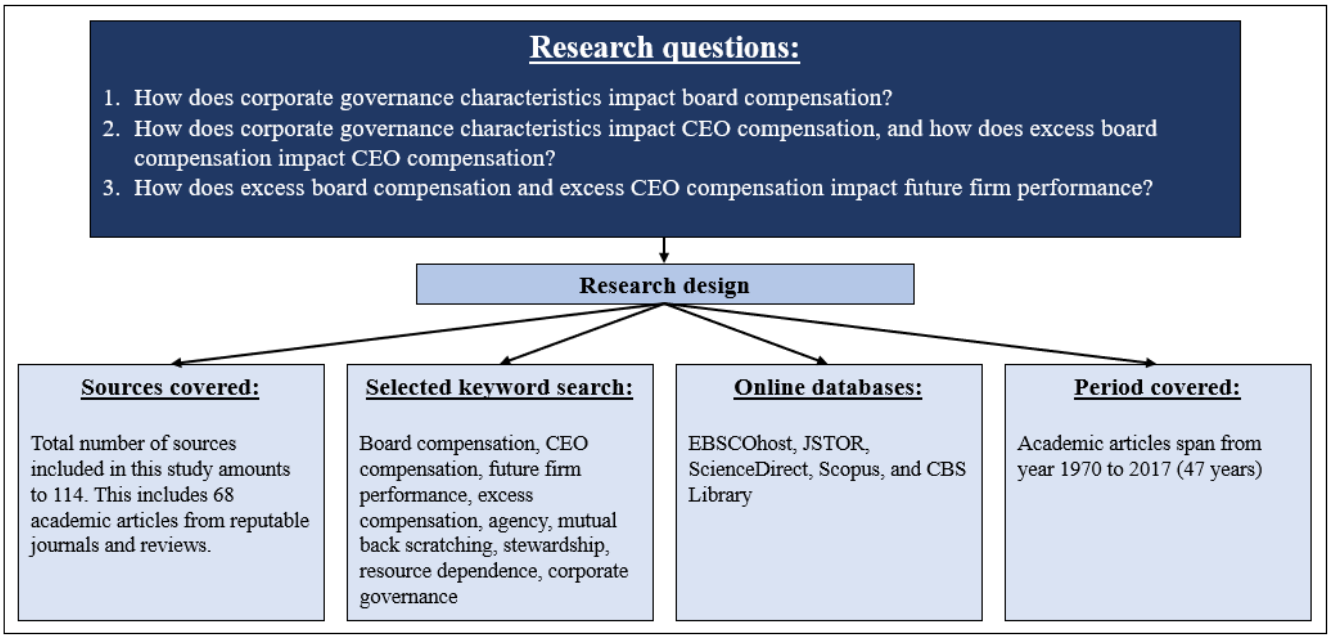
maximize shareholder wealth. Other arguments defending rising levels of CEO compensation include that it is a necessity to attract the best talent, and that the demands and scope of a CEO today are far greater compared to previous decades (Ibid.).

An alternative perspective on CEO compensation is the *managerial power view* (Bebchuk & Fried, 2004) which suggests that CEOs are able to impact their compensation structure to be in their own interest rather than in shareholder interest. According to the *managerial power view*, CEOs are able to exert power over the board due to a lack of "arm's length" bargaining, i.e. a lack of board independence. Thereby, the CEO accomplishes higher compensation levels, particularly when the board is considered "weak" (Thomsen & Conyon, 2012). This can be the case in several instances, for example if the board is relatively large, if the CEO is also the chairman (CEO duality), or if there are strong social ties between the CEO and the board (Ibid.).

3 Literature review and hypothesis development

In order to conduct an extensive literature review and formulate hypotheses, we use a systematic approach for collecting relevant literature. Firstly, we identify and define relevant databases (including EBSCOhost, ScienceDirect, Scopus), relevant academic journals (including *Strategic Management Journal*, *Journal of Corporate Finance*, *Academy of Management Journal*), and a number of keywords to search for. Secondly, after retrieving initial academic papers from relevant journals, we conduct a backwards and forward reference search to increase the number of relevant papers. For instance, in order to identify the most influential papers within our research area, we retrieve papers that are frequently referred to, and that are typically found in the bibliography of similar papers. An overview of the research design can be found in Figure 2 below. These papers constitute the foundation for the literature included in this review. Based on the existing literature within the fields of board compensation, CEO compensation, and future firm performance, we formulate hypotheses that we find appropriate for answering the proposed research questions. Hence, the literature review and development of hypotheses is structured by literature covering the three fields, namely i) board compensation, ii) CEO compensation, and iii) future firm performance.

Figure 2: Research design



Source: Figure constructed by the authors (2018).

3.1 Board compensation

Historically, CEO compensation has been much more extensively researched relative to board compensation, exemplified by the number of academic papers on EBSCOhost. However, in the last decade, studies covering the determinants of board compensation have gained more attention by researchers. There are two primary reasons for the increasing focus on the determinants of board compensation (Andreas et al., 2012). Firstly, due to the financial crisis in 2007-2008, questions have been asked about the role of boards and the adequacy of their compensation. Secondly, other studies, such as Carpenter & Westphal (2001) and Andreas et al. (2012), suggest that board compensation packages have great influence on corporate decisions.

The primary purpose of boards is to monitor and advise top management of a firm, while at the same time establishing incentives in order for the CEO to act in the interest of shareholders (Brick et al., 2006). Thus, much research focuses on boards' role in monitoring CEOs instead of discussing the actual compensation of boards and whether their paycheck is justifiable. An overview of findings regarding determinants of board compensation by existing literature can be found after the development of hypotheses in Table 3 (see page 35). As such, the following three hypotheses will constitute the basis for answering our first research question.

3.1.1 Board size

The impact of board size, i.e. the number of directors, on board compensation has been researched by a number of scholars (Adams & Ferreira, 2009; Andreas et al., 2012; Ertugrul & Hedge, 2008; Hempel & Fay, 1994; Lin & Lin, 2014; Ryan & Wiggins, 2004). However, there are ambiguous findings within this area. Within existing literature investigating the impact of board size on board compensation there are, broadly speaking, two main perspectives.

On the one hand, Andreas et al. (2012) argue that large boards are expected to be inefficient and thereby compensated less. This is supported by scholars such as Ryan & Wiggins (2004) and Ertugrul & Hedge (2008), who find that board size is negatively related to board compensation. Ryan & Wiggins (2004) suggest that this may be due to coordination issues within large boards preventing them from working efficiently. Coordination issues involve directors using additional time and efforts to collaborate, resulting in inefficiencies. Coordination issues are particularly associated with group-work dynamics and

inefficiencies arising when the board reaches a certain size. In fact, as Coles et al. (2008) and Jensen (1993) argue, the ideal board size for efficient group dynamics is generally 7-8 directors, although it may depend on the complexity of the firm. Moreover, it is typically favorable to reach an odd number in order to avoid equality of votes. Thus, these arguments are in line with Conyon (2014), who claims that free-riding problems are likely to take place on larger boards. As such, these arguments concerning coordination issues, inefficient monitoring, and free-riding problems advocate for board size having a negative impact on board compensation.

On the other hand, one would intuitively expect board compensation to increase as the number of directors receiving compensation grows. Moreover, Lin & Lin (2014) hypothesize that board size has a positive impact on board compensation, similar to the impact of firm size. The argument is that larger and more complex firms typically have larger boards, and these firms have higher demands for technical competences and effort of their board. This is in line with *resource dependence theory* and the argument that board size can reflect the resource richness of a board (Boyd, 1996). For large and highly complex firms, hiring directors with sufficient skills and expertise is difficult as the candidate pool is scarcer. This means that highly competent directors with expertise knowledge have higher reservation values, leading to higher board compensation (Andreas et al., 2012). Reservation values, in this context, capture the minimum compensation that a person would accept to take a position as director. Other scholars find a positive correlation between firm size, firm complexity, and board size (Brick et al., 2006; Lin & Lin, 2014). This could indicate that a positive correlation between board size and board compensation exists. Although the impact of firm complexity is more difficult to capture, Brick et al. (2006) find board size to have a positive and statistically significant impact on board compensation. Hence, the argument that larger and more complex firms are associated with larger boards speaks in favor of a positive impact of board size on board compensation. Given the above arguments, we choose to follow the argument that board size is positively correlated with firm size and complexity, and thereby expect a positive impact of board size on board compensation:

H1.1: The number of directors on the board will have a positive impact on board compensation.

3.1.2 CEO duality

As for the impact of CEO duality[5] on board compensation, there appears to be ambiguous findings. While Brick et al. (2006) find it to have a positive impact, Chung et al. (2015) and Lin & Lin (2014) find CEO duality to have a negative impact. Moreover, the findings of Ryan & Wiggins (2004) are inconclusive. Nevertheless, Brick et al. (2006) and Lin & Lin (2014) theorize that CEO duality may be positively related to board compensation. Both papers argue that CEO duality is associated with a higher degree of board entrenchment. According to Brick et al. (2006), CEO duality reflects less board independence and weak governance, as opposed to when the roles of the CEO and chairman are separated. In addition, an entrenched CEO may have stronger control over the board, which leads to reduced monitoring effort and less CEO turnover. Thus, this argumentation follows Brick et al.'s (2006) hypothesis regarding the existence of cronyism and *mutual back-scratching*, as it presumably is in the CEO's best interests to vouch for higher board compensation.

Larcker & Tayan (2016) claim that problems stemming from CEO duality are due to conflicts of interests affecting the compensation determination process, as it is difficult for the board to act strictly independently when the CEO at the same time is chairman of the board. Harris et al. (2012) argue that from an *agency* perspective, CEO duality represents less board control over the CEO, leading to increased *information asymmetry* and lower firm performance. However, as Larcker & Tayan (2016) discuss, it is not always advantageous to split the roles of the CEO and the chairman. For example, mandating separation can be artificial, and can lead to duplication of leadership, create internal confusion, and make recruitment of a new CEO more difficult. Additionally, splitting the roles increases the costs of information sharing (Harris et al., 2012). These arguments are in line with *stewardship theory*, where it is the consensus that CEO duality allows the CEO to *"take effective action"* (Donaldson & Davis, 1991).

Elaborating on Brick et al.'s (2006) theory regarding *mutual back-scratching*, we argue that CEO duality enables the CEO to affect the determination process of board compensation. The CEO could have personal interest in vouching for higher board compensation, as the *mutual back-scratching* logic is likely to create a positive spillover effect on CEO compensation. The CEO thereby has an interest in keeping the board comfortable. This will lead to a decreased probability of "rocking the boat", since highly paid

[5] When the CEO simultaneously holds the position as chairman of the board.

boards are more likely to be comfortable with the status quo (Brick et al., 2006; Lin & Lin, 2014). Hence, although there indeed are mixed findings within this area, we choose to follow the findings of Brick et al. (2006), and argue that CEO duality will have a positive impact on board compensation, as it could be in the interest of the CEO to maintain a comfortable board and prevent "rocking the boat":

H1.2: CEO duality will have a positive impact on board compensation.

3.1.3 Board independence ratio

Studies by Adams & Ferreira (2009), Andreas et al. (2012), and Ryan & Wiggins (2004) all find the proportion of independent directors on the board to have a positive impact on board compensation. Andreas et al. (2012) and Ryan & Wiggins (2004) argue that it is the general consensus in popular press and academic literature that an independent director is a more effective and less biased monitor of management compared to a non-independent director. Moreover, Ryan & Wiggins (2014) find that board independence is correlated with enhancement of shareholder welfare, and that independent directors are typically associated with a greater proportion of equity-based compensation. Independent directors are thereby more likely to vote for incentive-based board compensation rather than annual retainers or fees (Ibid.). Linck et al. (2008) argue that independent directors conduct more critical monitoring of the CEO, but are less informed about the firm's constraints and opportunities. Thus, according to Linck et al. (2008), independent directors are expected to prioritize the *Control* role relative to non-independent directors (Thomsen & Conyon, 2012). Hence, following the *agency* perspective, independent directors who receive higher proportions of incentive-based compensation should be more active and critical monitors acting in the shareholders' best interests.

In theory, board independence is one of the corporate governance tools that can reduce *agency problems* through more objective supervision of management. However, in a somewhat controversial paper named *"Hiring Cheerleaders: Board Appointments of 'Independent' Directors"*, Cohen et al. (2011) argue that the label "independent director" may not always be appropriate. Thus, Cohen et al. (2011) find evidence that firms appoint independent directors that are overly sympathetic to the existing management, while at the same time technically living up to the regulatory definitions of "independent directors". This suggests that although board independence ratio should indicate the proportion of independent directors on the board, one should exert caution when interpreting this measure, as it is uncertain that all independent directors in fact are truly independent.

Andreas et al. (2012) argue that the positive impact of board independence ratio on board compensation may be caused by the higher reservation values of independent directors relative to non-independent ones. Thus, according to Andreas et al. (2012), it is costlier to hire independent directors. Moreover, independent directors are found to be less biased and more effective monitors, which consequently leads to reduced *agency costs* for shareholders (Ibid.). Another argument justifying board compensation and board independence ratio to be positively correlated relates to *resource dependence theory*. This is because independent directors are expected to be more likely to possess resources that are not otherwise found internally in the firm, thus affecting their reservation values positively. These resources include expertise on specific areas or *social capital* that is valuable to the firm (Hillman et al., 2009).

Based on the findings of previous scholars (e.g. Adams & Ferreira, 2009; Andreas et al., 2012; Ryan & Wiggins, 2004), we expect independent directors to have relatively higher reservation values compared to non-independent directors. Moreover, we expect that shareholders, to a greater extent, are willing to compensate independent directors higher due to their less biased monitoring. This justifies our hypothesis that we expect board independence ratio to impact board compensation positively:

H1.3: Board independence ratio will have a positive impact on board compensation.

Table 3: Factors impacting board compensation

Author	Year	Country	Sample period	Obs.	Board size	CEO duality	Board independence ratio	CEO tenure	Board gender ratio	Firm size	Past firm performance	Firm complexity
Adams & Ferreira	2009	US	1996-2003	8,253	-		+		0	+*	+*	
Andreas et al.	2012	GER	2005-2008	1,180	-		+*			+*	+*	
Boyd	1996	US	1980 + 1987	642						+*	0	
Brick et al.	2006	US	1992-2001	5,923		+*		0		+*	+*	+*
Chung et al.	2015	TW	2005-2009	4,930		-*				-	+*	-
Cordeiro et al.	2000	US	1996	200						+	-	
Elston & Goldberg	2003	GER	1970-1986	1,365						+*	+	
Ertugrul & Hedge	2008	US	2000-2002	4,010	-					-	-	
Farrell et al.	2008	US	1998-2004	1,635						+*	0	
Hempel & Fay	1994	US	1986+1990	469	+					0	0	
Lin & Lin	2014	US	2007-2010	713	+*	-*		-*		+*	+*	
Ryan & Wiggins	2004	US	1997	1,018	-*	0	+			+*	0	

Source: Table constructed by the authors (2018). Note: * denotes statistical significance level of 10% or better. Signs (+) and (-) denote positive or negative coefficients respectively. Inconclusive results are reported by (0).

3.2 CEO compensation

In contrast to the determinants of board compensation, the academic research attention devoted to determinants of CEO compensation is rather extensive. An overview of findings regarding determinants of CEO compensation in previous literature can be found after the development of hypotheses in Table 4 (see page 41). We will use the following four hypotheses to answer our second research question.

3.2.1 Excess board compensation

Excess board compensation has not yet been extensively researched. Consequently, Brick et al. (2006), Chung et al. (2015), and Lin & Lin (2014) provide some of few studies on the matter. All of these studies find statistically significant support for excess board compensation having a positive impact on CEO compensation. Excess board compensation is defined as the extent of board undercompensation or overcompensation based on the residuals from a model measuring board compensation, when accounting for corporate governance and firm characteristics (Brick et al., 2006; Lin & Lin, 2014). Thus, excess board compensation stems from the difference between the observed value and the predicted value of board compensation, and acts as a measure for potential undercompensation or overcompensation of boards. In theory, if excess board compensation takes the value of zero, the board is "correctly" compensated as predicted by the model. Likewise, positive excess board compensation indicates that the board is compensated more than the model prediction justifies, while negative excess board compensation indicates that the board is compensated less than predicted.

The theoretical concept of excess board compensation and how this impacts CEO compensation builds upon *agency theory* with the terminology of *mutual back-scratching* (Brick et al., 2006; Chung et al., 2015; Lin & Lin, 2014). As Brick et al. (2006) and Lin & Lin (2014) argue, problems in board culture may be associated with an environment of cronyism and passivity, where highly compensated boards are less likely to "rock the boat" and conduct critical monitoring of the CEO. Thus, the phenomenon of *mutual back-scratching* refers to the expected positive impact of excess board compensation on CEO compensation. Additionally, well-compensated directors have a greater opportunity cost from potentially losing their seat on the board as a consequence of critical monitoring (Lin & Lin, 2014). However, it is important to underline that this opportunity cost of "rocking the boat" does not solely refer to a director fearing the loss of financial compensation. It may also relate to the potential loss of the social and professional network associated with a board membership (Pfeffer & Salancik, 1978; Hillman et al.,

2009). Moreover, the *mutual back-scratching* relationship can be interpreted in light of the three-level hierarchy (Andreas et al., 2012; Kumar & Sivaramakrishnan, 2008), which adds another layer to the *agency problem* (Jensen, 1993). In other words, the phenomenon of *mutual back-scratching* creates a situation where well-compensated directors favor own interests over shareholder interests.

Therefore, in light of the existing findings by Brick et al. (2006), Chung et al. (2015), and Lin & Lin (2014), we expect that excess board compensation will have a positive impact on CEO compensation due to a potential *mutual back-scratching* relationship:

H2.1: Excess board compensation will have a positive impact on CEO compensation.

3.2.2 Board size

The measurement of board size, i.e. number of directors on the board, has often been included as a variable explaining CEO compensation in previous research (Adams & Ferreira, 2009; Benkraiem et al., 2017; Conyon, 2014; Core et al., 1999; Lin & Lin, 2014; Ozkan, 2007). Within this area, literature generally agrees that board size is positively impacting CEO compensation. However, there are two deviating theories regarding the positive impact of board size on CEO compensation.

One argument regarding the positive impact of board size on CEO compensation is associated with greater bargaining power of the CEO due to inefficiencies within large boards. Ozkan (2007) argues that board size can strongly affect the effectiveness of boards' monitoring efforts. This argument is rooted in productivity losses arising when larger groups of people are working together. Jensen (1993, p. 865) even claims that keeping boards small can help improve their performance: *"When boards get beyond seven or eight people they are less likely to function effectively and are easier for the CEO to control."* Thereby, communication and coordination become increasingly difficult as board size increases beyond a certain threshold. Core et al. (1999) also use board size as a proxy effectiveness of board monitoring, arguing that larger boards are less effective and more susceptible to the influence of the CEO. Thereby, they argue that it might be easier for the CEO to influence his/her compensation package positively when the board is large, due to free-rider problems and coordination issues. Conyon (2014) supports this argument and interprets the positive impact of board size on CEO compensation as a governance problem. As such, arguments put forward by Conyon (2014), Core et al. (1999), Jensen (1993), and Ozkan (2007) follow the rationale that larger boards are less efficient in monitoring the CEO. This is presumably due to free-

riding problems, and the CEO taking advantage of this to affect the process of his/her compensation determination.

On the other hand, Lin & Lin (2014) hypothesize that larger boards usually are associated with larger and more complex firms. Large complex firms have additional demands for the combined competences and network of their directors, which typically results in larger board size. Similarly, large and complex firms are expected to be associated with higher CEO compensation, as these firms require a more extensive skillset of the CEO. Thereby, board size can act as an indicator of both firm size and firm complexity, according to Lin & Lin (2014), which is why board size is expected to impact CEO compensation positively.

Based on the arguments presented in existing literature, we find the rationale of both Conyon (2014), Core et al. (1999), Jensen (1993), Lin & Lin (2014), and Ozkan (2007) collectively to be convincing. We acknowledge that larger boards have coordination issues leading to increased CEO power in compensation negotiations, but we also recognize that larger boards are usually associated with larger and more complex firm. Thus, in line with findings of previous literature, we expect a positive impact of board size on CEO compensation:

H2.2: The number of directors on the board will have a positive impact on CEO compensation.

3.2.3 CEO duality

Studies investigating the impact of CEO duality on CEO compensation are somewhat ambiguous. Scholars such as Adams & Ferreira (2009), Brick et al. (2006), Conyon et al. (2011), and Core et al. (1999) find a positive relationship, while Benkraiem et al. (2017), Cordeiro & Veliyath (2003), and Lin & Lin (2014) find a negative relationship. Core et al. (1999) argue that CEO duality is a sign of weak governance. This relates to the *managerial power view* (Bebchuk & Fried, 2004), arguing that more powerful CEOs will be able to influence board decisions to their own advantage. Lin & Lin (2014) and Brick et al. (2006) support this argument suggesting that CEO duality can be used as a proxy for CEO entrenchment and CEO power. Furthermore, entrenched CEOs may be able to impact their compensation package positively. Hence, the argument is that higher CEO power can yield positive spillover effects on CEO compensation (Brick et al., 2006).

Jensen (1993) explains that it is common among US firms for the CEO to also hold position as chairman of the board. In short, the chairman role includes responsibilities of running board meetings as well as overseeing the process of hiring, firing, evaluating, and compensating the CEO. Thus, there can be some extra workload associated with the chairmanship. However, as Jensen (1993, p. 866) argues, the governance problem arises due to conflicts of interest:

"Clearly, the CEO cannot perform this function apart from his or her personal interest. Without the direction of an independent leader, it is much more difficult for the board to perform its critical function. Therefore, for the board to be effective, it is important to separate the CEO and chairman positions."

Harris et al. (2012) claim that CEO duality reflects weak governance and an *agency problem*, as it limits the board's independence, restricts the monitoring of the CEO, and increases *information asymmetry*. Lin & Lin (2014) argue that even if the CEO cannot participate in compensation committee meetings, the presence through chairmanship may give the CEO an ability to exert influence over the determination process of CEO compensation. Thus, the assumption of self-interest and ability to impact the compensation determination process will potentially have a positive spillover effect on the CEO's compensation.

Therefore, despite some scholars reporting a negative impact of CEO duality on CEO compensation, we choose to follow the majority of existing literature reporting it to have a positive impact. This is because of the CEO's expected ability to affect the compensation determination process indirectly through the chairmanship, and because the increased workload will likely affect the CEO's compensation:

H2.3: CEO duality will have a positive impact on CEO compensation.

3.2.4 CEO shareholding

The common response to aligning CEO incentives with those of shareholders is to design incentive-based compensation. This could be through equity ownership as a compensation form to ensure that the CEO will have proper incentives to act in a manner that maximizes shareholder value. Hence, Brick et al. (2006), Cordeiro & Veliyath (2003), Core et al. (1999), Lin et al. (2013), and Lin & Lin (2014) investigate the impact of CEO shareholding (i.e. the proportion of the firm's shares owned by the CEO) in relation to CEO compensation and report a negative impact.

The argument concerning a negative impact of CEO shareholding on CEO compensation is the *agency*-related argument that equity compensation can substitute other forms of compensation. Hence, when the CEO's interests are aligned through equity ownership, less cash compensation is needed to motivate the CEO to act in the interests of shareholders. Lin & Lin (2014) propose that CEO shareholding can act as a substitute for CEO compensation, which is supported by Cordeiro & Veliyath (2003) and Lin et al. (2013). CEOs with considerable shareholding have strong incentives to increase firm value, and the higher proportion of ownership thereby impacts CEO compensation negatively. Moreover, compensating CEOs through shares could improve alignment of interests with shareholders, which contributes to reducing *information asymmetry* problems, particularly *moral hazard*. This follows the argument by Jensen & Meckling (1976) regarding *agency costs* and the claim that the need for monitoring will decrease when CEO shareholding increases.

However, CEO shareholding can promote unintended actions by the CEO. For instance, the CEO's time horizon may affect the usefulness of CEO shareholding to align interests. Ryan & Wiggins (2001) find that CEO age can act as a proxy for the "CEO horizon problem". Their findings suggest that very young or very old CEOs may have other incentives that create a time horizon problem for choosing projects: *"Older CEOs have the incentives to choose projects that pay off before retirement, and younger CEOs have the incentives to focus on short-term goals to build their reputation"* (Ryan & Wiggins, 2001, p. 107).

Thus, equity-based compensation may not always promote the best long-term interest of shareholders, as other factors may influence the CEO's decision-making process. Nevertheless, we choose to follow the arguments of previous literature (e.g. Brick et al., 2006; Core et al., 1999; Lin & Lin, 2014), reporting a negative impact of CEO shareholding on CEO compensation, as CEO shareholding is expected to align interests and thereby offset some of the need for cash compensation:

H2.4: CEO shareholding will have a negative impact on CEO compensation.

Table 4: Factors impacting CEO compensation

Author	Year	Country	Sample period	Obs.	Excess board compensation	Board size	CEO duality	CEO shareholding	CEO gender	CEO tenure	Board gender ratio	Board independence ratio	Firm size	Past firm performance	Firm complexity
Adams & Ferreira	2009	US	1996-2003	8,253		+	+			-	+	0	+*	+*	
Benkraiem et al.	2017	FR	2008-2012	535		+*	-*				+*	+*	+*	+	
Brick et al.	2006	US	1992-2001	5,952	+*		+*	-*	+*	+*			+*	+*	+*
Chung et al.	2015	TW	2005-2009	4,930	+*		-						+	+*	-
Conyon	2014	US	2008-2012	26,966		+*				+*	-*	+*	+*	+*	
Conyon et al.	2011	US + UK	1997 + 2003	214						+			+*	+*	
Cordeiro & Veliyath	2003	US	1992-1995	222			-	-*		+			+*	+*	
Core et al.	1999	US	1982-1984	495		+*	+*	-*				+	+*	+*	
Finkelstein & Boyd	1998	US	1982-1987	600						-*			+*	+*	+*
Lin et al.	2013	US	2007-2010	3,612				-*					+*	+*	
Lin & Lin	2014	US	2007-2010	2,852	+*	+*	-*	-*	+	+*			+*	+	
Mehran	1995	US	1979-1980	153								+*	+		+*
Ozkan	2007	UK	2004	414		+*						+*	+*	+*	

Source: Table constructed by the authors (2018). Note: * denotes statistical significance level of 10% or better. Signs (+) and (-) denote positive or negative coefficients respectively. Inconclusive results are reported by (0).

3.3 Future firm performance

Shareholders are interested in achieving the highest returns possible generated by their firm (Brealey et al., 2007). Minimizing *agency problems* could aid in doing so. This can be achieved through corporate governance mechanisms that deter the individual from *moral hazard* and align the *agent's* incentives with the interests of *principals*. This includes appropriate performance compensation structures that ensures that the interests of shareholders, directors, and CEOs are aligned. In the following section, previous research will be scrutinized, and used as the foundation for the subsequent hypotheses regarding the impact of excess compensation on future firm performance. These two hypotheses will be used to answer our third research question. An overview of existing literature regarding future firm performance can be found after the hypothesis development in Table 5 (see page 45).

3.3.1 Excess board compensation

As Jensen (1993) proposes, board culture is a key component of board failure. Poor board culture can in some instances lead to cronyism and poor firm performance. Brick et al. (2006) and Chung et al. (2015) are among the few scholars investigating this area. Brick et al. (2006) study the effects of corporate governance characteristics on board compensation and CEO compensation, and whether levels of board compensation and CEO compensation have a significant impact on future firm performance. Brick et al. (2006) use the residuals from their modelling of board compensation to determine what they call "excess board compensation". Finally, they apply this input when explaining future firm performance.

Measuring future firm performance as 1-year excess returns, i.e. the excess holding period return from end year *t* to the end of year *t*+1, Brick et al. (2006) find that excess board compensation has a negative impact on future firm performance. Moreover, these findings are supported by Chung et al. (2015) who measure future firm performance in three different ways, namely Tobin's Q_{t+1}, ROA_{t+1}, and ROE_{t+1}. Brick et al. (2006) suggest that the negative relationship between excess board compensation and future firm performance is reflective of a "suboptimal performance" of directors that prioritize self-interests more than shareholder interests, possibly due to cronyism.

Brick et al. (2006) hypothesize that problems in board culture may be linked to board compensation. The argument is that highly compensated boards are less likely to "rock the boat", and therefore support a culture that does not allow for constructive criticism. As a consequence, this may lead to cronyism and

weak monitoring of management, as the board accepts status quo when receiving excessive compensation. In three out of four tests, Brick et al. (2006) find excess board compensation to have a negative impact on future firm performance, and in two of the cases the results are statistically significant. The study concludes that a 10% increase in excess board compensation leads to a 1% decrease in 1-year excess returns. This is consistent with the argument that excess board compensation leads to poor board culture and cronyism, which Brick et al. (2006) and Chung et al. (2015) argue is associated with lower future firm performance.

Accordingly, based on Brick et al.'s (2006) and Chung et al.'s (2015) findings and the theories regarding weak board culture and cronyism, we expect that excessively compensated boards reflect weak governance that eventually leads to lower future firm performance:

H3.1: Excess board compensation will have a negative impact on future firm performance.

3.3.2 Excess CEO compensation

Similar to the definition of excess board compensation, excess CEO compensation captures the estimated undercompensation or overcompensation of CEOs (Brick et al., 2006; Core et al., 1999). Brick et al. (2006) find support for excess CEO compensation having a negative impact on future firm performance. In fact, they find that for all of their four regressions explaining 1-year excess returns, excess CEO compensation has a negative coefficient, and is significant at the 1% level in three out of four cases. According to Brick et al. (2006), their results imply that excess CEO compensation is associated with lower future firm performance. Based on their findings, Brick et al. (2006) conclude that a 10% increase in excess CEO compensation corresponds to a 0.8 percentage point decrease in 1-year excess returns. These findings could support the *mutual back-scratching* perspective that overcompensated CEOs are a product of weak governance mechanisms, which in many instances leads to excess CEO compensation that is not justified by the underlying firm performance.

The findings regarding the effect of excess compensation made by Brick et al. (2006) is supported by the findings of Chung et al. (2015) and Core et al. (1999), who also study the impact of excess CEO compensation on future firm performance. Using Tobin's Q_{t+1}, ROA_{t+1}, and ROE_{t+1} as measures for future firm performance, Chung et al. (2015) find that excess CEO compensation has a negative impact on future firm performance, confirmed at the 1% significance level for all measures. Moreover, Core et

al.'s (1999) study measures future firm performance as ROA and stock returns, respectively, over a one, three, and five-year period. Core et al. (1999) find excess CEO compensation to have a negative impact on future firm performance, across all measures of performance. Based on their findings, Core et al. (1999) conclude that firms with weaker corporate governance structures have larger *agency problems*, and that these firms, as a result, perform worse than firms with strong corporate governance structures.

In light of the existing literature within this specific field (Brick et al., 2006; Chung et al., 2015; Core et al., 1999), we expect excess CEO compensation to be a product of weak corporate governance. Thus, our argument is that excessively compensated CEOs prioritize self-interests more than shareholders' interests, which eventually may lead to lower future firm performance:

H3.2: Excess CEO compensation will have a negative impact on future firm performance.

Table 5: Factors impacting future firm performance

Author	Year	Country	Sample Period	Obs.	Excess board compensation	Excess CEO compensation	CEO duality	CEO gender	CEO tenure	CEO shareholding	Board size	Board gender ratio	Board independence ratio	Firm size	Firm complexity
Adams & Ferreira	2009	US	1996-2003	8,253							-*	-	0	+*	
Anderson & Reeb	2003	US	1992-1999	2,713						+*			+	-*	+*
Bhagat & Black	2002	US	1988-1993	3,312						0	-*	-	-	0	
Brick et al.	2006	US	1992-2001	5,923	-*	-*	+	+		0				+	+
Chung et al.	2015	TW	2005-2009	4,930	-*	-*	-			+				-*	-
Core et al.	1999	US	1982-1984	495		-*								+*	
Hamori & Koyuncu	2014	US	2005	501					+					-*	
Mehran	1995	US	1979-1980	306						+*			+	-*	+*
Michelberger	2017	DE	2010-2015	640							-		0		
Puthenpurackal & Upadhyay	2010	US	1996-2005	8,541							-*	+*	0	+	+*
Reguera-Alvarado & Bravo	2017	US	2008-2012	2,423			+				0		+*	+*	
Shao & Liu	2014	US	1992-2013	6,690				+	+						
Villalonga & Amit	2006	US	1994-2000	2,808									+	+	+*

Source: Table constructed by the authors (2018). Note: * denotes statistical significance level of 10% or better. Signs (+) and (-) denote positive or negative coefficients respectively. Inconclusive results are reported by (0).

4 Data and methodology

This section covers the data and methodological considerations associated with this study. The structure of this section consists of the following elements: i) general research methodology, ii) sample, iii) statistical models, iv) description of data, v) limitations and delimitations, vi) correlation matrices, and vii) summary statistics.

4.1 General research methodology

This paper is structured around a hypothetic-deductive research approach. Deductive scientific research involves the development of a theory that is subject to rigorous tests. According to Saunders et al. (2009, pp. 124-125), deductive research revolves around the following five sequential stages, which has shaped the research design of this study:

i) deducing a hypothesis in light of existing literature, i.e. a testable proposition about a relationship between two or more variables,
ii) expressing the hypothesis in operational terms, i.e. indicating and stating how the variables are measured, which propose a relationship between two or more variables,
iii) testing the operational hypothesis,
iv) examining the outcome of the test, i.e. usually finding either support of existing theory, or an indication of the need for theory modification, and
v) if necessary, suggesting needs for further research.

As such, this overall research approach emphasizes scientific principles, the need to explain relationships between variables, collection of quantitative data, application of controls to ensure validity of data, and the necessity to select samples of sufficient size in order to generalize conclusions (Saunders et al., 2009).

To test the formulated hypotheses, we use quantitative data in order to conduct a number of statistical regressions using the software Stata. Thereby, we take our starting point in the hypotheses based on literature, and then gather observations afterwards. This approach allows us to test the stated hypotheses, which is a common approach used in quantitative research (Saunders et al., 2009). There are three overall reasons why this study takes a quantitative approach:

i) the nature of board compensation, CEO compensation, and firm performance is strongly related to quantitative data,
ii) it allows for a much larger sample size, and
iii) this is in line with the research method of previous literature, allowing us to compare the findings of this study with previous literature.

As the formulated hypotheses in this study are based on existing literature and findings by other scholars, there is a need for discussing our findings in that context. Thus, we will discuss our findings in light of relevant theory and literature. This will allow us to answer the proposed research questions.

4.2 Sample

This study investigates S&P 500 firms in the period 2010-2015. The S&P 500 (formally Standard & Poor's 500 Index) is a US stock market index consisting of 505 common stocks issued by 500 firms. The index measures the performance of the large-cap segment of the market, and it is widely considered a proxy for the US equity market (Standard & Poor's, 2018). There are three main reasons why this study investigates S&P 500 firms:

i) higher degree of data availability for large-cap US-listed firms,
ii) many large-cap US firms were criticized for their role during the 2007-2008 financial crisis, and
iii) the S&P 500 index is generally used as a proxy for the US equity market.

Compared to the financial disclosure regulation of some European countries (e.g. the Scandinavian countries), the SEC regulations regarding disclosure requirements are generally more formalized and strict, enabling better comparison among firms. In order to be included in the S&P 500 index, a firm must live up to the following criteria:

i) have US domicile,
ii) be listed on one of the main US stock exchanges[6],
iii) have the organizational structure as a firm and issue common stock,

[6] Main US stock exchanges include: NYSE, NYSE Arca, NYSE American, Nasdaq Global Select Market, Nasdaq Select Market, Investors Exchange, Nasdaq Capital Market, Bats BZX, Bats BYX, Bats EDGA, and Bats EDGX.

iv) have a market capitalization of $6.1 billion or more, and

v) follow regulations set by the SEC and report 10-K annual report.

One of the prerequisites for having a US domicile is that the firm must have a considerable proportion of revenues, assets, and employees located domestically, although there are exceptions to the rules (e.g. Berkshire Hathaway Inc.). Based on the inclusion criteria for the S&P 500 index, it is evident that only very large US firms are included in the index. It is therefore important to underline that this study cannot constitute a generalization of neither all US firms nor foreign large-cap firms, as it solely investigates S&P 500 firms. Similarly, it is important to stress that when discussing development across years, it is financial firm-years we are referring to, given differences in reporting dates among US-listed firms. A complete list of sample firms included in this study can be found in Appendix 1.

In order to be included in our data sample, a firm must provide full data for all variables across all of the sample years. Thus, we deal with balanced panel data. In practice, this means that the firm must have data for the years 2007-2016 as some variables are lagged and others are moved forward. While balanced panel data ensures high data quality and enables better comparison across years and firms (Saunders et al., 2009), the main downside of using this approach relates to the selection bias, known as survivorship bias. This bias was discussed in Wald's (1980) paper *"A Method of Estimating Plane Vulnerability Based on Damage of Survivors."* In short, it is argued that looking at 'surviving' firms only may be misleading, and relying on survivors could influence the results (Denrell, 2005).

In our study, the survivorship bias arises because we only include data on firms that were part of the S&P 500 index for the entire period. For instance, firms that went bankrupt during the sample period are not included. As Denrell (2005) argues, studying failing firms may provide insights as to why they fail, which could be useful for other firms. Moreover, as Conyon (2014) claims, failing corporate governance and excess compensation might be reasons why firms fail. Thus, this kind of bias can influence the findings of a study. However, in the interest of data quality, we have explicitly chosen to prioritize firms with strong data availability in order to obtain a balanced panel data.

4.2.1 Statistical approach

When constructing our statistical models, we make use of random-effects Generalized Least Squares (GLS) fitting cross-sectional and time-series data in Stata (i.e. panel data). The time-series aspect of the

study emphasizes the intent to investigate whether there is a development over time, also referred to as a "diary perspective" (Saunders et al., 2009). Therefore, we argue that a time-series aspect is appropriate as we intent to explain the situation in the years after the 2007-2008 financial crisis. Moreover, this provides us with a larger sample size. Likewise, the cross-sectional aspect, referred to as "snapshot perspective" (Ibid.), provides valuable insights in terms of explaining the dependent variable using several factors. Hence, by using a balanced panel data approach, this study intends to not only provide an insightful snapshot of determinants of board compensation, CEO compensation, and future firm performance, but also to explain the situation after the financial crisis 2007-2008. This method corresponds to the scientific approach in previous literature, enabling comparison of our findings. As for the regression approach of using random-effects GLS, this has been applied by previous scholars, including Becher et al. (2005), Canarella & Gasparyan (2008), and Khanna (2016). Becher et al. (2005) argue that random-effects GLS multivariate regression allow for examination of the effects on board compensation, CEO compensation, and firm performance after controlling for potential determinants associated with the dependent variables. Hence, we considered it the appropriate approach for this study[7].

4.2.2 Data collection

In line with previous literature (e.g. Adams & Ferreira, 2009; Brick et al., 2006; Lin & Lin, 2014), a variety of internationally recognized databases have been used for the collection of secondary data. In terms of collecting the secondary data, we consider corporate governance characteristics (hereunder board and CEO characteristics), to be part of the overall characteristics of the firm. According to Saunders et al. (2009), the main advantage of using secondary data relates to feasibility of collecting large amounts of data that in reality would have been nearly impossible to collect as primary data. Thereby, we collect data from the following three databases: i) Standard & Poor's Capital IQ, ii) WRDS' Execucomp, and iii) Thomson Reuters' Datastream.

The majority of data regarding firm characteristics has been retrieved from Standard & Poor's Capital IQ. This database offers a great variety of data from annual reports, and its firm screening interface enables sample collection of current S&P 500 firms (as of December 2017). This database is also used

[7] We also conducted regressions using OLS and obtained similar results.

by many advisory agencies, firms, top universities, and widely regarded as one of the most extensive and reliable databases.

The second database, WRDS' Execucomp, we primarily used for collecting data regarding board compensation and CEO compensation. Distinctive for this database is that it provides one of the most comprehensive collections of data regarding CEO and board characteristics.

Thirdly, Thompson Reuters' Datastream was used as a supplement to collect missing data regarding board characteristics. Similar to Standard & Poor's Capital IQ, this database provides a great variety of data, including relevant board characteristics.

Moreover, data gaps from the above-mentioned databases were filled by manually collecting data from annual reports and Yahoo Finance (e.g. data for stock returns). To ensure accuracy and reliability of the utilized databases, we have conducted an extensive process of collecting random data samples from other sources to verify the data. An overview of the retrieved data can be seen in Appendix 2, while the complete finalized data for all variables included in this study can be found in Table 6. The total sample includes 411 S&P 500 firms for the period 2010-2015, resulting in 2,466 firm-years (81.4% of the theoretical sample).

Table 6: Overview of variables

Variable type:	Category:	Variable name:	Source:
Main dependent variables	Board compensation	Log(Board total compensation)	WRDS
	CEO compensation	Log(CEO compensation (SEC))	WRDS
	Future firm performance	Tobin's Q_{t+1}	WRDS
Robustness dependent variables	Board compensation	Log(Average. director compensation)	WRDS
	Board compensation	Log(Board cash compensation)	WRDS
	Board compensation	Log(Average director cash compensation)	WRDS
	CEO compensation	Log(CEO cash compensation)	WRDS
	CEO compensation	Log(CEO compensation (option grants))	WRDS
	CEO compensation	Log(CEO compensation (option exercised))	WRDS
	Future firm performance	Excess $returns_{t+1}$	Yahoo Finance
	Future firm performance	ROA_{t+1}	S&P Capital IQ
	Future firm performance	ROE_{t+1}	S&P Capital IQ
Independent variables	Excess compensation	Excess board compensation	Derived from Model 1
	Excess compensation	Excess CEO compensation	Derived from Model 2
	CEO characteristics	CEO duality	WRDS
	CEO characteristics	CEO shareholding	WRDS
	Board characteristics	Board size	WRDS
	Board characteristics	Board independence ratio	Datastream
Control variables	CEO characteristics	CEO gender	WRDS
	CEO characteristics	CEO tenure	WRDS
	Board characteristics	Board gender ratio	Datastream
	Firm characteristics	Log(Firm size total $assets)_{t-1}$	S&P Capital IQ
	Firm characteristics	Log(Firm size $revenue)_{t-1}$	S&P Capital IQ
	Firm characteristics	ROA_{t-1}	S&P Capital IQ
	Firm characteristics	ROE_{t-1}	S&P Capital IQ
	Firm characteristics	$ROA_{average\ past\ 3\text{-}years}$	S&P Capital IQ
	Firm characteristics	$ROE_{average\ past\ 3\text{-}years}$	S&P Capital IQ
	Firm characteristics	Tobin's Q_{t-1}	WRDS
	Firm characteristics	Firm complexity (R&D/total $assets)_{t-1}$	S&P Capital IQ
	Firm characteristics	Industry	S&P Capital IQ
	Firm characteristics	Year	S&P Capital IQ

Source: Table constructed by the authors (2018).

4.2.3 Data adjustments

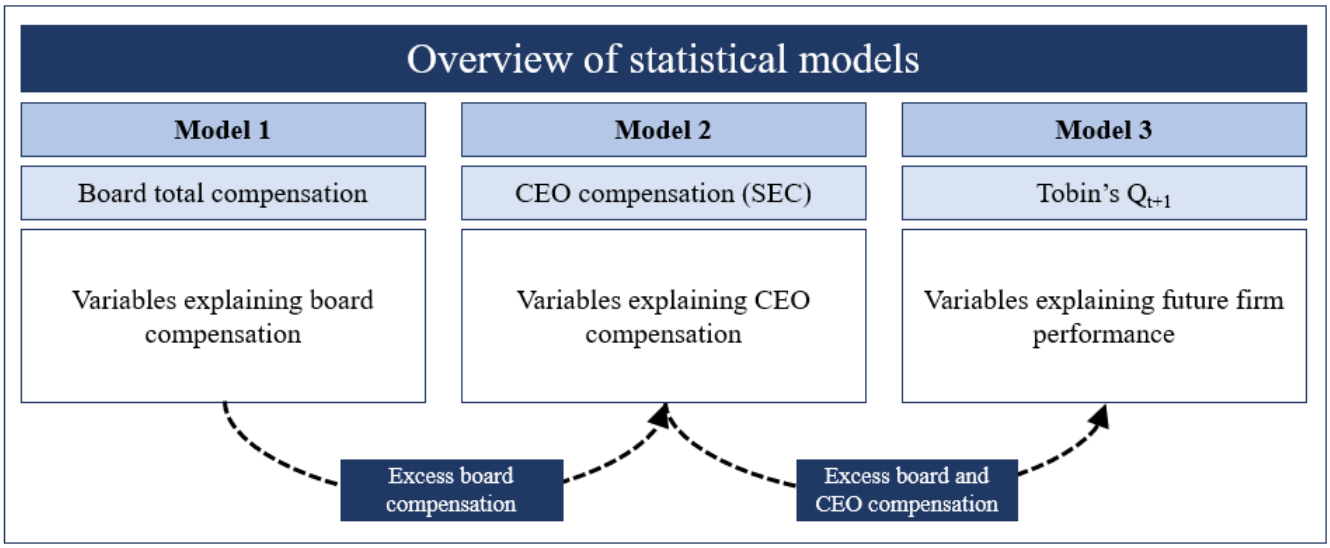
To finalize the collected data, we follow the approach of existing literature by transforming certain variables into natural logarithmic values in Stata (Andreas et al., 2012; Brick et al., 2006; Lin & Lin, 2014). These include the measures for board compensation and CEO compensation. This is done as the log transformation can be beneficial in terms of making distributions less skewed. This approach is widely adopted in previous literature to enable better interpretation of results (Agresti & Franklin, 2013).

Additionally, we face the methodological consideration of dealing with outliers, i.e. extreme values disturbing the regression outputs (Agresti & Franklin, 2013). To do so, we use the "winsorization" function in Stata by winsorizing 1% percentile in each end of the tails for all of the dependent variables included in this study. This means that observations below the 1st percentile are set to the value of the 1st percentile, and data above the 99th percentile are set to the value of the 99th percentile (Statalist, 2018). This is in contrast to excluding those observations, and this approach is preferred to keep the sample size as large as possible (Agresti & Franklin, 2013).

4.3 Statistical models

To test our hypotheses, we construct three statistical models in line with previous literature (Brick et al., 2006): i) Model 1 explaining board compensation, ii) Model 2 explaining CEO compensation, and iii) Model 3 explaining future firm performance. We do this in order to derive excess board compensation from Model 1, and use it as an input for Model 2. Similarly, we derive excess CEO compensation from Model 2, and incorporate both excess board compensation and excess CEO compensation as independent variables in Model 3. Figure 3 shows a visualization of the three respective statistical models, including our main dependent variables, and how these models are linked to each other.

Figure 3: Overview of statistical models



Source: Figure constructed by the authors (2018).

4.3.1 Model 1 – Board compensation

In Model 1, we explain board compensation using a number of corporate governance and firm characteristics. We consider the variable board total compensation, i.e. the total compensation to the board, as our main dependent variable for this model (Lin & Lin, 2014). This is opposed to using measures for average director compensation. We do this due to the argument that the power of the board does not rest on any individual director, but on the board as a whole (Ibid.). As our paper intents to investigate the impact of excess board compensation, we derive residuals from Model 1 using board total compensation as the dependent variable. Model 1 holds the following equation:

$$
\begin{aligned}
&Log(Board\ compensation)_{i,t} \\
&\quad = \beta_1 Board\ size_{i,t} + \beta_2 CEO\ duality_{i,t} \\
&\quad + \beta_3 Board\ independence\ ratio_{i,t} + \beta_4 CEO\ tenure_{i,t} + \beta_5 Board\ gender\ ratio_{i,t} \\
&\quad + \beta_6 Log(Firm\ size)_{i,t-1} + \beta_7 Past\ firm\ performance_{i,t-1} \\
&\quad + \beta_8 Firm\ complexity_{i,t-1} + Industry_t + Year_t + \alpha_{i,t}
\end{aligned}
$$

4.3.2 Model 2 – CEO compensation

For CEO compensation, i.e. Model 2, we argue that CEO compensation (SEC) is the most appropriate measure, and therefore consider this our main dependent variable. This is because the measure is widely

used in previous research, as it accurately captures the total compensation of CEOs (e.g. Brick et al., 2006; Lin & Lin, 2014). Moreover, we derive residuals for excess CEO compensation based on Model 2 using CEO compensation (SEC) as the dependent variable. We then use this as an independent variable in Model 3. Model 2 explaining CEO compensation holds the following equation:

$$\begin{aligned} Log(CEO\ compensation)_{i,t} \\ &= \beta_1 Excess\ board\ compensation_{i,t} + \beta_2 Board\ size_{i,t} + \beta_3 CEO\ duality_{i,t} \\ &+ \beta_4 CEO\ shareholding_{i,t} + \beta_5 CEO\ gender_{i,t} + \beta_6 CEO\ tenure_{i,t} \\ &+ \beta_7 Board\ gender\ ratio_{i,t} + \beta_8 Board\ independence\ ratio_{i,t} \\ &+ \beta_9 Log(Firm\ size)_{i,t-1} + \beta_{10} Past\ firm\ performance_{i,t-1} \\ &+ \beta_{11} Firm\ complexity_{i,t-1} + Industry_t + Year_t + \alpha_{i,t} \end{aligned}$$

4.3.3 Model 3 – Future firm performance

Finally, in Model 3, we explain future firm performance. As this area is relatively unexplored in relation to excess compensation, we use four different measures for capturing future firm performance: i) Tobin's Q_{t+1}, ii) excess $returns_{t+1}$, iii) ROA_{t+1}, and iv) ROE_{t+1}. Nonetheless, we argue that Tobin's Q_{t+1} is our preferred measure as it provides the highest explanatory power and is in line with literature such as Adams & Ferreira (2009), Chung et al. (2015), and Mehran (1995). Model 3 explaining future firm performance holds the following equation:

$$\begin{aligned} Log(Future\ firm\ performance)_{i,t+1} \\ &= \beta_1 Excess\ board\ compensation_{i,t} + \beta_2 Excess\ CEO\ compensation_{i,t} \\ &+ \beta_3 CEO\ duality_{i,t} + \beta_4 CEO\ gender_{i,t} + \beta_5 CEO\ tenure_{i,t} \\ &+ \beta_6 CEO\ shareholding_{i,t} + \beta_7 Board\ size_{i,t} + \beta_8 Board\ gender\ ratio_{i,t} \\ &+ \beta_9 Board\ independence\ ratio_{i,t} + \beta_{10} Log(Firm\ size)_{i,t-1} \\ &+ \beta_{11} Firm\ complexity_{i,t-1} + Industry_t + Year_t + \alpha_{i,t} \end{aligned}$$

4.4 Description of data

This subsection will discuss and explain all variables used in this study. Variables included in each statistical model are selected based on previous literature, with papers such as Adams & Ferreira (2009), Brick et al. (2006), Chung et al. (2015), Conyon (2014), Core et al. (1999), and Lin & Lin (2014) being the most influential ones.

4.4.1 Variables used in Model 1

This section will describe all variables used in Model 1 to explain board compensation. Model 1 holds the following equation:

$$
\begin{aligned}
&Log(Board\ compensation)_{i,t} \\
&\quad = \beta_1 Board\ size_{i,t} + \beta_2 CEO\ duality_{i,t} \\
&\quad + \beta_3 Board\ independence\ ratio_{i,t} + \beta_4 CEO\ tenure_{i,t} + \beta_5 Board\ gender\ ratio_{i,t} \\
&\quad + \beta_6 Log(Firm\ size)_{i,t-1} + \beta_7 Past\ firm\ performance_{i,t-1} \\
&\quad + \beta_8 Firm\ complexity_{i,t-1} + Industry_t + Year_t + \alpha_{i,t}
\end{aligned}
$$

4.4.1.1 Board total compensation

Board total compensation captures the total compensation to the entire board, in accordance with SEC Filings. This follow the method of previous scholars (Chung et al., 2015; Lin & Lin, 2014). To get the measure of the total compensation paid to the entire board, we sum each director's compensation. This measure accounts for the value of cash fees, stock awards, option awards, non-equity incentive plans, change in pension value, and other compensation. We use board total compensation as our main measure for Model 1 because of three reasons:

i) it is a commonly used measure in existing literature enabling comparison with previous research,
ii) data availability is better compared to individual director compensation, and
iii) the power of the board rests on the board in its entirety, not on any individual.

4.4.1.2 Board cash compensation

Board cash compensation is calculated by summing all fees paid in cash to directors on the same board, to get a variable capturing the total cash payment to the entire board. This measure is included for

robustness purposes, and to get an understanding of the proportion of base salary that boards receive. This follows the method of previous scholars (e.g. Brick et al., 2006; Ryan & Wiggins, 2004).

4.4.1.3 Average director compensation

Average director compensation is calculated by dividing board total compensation by the number of directors on the board. Thus, this variable captures the value of cash fees, stock awards, option awards, non-equity incentive plans, change in pension value, and other compensation. The measure is included for robustness purposes, and to test if the results differ when assessing individual director compensation as opposed to board total compensation. This follows the method of previous scholars (Brick et al., 2006; Lin & Lin, 2014). A drawback of using this measure is that it is an average measure, and thereby ignores compensation dispersion between different directors, as Lin & Lin (2014) argue.

4.4.1.4 Average director cash compensation

Average director cash compensation is calculated as board cash compensation divided by the number of directors on the board. This provides a measure for the average cash compensation to each director. This measure is included for robustness purposes. Furthermore, it enables us to analyze whether the average cash compensation differs considerably from the average total director compensation. This follows the method of previous scholars (e.g. Brick et al., 2006; Ryan & Wiggins, 2004).

4.4.1.5 Board size

Board size measures the number of directors on the board. In line with previous studies, this measure is used as an independent variable when determining board compensation (Adams & Ferreira, 2009; Lin & Lin, 2014; Ryan & Wiggins, 2004). We argue that board size is a relevant variable when determining board compensation, as it can be used as a proxy for firm size and firm complexity, and enables us to account for the number of directors on the board (Andreas et al., 2012; Lin & Lin, 2014).

4.4.1.6 Board independence ratio

Board independence ratio is the percentage of independent directors as reported by the firm. A director is deemed *not* to be independent if one or more of the following conditions apply (NYSE, 2014, p. 109):

i) the director, or an immediate family member, has been an employee of the firm in the last three years,
ii) the director has received fees from the firm above a threshold during the last three years,

iii) the director is a partner or employee of the firm's auditor,

iv) there has been an interlocking relationship between the director and the firm via membership of the compensation committee, or

v) the director has a material financial relationship with the firm.

Consequently, the measure of board independence ratio measures the extent to which directors of a certain firm fulfill these requirements for independence. Similar to previous studies this variable is used as an independent variable when explaining board compensation (e.g. Adams & Ferreira, 2009; Andreas et al., 2012).

4.4.1.7 Board gender ratio

Board gender ratio measures the percentage of female directors out of the total number of directors on the board. The reason for controlling for this variable across our statistical models relates to the research of Adams & Ferreira (2009), Jizi & Nehme (2017), and Puthenpurackal & Upadhyay (2010) as well as the increased attention devoted to gender quotas through papers such as Tinsley et al. (2017). Shao & Liu (2014) and Huang & Kisgen (2013) argue that gender has a considerable influence on leadership style. Huang & Kisgen (2013) find that males are more aggressive from an investment aspect, which influences strategic decisions. Thus, board gender diversity can have an impact on board compensation, and we therefore choose to include this variable (Adams & Ferreira, 2009; Puthenpurackal & Upadhyay, 2010; Shao & Lui, 2014).

4.4.1.8 CEO duality

CEO duality is a dummy variable taking the value of 1 if the CEO and the chairman of the board is the same person. If not, the variable takes the value of 0. It is important to note that in order to take the value of 1, the CEO must hold the position among directors as *chairman*. Thus, if the CEO is a non-chairman director, this gives the value of 0. In line with previous studies, we use CEO duality as an independent variable when determining board compensation (Brick et al., 2006; Lin & Lin, 2014).

4.4.1.9 CEO tenure

CEO tenure captures the number of years that the CEO has been in the CEO position since hiring date. Similar to previous studies, this control variable is used as a proxy for CEO experience as well as CEO power (Brick et al., 2006; Lin & Lin, 2014). In line with Lin & Lin (2014), we contemplate that long-

tenured CEOs discourage board scrutiny of the CEO due to less monitoring incentives. Therefore, we choose to control for this factor when explaining board compensation.

4.4.1.10 Firm size$_{t-1}$

Inspired by previous research, we use different measures of firm size to conduct robustness tests. In this study, firm size is measured as total assets$_{t-1}$ and revenue $_{t-1}$, respectively. Total assets is defined as the sum of all current and non-current assets. Revenue is defined as the total sales of the firm. Previous studies within our research topic have primarily used total assets$_{t-1}$ as their main measure of firm size (e.g. Andreas et al., 2012; Lin & Lin, 2014), while other studies have used revenue$_{t-1}$ (Brick et al., 2006). We argue that it is appropriate for firm size measures to be 1-year lagged because current board compensation is more likely to be affected by last year's firm size in the compensation determination process. This argument is widely agreed upon in previous literature, as most scholars studying determinants of board compensation include a 1-year lagged firm size control variable (e.g. Brick et al., 2006; Chung et al., 2015; Lin & Lin, 2014).

4.4.1.11 Past firm performance$_{t-1}$

We measure past firm performance in five different ways: i) ROA$_{t-1}$, ii) ROE$_{t-1}$, iii) ROA$_{\text{average past 3-years}}$, iv) ROE$_{\text{average past 3-years}}$, and v) Tobin's Q$_{t-1}$. Similar to previous literature (e.g. Andreas et al., 2012; Brick et al., 2006; Chung et al., 2015; Lin & Lin, 2014), we control for past firm performance as this is likely to impact board compensation. We consider ROA$_{t+1}$ as our preferred measure for past firm performance, which is in line with Brick et al. (2006) and Lin & Lin (2014). It is important to note that all the past firm performance measures are time-lagged when applied to the statistical models. This is because typically, board compensation is contingent on past firm performance rather than current firm performance. The main reason for including several measures for past firm performance is to support the robustness of the findings, and that previous research has underlined the difficulties of accurately measuring firm performance (e.g. Brick et al., 2006; Lin & Lin, 2014). Consequently, we consider different time perspectives by using both last year's performance, and the average performance of the past three years. While ROA indicates a firm's ability to utilize its assets, ROE gives an indication of a firm's ability to generate shareholder returns. Tobin's Q measures the firm's market value in relation to its replacement value (book value). Thus, Tobin's Q gives an indication of whether the firm is undervalued or overvalued (Pinto et al., 2010). The five measures for past firm performance are calculated as follows:

$$ROA_{t-1} = \frac{Net\ income_{t-1}}{Total\ assets_{t-1}}$$

$$ROE_{t-1} = \frac{Net\ inome_{t-1}}{Shareholders'\ equity_{t-1}}$$

$$ROA_{average\ past\ 3\ years} = Average\left(\frac{Net\ income_{t-1}}{Total\ assets_{t-1}}, \frac{Net\ income_{t-2}}{Total\ assets_{t-2}}, \frac{Net\ income_{t-3}}{Total\ assets_{t-3}}\right)$$

$$ROE_{average\ past\ 3\ years}$$
$$= Average\left(\frac{Net\ income_{t-1}}{Shareholders'\ equity_{t-1}}, \frac{Net\ income_{t-2}}{Shareholders'\ equity_{t-2}}, \frac{Net\ income_{t-3}}{Shareholders'\ equity_{t-3}}\right)$$

$$Tobin's\ Q_{t-1} = \frac{Total\ market\ value\ of\ firm_{t-1}}{Total\ assets_{t-1}}$$

4.4.1.12 Firm complexity$_{t-1}$

Firm complexity$_{t-1}$ is a variable included in this study intended to capture the complexity of firms, proxied by R&D intensiveness. As such, firm complexity$_{t-1}$ is measured as R&D expenses divided by total assets. This way of measuring firm complexity has been utilized in previous papers (Brick et al., 2006; Chung et al., 2015), who similarly use firm complexity$_{t-1}$ as a control variable when explaining board compensation. Similar to Brick et al. (2006), we argue that past firm complexity is likely to influence current compensation levels, and we have therefore lagged this variable. Although it can be difficult to determine whether higher R&D spend is actually associated with greater firm complexity, it should be seen as a proxy for firms investing in knowledge-intensive businesses. This reasoning follows the arguments of previous papers, such as Brick et al. (2006), arguing that this could be an indication of greater complexity compared to firms with very low R&D spend in less knowledge-intensive industries.

4.4.1.13 Industry dummy

An industry dummy variable is included in this study to capture potential differences across industries, which may affect board compensation. Although it can be difficult to classify firms into certain industry categories, the industry dummy variables included in the study follows the main SIC industry classifications. These industries are:

i) *agriculture, forestry, and fishing*,
ii) *mining*,
iii) *construction*,
iv) *manufacturing*,
v) *transportation and public utilities*,
vi) *wholesale trade*,
vii) *retail trade*,
viii) *finance, insurance, and real estate*,
ix) *services*, and
x) *public administration*.

Since this is a dummy variable, the variable takes the value of 1 for the given industry, and the value 0 for the remaining industries. Thus, only the first nine industries are included, and if all of these take the value of 0, then the firm falls into the *public administration* industry classification. The main difficulty of using an industry variable relates to the classification of diversified firms operating in several industries across the globe. Although we find that the SIC industry classifications are rather broad, it has been widely used by previous literature (e.g. Adams & Ferreira, 2009; Brick et al., 2006; Lin & Lin, 2014).

Another discussion regarding the use of an industry variable relates to the inclusion of financial firms, i.e. the industry *finance, insurance, and real estate*. Some scholars include all industries (Andreas et al., 2012; Brick et al., 2006; Ozkan, 2007), while others explicitly exclude financial firms from their samples (Lin & Lin, 2014; Villalonga & Amit, 2006). The main argument for excluding financial firms is that they typically have different debt-to-equity structures compared to non-financial firms. However, as this study focuses on the post-financial crisis era, we find it appropriate to include financial firms[8], as these were subject to much debate after the crisis. Hence, from the perspective of this study, we find that there are sufficient arguments behind the inclusion of this industry.

[8] We also conducted regressions excluding the industry *finance, insurance, and real estate* and reached identical conclusions.

4.4.1.14 Year dummy

We also include a dummy variable for the sample years 2010-2015, to capture differences across the sample period that may affect board compensation. The variable takes the value of 1 for the given year while leaving the rest with the value of 0. If all variables are left with 0, then this refers to the year 2010. It is important to note that due to reporting differences, our year dummies capture financial years and not calendar years. Previous studies have likewise incorporated year dummies to control for difference between years (Brick et al., 2006; Chung et al., 2015; Lin & Lin, 2014).

4.4.2 Variables used in Model 2

This section will explain variables included in Model 2 to explain CEO compensation. Model 2 holds the following equation:

$$
\begin{aligned}
&Log(CEO\ compensation)_{i,t} \\
&\quad = \beta_1 Excess\ board\ compensation_{i,t} + \beta_2 Board\ size_{i,t} + \beta_3 CEO\ duality_{i,t} \\
&\quad + \beta_4 CEO\ shareholding_{i,t} + \beta_5 CEO\ gender_{i,t} + \beta_6 CEO\ tenure_{i,t} \\
&\quad + \beta_7 Board\ gender\ ratio_{i,t} + \beta_8 Board\ independence\ ratio_{i,t} \\
&\quad + \beta_9 Log(Firm\ size)_{i,t-1} + \beta_{10} Past\ firm\ performance_{i,t-1} \\
&\quad + \beta_{11} Firm\ complexity_{i,t-1} + Industry_t + Year_t + \alpha_{i,t}
\end{aligned}
$$

4.4.2.1 CEO compensation (SEC)

CEO compensation (SEC) is formally defined as *"total CEO compensation as reported in SEC Filings"* by WRDS, and captures the total compensation paid to the CEO as listed in SEC Filings. This measure includes the sum of salary, bonus, stock awards, option awards, non-equity incentive plans, change in pension value, and other compensation. Thus, it is also the compensation that US-listed firms must report to the SEC (US Securities and Exchange Commission, 2015). This follows the method of previous scholars (Brick et al., 2006; Core et al., 1999; Lin & Lin, 2014). CEO compensation (SEC) is one of four measures for CEO compensation used in this study. The reason for including several measures of CEO compensation is that previous literature is inconsistent in terms of choice of measurement. While some studies look at base salary, others include value of stock and options awards (Brick et al., 2006; Conyon, 2014). Thus, including several measures enables this study to test for potential differences when using several measures, or simply to confirm findings regardless of which compensation measure is used. It is

important to underline that we choose CEO compensation (SEC) as our main estimate of CEO compensation. There are two primary reasons for this: i) it is a commonly-used measure for CEO compensation in existing literature, and ii) it enables strong comparison between firms due to the SEC requirements.

4.4.2.2 CEO compensation (option grants)

CEO compensation (option grants) is formally defined by WRDS as the sum of payments to the CEO covering salary, bonus, non-equity incentive plan compensation, grant-date fair value of options awards, grant-date fair value of stock awards, deferred compensation earnings reported as compensation, and other compensation. Hence, this measure accounts for payments stemming from grant-date option and stock grants. As Kaplan (2008) argues, this way of calculating CEO compensation is the estimated or ex ante value including the value of options (calculated using the Black-Scholes model). Furthermore, it is a good estimate of what the board expects to compensate the CEO. However, this measure is not what the CEO actually receives, since it is ex ante estimates of the option value. The reason why we include this measure is to test for potential differences in results depending on the valuation method of options, in line with the research of Conyon (2014). It has been discussed in previous literature that the value of CEO compensation can vary greatly depending on the option valuation method (Conyon, 2014; Kaplan, 2008). We therefore choose to include this measure to support the robustness of results.

4.4.2.3 CEO compensation (option exercised)

CEO compensation (option exercised) is similar to the variable CEO compensation (option grants), with the exception of the options valuation approach. For this measure, WRDS uses the option exercise date rather than option grant date when valuing the CEO compensation. Thus, CEO compensation (option exercised) is formally defined as the sum of payments to the CEO covering salary, bonus, non-equity incentive plan compensation, value realized from stock options exercised, grant-date fair value of stock grants, deferred compensation earnings reported as compensation, and other compensation. Thus, having additional ways of calculating the CEO compensation enables stronger robustness, and is in line with previous literature (Conyon, 2014). This compensation measure is the realized compensation paid to the CEO. The reason for this is the use of actual option gains, as opposed to theoretical gains. Hence, this measure is more appropriate for considering whether CEOs are being paid for their performance, according to Kaplan (2008).

4.4.2.4 CEO cash compensation

CEO cash compensation is the value of the base salary paid to the CEO. This measure does not account for the value of bonuses, stock options, or other incentive plans. It solely measures the base salary that the CEO receives. This measure is included to understand factors that impact the CEO compensation that is not directly dependent on performance. This is in line with previous studies that also use this measure for robustness tests (e.g. Brick et al., 2006; Core et al., 1999).

4.4.2.5 Excess board compensation

Excess board compensation is calculated as the residuals from Model 1 using our main measure, board total compensation, as the dependent variable. The residuals are calculated as the difference between the observed board total compensation and the predicted board total compensation as estimated in Model 1. Previous scholars have derived excess board compensation in a similar manner, using their main measure for board compensation to derive excess board compensation (Brick et al., 2006; Chung et al., 2015; Lin & Lin, 2014). Positive excess board compensation indicates that the board is compensated more than the model prediction suggests. On the other hand, negative excess board compensation indicates that the board is compensated less than predicted. We incorporate this variable in Model 2 to test the effect of excess board compensation on CEO compensation. Hence, excess board compensation is calculated as follows:

$$\begin{aligned} &Excess\ board\ compensation \\ &\quad = Log(observed\ board\ total\ compensation) \\ &\quad - Log(predicted\ board\ total\ compensation) \end{aligned}$$

However, we want to stress that these residuals may not fully capture excess board compensation, as there may be unobserved firm characteristics that the model does not account for.

4.4.2.6 Board size

As discussed in Model 1, board size measures the number of directors on the board. In accordance with previous studies, this measure is used as an independent variable when explaining CEO compensation (Adams & Ferreira, 2009; Core et al., 1999; Lin & Lin, 2014). We argue that larger boards are associated with larger and more complex firms, which may affect CEO compensation positively (Lin & Lin, 2014).

4.4.2.7 CEO duality

In line with previous studies, CEO duality[9] is used as an independent variable when explaining CEO compensation (Brick et al., 2006; Core et al., 1999; Lin & Lin, 2014). We argue that CEO duality reflects increased CEO power over the board, which may affect CEO compensation positively (Bebchuk & Fried, 2004; Brick et al., 2006).

4.4.2.8 CEO shareholding

CEO shareholding is defined as the percentage of total shares outstanding held by the CEO. This variable gives an indication of the proportion of ownership held by the CEO of the firm and captures the incentive to maximize shareholder value. In line with previous literature (e.g. Brick et al., 2006; Lin & Lin, 2014), we include this variable because CEO shareholding is linked to *agency theory* as well as compensation. Previous studies have used CEO shareholding as an independent variable when explaining CEO compensation (Brick et al., 2006; Core et al., 1999; Lin & Lin, 2014). Nevertheless, we acknowledge that this measure does not take firm size or market capitalization into account, as it merely measures the proportion of ownership.

4.4.2.9 CEO gender

CEO gender is a dummy variable capturing the gender of the CEO. If the CEO is male, the variable takes the value of 1, and 0 if the CEO is female. This variable is intended to measure potential differences in CEO compensation depending on gender. This is similar to the approach of previous scholars (Brick et al., 2006; Lin & Lin, 2014) who use CEO gender as a control variable when measuring CEO compensation. We argue that this variable is of high topicality due to increased societal focus on gender pay gap. For example, according to Graf et al. (2018), in 2017, women typically earned approximately 82% of what men earned in the US. Although the gender pay gap has narrowed since the 1970s, we find it topical to include a CEO gender variable to control for potential pay gaps. Moreover, Huang & Kisgen (2013) and Shao & Liu (2014) argue that gender can affect leadership style in terms of attitude towards investment decisions. We therefore include this variable to capture potential differences from the CEO gender.

[9] CEO duality is further explained in section 4.4.1.8 on page 57.

4.4.2.10 CEO tenure

CEO tenure captures the number of years that the CEO has been in the position since hiring date. Similar to previous studies, we include this control variable in order to proxy for CEO experience as well as CEO power (Brick et al., 2006; Lin & Lin, 2014; Conyon, 2014). As CEO compensation is likely to be impacted by the experience and power of the CEO, we choose to control for this factor when explaining CEO compensation (Brick et al., 2006).

4.4.2.11 Board gender ratio

Board gender ratio measures the percentage of female directors out of the total number of directors on the board. We include this control variable because previous research (Adams & Ferreira, 2009; Conyon, 2014; Benkraiem et al., 2017) have found that board gender ratios impact the level as well as the composition of CEO compensation. Moreover, the effect of board gender ratios is a topic receiving increasing academic attention within the field of corporate governance (Huang & Kisgen, 2013; Tinsley et al., 2017). Therefore, we find it relevant to control for board gender ratio when explaining CEO compensation.

4.4.2.12 Board independence ratio

Board independence ratio[10] is the percentage of independent directors as reported by the firm. Inspired by previous studies, we control for this variable when explaining CEO compensation (Conyon, 2014; Core et al., 1999; Ozkan, 2007). Previous literature has found board independence ratio to have a positive impact on CEO compensation levels (Conyon, 2014; Core et al., 1999; Ozkan, 2007). Conyon (2014) argues the reason to be that a higher proportion of independent directors involve stronger monitoring of the CEO. The stricter monitoring results in higher CEO effort, as the board is more likely to discover inferior CEO performance. Consequently, the CEO receives higher compensation due to the increased workload and risk of being laid off (Ibid.).

4.4.2.13 Firm size$_{t-1}$

In line with previous research, we use measures of firm size$_{t-1}$[11] as a control variable when explaining CEO compensation (Brick et al., 2006; Core et al., 1999; Lin & Lin, 2014). We find it relevant to include

[10] Board independence ratio is further explained in section 4.4.1.6 on page 56.
[11] Firm size is further explained in section 4.4.1.10 on page 58.

this variable when explaining CEO compensation, as the level of CEO compensation is strongly related to firm size (Brick et al., 2006; Lin & Lin, 2014).

4.4.2.14 Past firm performance$_{t-1}$

Similar to our approach in Model 1, we control for past firm performance[12] when determining CEO compensation. This is in line with previous literature (Brick et al., 2006; Chung et al., 2015; Lin & Lin, 2014). We control for past firm performance because the compensation of CEOs is contingent on the past performance of the firm (e.g. Brick et al., 2006). We include several measures for past firm performance to ensure robustness of our model: i) ROA_{t-1}, ii) ROE_{t-1}, iii) $ROA_{average\ past\ 3\text{-}years}$, iv) $ROE_{average\ past\ 3\text{-}years}$, and v) Tobin's Q_{t-1}.

4.4.2.15 Firm complexity$_{t-1}$

In accordance with previous literature (Brick et al., 2006; Chung et al., 2015; Mehran, 1995), firm complexity$_{t-1}$[13] is included as a control variable when explaining CEO compensation. We follow the argument proposed by Brick et al. (2006) that CEO compensation is influenced by the difficulty of the CEO's tasks, and that this is related to the complexity of the firm. Similar to our approach in Model 1, firm complexity is proxied through R&D intensiveness.

4.4.2.16 Industry dummy

Similarly to our approach in Model 1, we control for industry[14] differences when explaining CEO compensation. This is in line with previous scholars (e.g. Brick et al., 2006; Lin & Lin, 2014).

4.4.2.17 Year dummy

As discussed in Model 1, we include a year dummy[15] to control for differences among the sample years when determining CEO compensation. This is in accordance with previous scholars (e.g. Brick et al., 2006; Lin & Lin, 2014).

[12] Past firm performance is further explained in section 4.4.1.11 on page 58.
[13] Firm complexity is further explained in section 4.4.1.12 on page 59.
[14] Industry dummy is further explained in section 4.4.1.13 on page 59.
[15] Year dummy is further explained in section 4.4.1.14 on page 61.

4.4.3 Variables used in Model 3

This section will explain all variables that are being used in Model 3 to explain future firm performance. Model 3 holds the following equation:

$$Log(Future\ firm\ performance)_{i,t+1} = \beta_1 Excess\ board\ compensation_{i,t} + \beta_2 Excess\ CEO\ compensation_{i,t} + \beta_3 CEO\ duality_{i,t} + \beta_4 CEO\ gender_{i,t} + \beta_5 CEO\ tenure_{i,t} + \beta_6 CEO\ shareholding_{i,t} + \beta_7 Board\ size_{i,t} + \beta_8 Board\ gender\ ratio_{i,t} + \beta_9 Board\ independence\ ratio_{i,t} + \beta_{10} Log(Firm\ size)_{i,t-1} + \beta_{11} Firm\ complexity_{i,t-1} + Industry_t + Year_t + \alpha_{i,t}$$

4.4.3.1 Tobin's Q_{t+1}

When used for Model 3, Tobin's Q_{t+1}[16] is moved one year forward in order to explain future firm performance. We argue that Tobin's Q_{t+1} is the preferred measure for future firm performance in our model, similar to Chung et al. (2015). The reason for this is that Tobin's Q has been widely used in previous literature when analyzing the impact of corporate governance characteristics on future firm performance (Adams & Ferreira, 2009; Chung et al., 2015; Mehran, 1995). However, we identify a research gap in terms of using excess board compensation and excess CEO compensation to determine Tobin's Q_{t+1} for US listed firms. Another reason why we consider Tobin's Q_{t+1} as our preferred measure is that it has a considerably higher R-square value than any other of the future performance measures used. We therefore argue that Tobin's Q_{t+1} is the most appropriate and useful future firm performance measure for this study, given its higher explanatory power and inclusion in previous research.

4.4.3.2 Excess returns$_{t+1}$

1-year excess returns (excess returns$_{t+1}$) is calculated as the adjusted year-end closing stock price year-on-year percentage change of the firm, relative to the adjusted year-end closing stock price year-on-year percentage change of the S&P 500 index. This is done in order to give an indication of the extent to which a firm has delivered shareholder returns relative to the entire S&P 500 index. The reason why this study looks at the adjusted stock price, and not at the regular stock price, is that the adjusted price is commonly used when examining historical returns as it is more comparable (Zacks Investment Research,

[16] Tobin's Q is further explained in section 4.4.1.11 on page 58, including the formula for this measure.

2018). The adjusted stock price adjusts for all corporate actions such as stock splits, dividends, and rights offerings, which may influence the stock price. Since this variable intends to explain future firm performance, we have moved this data one year forward. The equation for calculating excess returns$_{t+1}$ is as follows:

$$Excess\ returns_{i,t+1} = \left(\frac{Firm\ closing\ price_{t+1}}{Firm\ closing\ price_t}\right) - \left(\frac{S\&P\ 500\ index\ closing\ price_{t+1}}{S\&P\ 500\ index\ closing\ price_t}\right)$$

The reason for including excess returns$_{t+1}$ is that existing literature estimating the impact of excess board compensation and excess CEO compensation uses this measure. Thereby, as we intend to compare our results to similar research (Brick et al., 2006; Core et al., 1999), we find it relevant to measure future firm performance as excess returns$_{t+1}$ to enable better comparison.

4.4.3.3 ROA$_{t+1}$

When used as a future firm performance measure, ROA$_{t+1}$[17] is moved one year forward. This has been used in previous research (Adams & Ferreira, 2009; Anderson & Reeb, 2003; Core et al., 1999). The reason for including ROA$_{t+1}$ is to support the robustness of our results, as well as to include an accounting measure for future firm performance (as opposed to market measures through Tobin's Q$_{t+1}$ and excess returns$_{t+1}$).

4.4.3.4 ROE$_{t+1}$

The exact same approach used for ROA$_{t+1}$ has been used for the ROE$_{t+1}$[18] variable. The main reason for including ROE$_{t+1}$ is to support the robustness of our findings, similarly to Chung et al. (2015), as well as to provide an accounting performance measure from a shareholder perspective.

4.4.3.5 Excess board compensation

Excess board compensation[19] is calculated as the residuals of Model 1, using our main measure, board total compensation, as the dependent variable. This variable has likewise been included in studies by Brick et al. (2006) and Chung et al. (2015) as an independent variable when explaining future firm performance. We argue that problems in board culture may be related to excess board compensation,

[17] ROA is further explained in section 4.4.1.11 on page 58, including the formula for this measure.
[18] ROE is further explained in section 4.4.1.11 on page 58, including the formula for this measure.
[19] Excess board compensation is further explained in section 4.4.2.5 on page 63.

which Brick et al. (2006) find is associated with lower future firm performance. Consequently, excess board compensation can reflect cronyism and weak monitoring of the CEO (Ibid.). Thus, we include excess board compensation in Model 3 to test if excess board compensation has an impact on future firm performance.

4.4.3.6 Excess CEO compensation

The variable excess CEO compensation has been calculated as the residuals of Model 2, using our main measure, CEO compensation (SEC), as the dependent variable. This in line with previous research, which also uses the main measure for CEO compensation when deriving excess CEO compensation (Brick et al., 2006; Core et al., 1999). As such, in line with previous studies, residuals are calculated as the observed CEO compensation (SEC) minus the predicted CEO compensation (SEC) as estimated in Model 2 (Brick et al., 2006; Chung et al., 2015; Core et al., 1999). It is important to note that although the residuals may suggest significant undercompensation or overcompensation, there may be unobserved firm characteristics as well as other factors that our model does not account for. However, according to theory (Brick et al., 2006), residuals with values of exactly zero suggest that the CEO is compensated in accordance with the predicted compensation. Hence, residuals below zero indicate that the CEO is compensated less than the model prediction, i.e. negative excess compensation. Similarly, residuals above zero, i.e. positive excess compensation, suggests that the CEO is paid more than the model predicts. The formula for calculating excess CEO compensation is as follows:

$$\begin{aligned} &Excess\ CEO\ compensation \\ &\quad = Log(observed\ CEO\ compensation\ (SEC)) \\ &\quad - Log(predicted\ CEO\ compensation\ (SEC)) \end{aligned}$$

4.4.3.7 CEO duality

In line with existing literature, we incorporate CEO duality[20] as a control variable when explaining future firm performance (Brick et al., 2006; Chung et al., 2015; Reguera-Alvarado & Bravo, 2017). As Harris et al. (2012) argue, CEO duality may lead to lower firm performance. This is due to weak governance, which is the result of less board control over the CEO and increased *information asymmetry*. Thus, we choose to control for this factor when explaining future firm performance.

[20] CEO duality is further explained in section 4.4.1.8 on page 57.

4.4.3.8 CEO gender

We incorporate a control variable for CEO gender[21] to capture potential differences in future firm performance depending on the gender of the CEO. This is in line with scholars such as Brick et al. (2006) and Shao & Liu (2014) who use CEO gender as a control variable when explaining future firm performance. We control for this variable due to the argument proposed by Huang & Kisgen (2013) and Shao & Liu (2014), namely that gender may affect leadership style in terms of attitude towards investment decisions.

4.4.3.9 CEO tenure

We incorporate CEO tenure[22] as a control variable when explaining future firm performance. This is in line with Shao & Liu (2014) and Hamori & Koyuncu (2014) who argue that CEO tenure can act as a proxy for CEO experience, which may influence the performance of the firm.

4.4.3.10 CEO shareholding

We include CEO shareholding[23] as a control variable in Model 3. CEO shareholding measures the percentage of total shares outstanding held by the CEO. This is similar to previous literature such as Brick et al. (2006), Chung et al. (2015), and Mehran (1995) who also control for CEO shareholding when explaining future firm performance. We argue that CEO's with higher shareholding have stronger incentive to improve future firm performance, and thus control for this factor.

4.4.3.11 Board size

In line with previous studies, board size[24] is included as a control variable when explaining future firm performance (Adams & Ferreira, 2009; Reguera-Alvarado & Bravo, 2017). As Thomsen & Conyon (2012) argue, board performance is contingent on the number of directors on the board. We argue that board performance influences future firm performance, and thus choose to control for this factor.

4.4.3.12 Board gender ratio

Similar to previous studies, we control for board gender ratio[25] in Model 3 when explaining future firm performance (Adams & Ferreira, 2009; Puthenpurackal & Upadhyay, 2010). The reason for this relates

[21] CEO gender is further explained in section 4.4.2.9 on page 64.
[22] CEO tenure is further explained in section 4.4.1.9 on page 57.
[23] CEO shareholding is further explained in section 4.4.2.8 on page 64.
[24] Board size is further explained in section 4.4.1.5 on page 56.
[25] Board gender ratio is further explained in section 4.4.1.7 on page 57.

to Shao & Liu (2014) and Huang & Kisgen (2013) who argue that gender has a considerable influence on leadership style. Thus, we argue that leadership style may affect future firm performance.

4.4.3.13 Board independence ratio

We incorporate board independence ratio[26] as a control variable in Model 3. This approach is similar to existing research by Adams & Ferreira (2009), Anderson & Reeb (2003), and Mehran (1995). We argue that independent directors are more likely to conduct critical monitoring, which could incentivize management and prevent cronyism. In accordance with previous research (Adams & Ferreira, 2009; Reguera-Alvarado & Bravo, 2017), we choose to control for this factor when explaining future firm performance.

4.4.3.14 Firm size$_{t-1}$

In line with research by Anderson & Reeb (2003), Mehran (1995), and Villalonga & Amit (2006), we control for firm size$_{t-1}$[27] when explaining future firm performance.

4.4.3.15 Firm complexity$_{t-1}$

We control for firm complexity$_{t-1}$[28] in order to capture the potential impact of R&D intensiveness in relation to explaining future firm performance. This is approach is similarly used by Brick et al. (2006), Mehran (1995), and Villalonga & Amit (2006).

4.4.3.16 Industry dummy

Following previous literature (e.g. Brick et al., 2006), we incorporate an industry dummy[29] variable to capture potential differences in future firm performance, depending on industry.

4.4.3.17 Year dummy

To capture potential differences in the sample years, we incorporate year dummies[30] when explaining future firm performance. This is in line with previous literature such as Brick et al. (2006) and Chung et al. (2015).

[26] Board independence ratio is further explained in section 4.4.1.6 on page 56.
[27] Firm size is further explained in section 4.4.1.10 on page 58.
[28] Firm complexity is further explained in section 4.4.1.12 on page 59.
[29] Industry dummy is further explained in section 4.4.1.13 on page 59.
[30] Year dummy is further explained in section 4.4.1.14 on page 61.

4.5 Limitations and delimitations

In this section, we discuss limitations and delimitations associated with this study. We will initially cover the shortcomings and drawbacks of this study through the limitations, and then discuss boundaries and scope through the delimitations.

4.5.1 Limitations

It may be argued that quantitative studies have some inherent limitations. For instance, statistical regressions tend to oversimplify reality (Agresti & Franklin, 2013). Although our regression outputs enable us to comment on and discuss correlations and trends, it does not fully depict reality, but rather a "best fit" (Ibid.). Similarly, we have based the estimation of excess board compensation and excess CEO compensation on a "best fit" assumption from our statistical models. Thus, it cannot be ruled out unequivocally that our findings could be explained by unobserved firm characteristics. Moreover, by using a quantitative approach, it is evident that this method makes it difficult to provide the in-depth insights that may be achieved through qualitative research. Therefore, one should be aware of the shortcoming of using a quantitative approach.

We intuitively focus on CEOs as the main *agent* of the firm, which serves as another limitation. Thereby, we depict the *agent* as the CEO, while in reality other managers will have influence on the actions of the firm. It is common for large firms that individuals such as the CFO and COO receive compensation of at a somewhat similar level as the CEO. The *agency problem* is therefore usually more complex and does not just involve the CEO. Nevertheless, our model does not account for the compensation structures of other individuals than the directors and the CEO.

As for limitations specifically associated with our research design, we acknowledge that this study follows a structure comparable to Brick et al. (2006). The main reason for this is that literature including both elements of excess compensation and future firm performance is scarce. Furthermore, Brick et al.'s (2006) paper has been widely cited and published in the reputable *Journal of Corporate Finance*. Although it enables strong comparison to Brick et al.'s (2006) study, we find that their study has two main shortcomings: i) low explanatory power of future firm performance, and ii) difficulty of estimating firm complexity. For example, Brick et al. (2006) report R-square values of 0.04 for their model explaining future firm performance. We experience similar issues, specifically related to excess returns$_{t+1}$

and ROE_{t+1}. The low explanatory power of Brick et al.'s (2006) model could limit the validity of conclusions drawn from this model. Similarly, estimating firm complexity is very difficult, which could question the usefulness of relying on this measure. Scrutinizing other studies, we have attempted to develop other proxies for firm complexity. However, due to insufficient data availability, we have not been able to retrieve the necessary data for our chosen sample.

Another limitation are the biases related to our sample. Acknowledging that this study solely investigates survivors of the S&P 500 index, one should be careful about transferring conclusions to other firms. There are certain characteristics associated with being included in the S&P 500 index that are attributed to the way the index is constructed. The characteristics of the index create a bias, as we only focus on some of largest firms in the US. For instance, Ivanov et al. (2014) find that managers are under greater scrutiny once the firm is added to the S&P 500 index. Moreover, managers are relatively more concerned about earnings performance (Ibid.). Hence, our conclusions cannot directly be applied to other firms, as there are unique characteristics to the S&P 500.

Furthermore, we recognize the human bias related to confirmation biases. As Nickerson (1998) argues, confirmation bias connotes the seeking and interpretation of evidence that support existing expectations and hypotheses. Although we strive to interpret empirical findings and apply theoretical concepts as objectively as possible, this bias may influence conclusions.

4.5.2 Delimitations

One of the downsides of using a quantitative approach is the lack of qualitative and behavioral aspects that may explain compensation determination. For example, in the case of CEO compensation, one could argue that also CEO personality and other *human capital* skills strongly affect CEO compensation, which is something our study does not capture. This is related to the difficulty of quantifying and collecting this data, which in practice would require an extensive survey and qualitative interviews with S&P 500 CEOs and directors.

Another delimitation relates to the choice of geographical focus and time-span. US-listed firms are, generally speaking, the most extensively researched firms, as measured by number of academic papers on EBSCOhost. However, it could have been interesting to compare findings with other countries as well as extending the time-span of our study.

In terms of theoretical delimitations, we acknowledge that other scholars (e.g. Andreas et al., 2012) have included an additional perspective through *institutional theory*. Through the concept of isomorphism, DiMaggio & Powell (1983) further explain that there is a need to conform to market expectation and to seek legitimacy by examining industry traditions and peer evaluations. However, we find that this theoretical perspective to be more appropriate for a qualitative research method, where interviews could potentially reveal instances of isomorphism and *institutional theory*. Therefore, this theoretical aspect has not been included for this study.

4.6 Correlation matrices

To test for multicollinearity among the variables included in Model 1, Model 2, and Model 3, we conduct a Pearson correlation matrix for each of the models. Problems with multicollinearity arise when two or more variables included in the same regression have correlation of ±0.9 (Hair et al., 2006; Saunders et al., 2009), as this makes it difficult to interpret the impact of each variable. Pearson correlation matrices for Model 1, Model 2, and Model 3 can be found in Appendix 3-5, respectively.

As the Pearson correlation matrices in Appendix 3-5 show, we find that no variables included in the same regression at the same time have a correlation above or below the critical limit of ±0.9 (Saunders et al., 2009). We do therefore not find any indication of multicollinearity based on the Pearson correlation matrices.

4.7 Summary statistics

Table 7 (see page 76) shows the summary statistics for the full sample data. The table displays variable type, category, name, unit, mean, and standard deviation for all variables included in the study. For the dependent variables, there are some noteworthy observations: i) board cash compensation constitutes 37.4% of board total compensation, ii) CEO cash compensation constitutes 9.3% of CEO compensation (SEC), iii) there is a considerable difference in CEO compensation levels depending on the valuation method of options, and iv) mean Tobin's Q_{t+1} is 2.1.

Firstly, the mean of board total compensation is $2,563 thousands, which is more than 2.5 times the mean of board cash compensation of $956 thousands. This indicates that, on average, 37.4% of board total compensation is made up of cash compensation. Secondly, there appears to be great differences between the mean values of our CEO compensation measures. Mean CEO cash compensation and mean CEO

compensation (SEC) deviate by almost $10,800 thousands, with a CEO cash compensation mean of $1,106 thousands and a CEO compensation (SEC) mean of $11,875 thousands. This shows that CEOs' compensation is highly dependent on performance-based compensation, as CEO cash compensation merely makes up 9.3% of CEO compensation (SEC). Thirdly, the mean values of CEO compensation (option grants) and CEO compensation (option exercised) deviate by roughly $3,600 thousands. The only difference in these measures is the option valuation method, i.e. using grant or exercise date, respectively. This emphasizes the difficulties of estimating CEO compensation, as valuation date of stock options significantly influences the value of the compensation. Fourthly, our mean values for future firm performance are all positive. For example, the mean Tobin's Q_{+1} is 2.1, suggesting that on average our sample firms have a market value that is twice the size of the replacement value.

Furthermore, it is worth noticing that our sample is dominated by CEO duality (60%) and male CEOs (97%). Additionally, boards appear to be largely dominated by male directors (82.7% of directors are males), and the average board size is approximately 10 directors. Lastly, our sample firms have an average board independence ratio considerably above the requirement of 50%, with the average board having 83% independent directors.

Table 7: Full sample summary statistics

Type:	Category:	Variable name:	Unit:	Mean:	Standard dev:
Main dependent variables	Board compensation	Board total compensation	$ '000	2,563.7	1,026.8
		(Logarithm in $'000)		7.8	0.4
	CEO compensation	CEO compensation (SEC)	$ '000	11,875.1	7,143.6
		(Logarithm in $'000)		9.2	0.6
	Future firm performance	Tobin's Q_{t+1}	Q-ratio	2.1	1.2
Robustness dependent variables	Board compensation	Average director compensation	$ '000	252.0	90.0
		(Logarithm in $'000)		5.5	0.3
	Board compensation	Board cash compensation	$ '000	959.3	432.3
		(Logarithm in $'000)		6.7	0.6
	Board compensation	Average director cash compensation	$ '000	92.3	32.8
		(Logarithm in $'000)		4.4	0.4
	CEO compensation	CEO compensation (option grants)	$ '000	10,793.1	6,494.2
		(Logarithm in $'000)		9.1	0.6
	CEO compensation	CEO compensation (option exercised)	$ '000	14,426.8	13,269.2
		(Logarithm in $'000)		9.2	0.8
	CEO compensation	CEO cash compensation	$ '000	1,106.3	398.0
		(Logarithm in $'000)		6.9	0.4
	Future firm performance	Excess $returns_{t+1}$	%	5.9	22.0
	Future firm performance	ROA_{t+1}	%	6.4	5.4
	Future firm performance	ROE_{t+1}	%	17.2	24.5
Independent variables	Excess compensation	Excess board compensation	Log($'000)	0.0	0.3
	Excess compensation	Excess CEO compensation	Log($'000)	0.0	0.5
	CEO characteristics	CEO duality (% of total)	1=Yes, 0=No	0.60	0.5
	CEO characteristics	CEO shareholding	%	1.0	3.2
	Board characteristics	Board size	#	10.3	2.6
	Board characteristics	Board independence ratio	%	82.6	10.2
Control variables	CEO characteristics	CEO gender (% of total)	1=Male, 0=Female	0.97	0.2
	CEO characteristics	CEO tenure	Years	7.7	6.5
	Board characteristics	Board gender ratio	%	17.3	8.9
	Firm characteristics	Firm size total $assets_{t-1}$	$ '000,000	56,114.9	205,562.0
		(Logarithm in $'000,000)		9.7	1.4
	Firm characteristics	Firm $size\ revenue_{t-1}$	$ '000,000	18,012.0	32,345.9
		(Logarithm in $'000,000)		8.9	1.3
	Firm characteristics	ROA_{t-1}	%	6.3	6.3
	Firm characteristics	ROE_{t-1}	%	21.3	206.4
	Firm characteristics	$ROA_{average\ past\ 3\text{-}years}$	%	6.0	6.2
	Firm characteristics	$ROE_{average\ past\ 3\text{-}years}$	%	14.8	149.2
	Firm characteristics	Tobin's Q_{t-1}	Q-ratio	2.0	1.3
	Firm characteristics	Firm complexity (R&D/total $assets)_{t-1}$	%	1.6	3.6

Source: Table constructed by the authors (2018).

4.7.1 Summary statistics by industry

In this section, we will comment on summary statistics with regards to the different industry classifications used in this study. In terms of industry differences, Table 8 (see page 78) shows an overview of mean and median values for the three statistical models, using our main measures, i.e. board compensation (board total compensation), CEO compensation (CEO compensation (SEC)), and future firm performance (Tobin's Q_{t+1}).

Firstly, board total compensation has the highest mean and median values for the *public administration* industry classification, with mean of $4,335 thousands and median of $4,265 thousands. However, one should notice that there are very few firms in this industry classification, accounting only for 0.5% of the full sample. Moreover, the *mining* industry has the second-highest mean and median board total compensation values of $3,042 thousands and $2,817 thousands, respectively. The *mining* industry represents 5.6% of the total sample. In addition, the *retail trade* industry has the lowest mean board total compensation of $2,286 thousands, while the *construction* industry has the lowest median board total compensation of $2,223 thousands. These two industries account for 7.5% and 1.2% of the full sample, respectively.

Secondly, with the exception of the *public administration* industry, the *mining* industry has the highest mean CEO compensation of $13,277 thousands. In comparison, the *agriculture, forestry, and fishing* industry has the highest median CEO compensation of $12,873. The lowest paying industry, in terms of mean and median CEO compensation, is the *construction* industry, with a mean of $9,087 thousands and median $9,203 thousands.

Thirdly, the *retail trade* industry holds the highest mean value for future firm performance, measured as *Tobin's* Q_{t+1} with a mean of 3.01, right ahead of the *agriculture, forestry, and fishing* and *services* industries. However, measured by median value, the *agriculture, forestry, and fishing* industry has the highest value of 2.94. Conversely, the *construction* industry has the lowest future firm performance mean value (1.33), while *finance, insurance, and real estate* holds the lowest median value (1.17).

Among other findings, one should notice that this sample is dominated by three large industries, namely *manufacturing* (36.7%), *finance, insurance, and real estate* (21.4%), and *transportation and public utilities* (14.6%), together accounting for 72.7% of the firms included in the sample.

Table 8: Summary statistics by industry

	MODEL 1		MODEL 2		MODEL 3		Firm-years	Number of firms	Of total sample
	Board total compensation *(USD '000)*		CEO compensation SEC *(USD '000)*		Tobin's Q_{t+1} mean *(Q-ratio)*				
	Mean	**Median**	**Mean**	**Median**	**Mean**	**Median**	**#**	**#**	**%**
Industry: Agriculture, forestry, fishing	2,697.8	2,614.8	12,817.7	12,873.3	2.85	2.94	6	1	0.2%
Industry: Mining	3,042.7	2,817.8	13,276.9	11,453.9	1.54	1.44	138	23	5.6%
Industry: Construction	2,354.4	2,223.4	9,086.5	9,202.6	1.33	1.31	30	5	1.2%
Industry: Manufacturing	2,618.9	2,509.9	12,497.7	10,716.5	2.34	2.03	906	151	36.7%
Industry: Transportation and public utilities	2,469.5	2,467.1	11,847.6	9,641.1	1.55	1.30	360	60	14.6%
Industry: Wholesale trade	2,426.8	2,361.3	11,590.5	8,844.3	2.02	1.95	42	7	1.7%
Industry: Retail trade	2,286.4	2,267.8	11,001.5	9,459.8	3.01	2.44	186	31	7.5%
Industry: Finance, insurance, real estate	2,449.9	2,307.5	10,854.5	10,020.7	1.48	1.17	528	88	21.4%
Industry: Services	2,638.4	2,359.3	11,305.5	9,683.3	2.77	2.46	258	43	10.5%
Industry: Public administration	4,335.3	4,264.7	27,753.9	27,557.7	1.68	1.66	12	2	0.5%
Full sample	**2,563.7**	**2,434.5**	**11,875.1**	**10,200.9**	**2.07**	**1.68**	**2,466**	**411**	**100.0%**

Source: Table constructed by the authors (2018).

4.7.2 Summary statistics by year

In this section, we will comment on summary statistics for each of the sample years. Table 9 (see page 80) reports mean and median values for each of the three statistical models, using our main measures.

Firstly, there has been a consistent annual increase in board total compensation for each year 2010-2015, both measured by mean values and median values. Mean board total compensation in year 2010 was $2,284 thousands. Over the course of the sample period, this number increased to $2,849 thousands in 2015, corresponding to an increase of 24.8%. Similarly, median board total compensation has seen a growth of 28.1%, from $2,091 thousands in 2010 to $2,696 thousands in 2015. Our findings clearly suggest that both mean and median board total compensation has increased consistently during the sample period.

Secondly, mean CEO compensation (SEC) increased by 12.1% from 2010-2015. This resulted in the mean CEO compensation (SEC) growing from $10,875 thousands to $12,268 thousands. However, the mean CEO compensation (SEC) has not increased throughout all years of the sample period. From 2014 to 2015 the mean value decreased by 6.0%. Overall, the median CEO compensation (SEC) has increased from $9,234 thousands in 2010 to $10,768 thousands in 2015, corresponding to an increase of 16.6%. However, median CEO compensation decreased from 2012 to 2013, and again from 2014 to 2015. Hence, these findings suggest that overall, CEO compensation (SEC) has increased from 2010 to 2015, although there has not been consistent annual growth throughout all sample years.

Thirdly, future firm performance, measured by Tobin's Q_{t+1}, has increased over the sample period. Although there is more fluctuation between each of the years, mean Tobin's Q_{t+1} has increased from 1.85 in 2010 to 2.18 in 2015. Likewise, median Tobin's Q_{t+1} has increased from 1.51 to 1.75 over the course of the sample period.

Table 9: Summary statistics by year

	MODEL 1				MODEL 2				MODEL 3			
	Board total compensation				CEO compensation (SEC)				Tobin's Q_{t+1}			
	Mean *(USD '000)*	**Annual change** *(%)*	**Median** *(USD '000)*	**Annual change** *(%)*	**Mean** *(USD '000)*	**Annual change** *(%)*	**Median** *(USD '000)*	**Annual change** *(%)*	**Mean** *(Q-ratio)*	**Annual change** *(%)*	**Median** *(Q-ratio)*	**Annual change** *(%)*
Year 2015	2,849.4	3.5%	2,696.2	1.7%	12,268.5	-6.0%	10,767.8	-6.4%	2.18	0.7%	1.75	-0.8%
Year 2014	2,752.1	6.3%	2,650.2	7.1%	13,050.3	10.7%	11,498.1	14.9%	2.17	-2.8%	1.76	-3.8%
Year 2013	2,589.1	4.0%	2,475.4	3.9%	11,787.1	0.7%	10,007.4	-3.2%	2.23	5.5%	1.83	5.0%
Year 2012	2,488.9	2.9%	2,383.0	6.0%	11,701.7	1.2%	10,337.4	6.0%	2.11	10.7%	1.74	9.3%
Year 2011	2,418.6	5.9%	2,248.0	7.5%	11,568.1	6.4%	9,754.2	5.6%	1.91	3.1%	1.60	5.4%
Year 2010	2,283.8	N/A	2,091.4	N/A	10,874.7	N/A	9,233.8	N/A	1.85	N/A	1.51	N/A
Full sample	**2,563.7**	**24.8%***	**2,434.5**	**28.9%***	**11,875.1**	**12.8%***	**10,200.9**	**16.6%***	**2.07**	**17.9%***	**1.68**	**15.5%***

Source: Table constructed by the authors (2018). Note: * Full sample % change from 2010-2015.

5 Empirical findings

In this section, we will discuss our empirical findings, interpret these using relevant theory previously introduced, and compare our empirical findings with previous studies. This section will follow the structure of the proposed hypotheses. We begin by discussing the findings from Model 1 covering how board compensation is impacted by board size, CEO duality, and board independence ratio. Subsequently, we discuss the findings from Model 2 on how CEO compensation is impacted by excess board compensation, board size, CEO duality, and CEO shareholding. Lastly, we discuss the findings of Model 3 investigating how future firm performance is impacted by excess board compensation and excess CEO compensation. An overview of our empirical findings for each hypothesis can be found in Table 10.

Table 10: Overview of hypotheses and empirical findings

ID:	Model:	Independent variable:	Expected impact:	Finding:	Conclusion:
H1.1	Board compensation	Board size	+	+*	Supported
H1.2	Board compensation	CEO duality	+	-*	Not supported
H1.3	Board compensation	Board independence ratio	+	0	Not supported
H2.1	CEO compensation	Excess board compensation	+	+*	Supported
H2.2	CEO compensation	Board size	+	+	Not supported
H2.3	CEO compensation	CEO duality	+	+*	Supported
H2.4	CEO compensation	CEO shareholding	-	-*	Supported
H3.1	Future firm performance	Excess board compensation	-	-*	Supported
H3.1	Future firm performance	Excess CEO compensation	-	+*	Not supported

Source: Table constructed by the authors (2018). Note: * denotes statistical significance level of 10% or better. Signs (+), (-) and (0) denote positive, negative, or inconclusive coefficients, respectively.

5.1 Board compensation

Table 11 (see page 82) shows the findings from Model 1 concerning the explanation of board compensation. The first column in the table displays regression results using our main measure, board total compensation, as the dependent variable. The following three columns show regression results using board cash compensation, average director compensation, and average director cash compensation as the dependent variables. We will now discuss the empirical findings in relation to our hypotheses for board compensation.

Table 11: Model 1 – Board compensation

MODEL 1	Log(Board total compensation)	Log(Board cash compensation)	Log(Average director compensation)	Log(Average director cash compensation)
Board size	0.054***	0.056***	-0.029***	-0.033***
	(0.003)	(0.003)	(0.003)	(0.003)
CEO duality	-0.028*	-0.058***	-0.036**	-0.063***
	(0.015)	(0.016)	(0.014)	(0.015)
Board independence ratio	0.000	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
CEO tenure	-0.001	-0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Board gender ratio	-0.001	0.003***	-0.001	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Log(Firm size total assets$_{t-1}$)	0.117***	0.156***	0.103***	0.146***
	(0.010)	(0.013)	(0.009)	(0.012)
Past firm performance(ROA$_{t-1}$)	0.002**	0.002*	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Firm complexity$_{t-1}$	0.003	-0.011***	0.004	-0.010***
	(0.003)	(0.004)	(0.003)	(0.003)
Industry: Agriculture, forestry, fishing	-0.079	0.490	-0.166	0.424
	(0.309)	(0.472)	(0.298)	(0.443)
Industry: Mining	0.079	0.196	0.022	0.150
	(0.186)	(0.285)	(0.179)	(0.267)
Industry: Construction	-0.079	0.146	-0.170	0.072
	(0.212)	(0.324)	(0.204)	(0.304)
Industry: Manufacturing	-0.047	0.230	-0.124	0.173
	(0.181)	(0.276)	(0.174)	(0.259)
Industry: Transp. and public utilities	-0.216	0.152	-0.286	0.104
	(0.182)	(0.277)	(0.175)	(0.260)
Industry: Wholesale trade	-0.063	0.185	-0.153	0.111
	(0.203)	(0.310)	(0.195)	(0.291)
Industry: Retail trade	-0.147	-0.092	-0.218	-0.130
	(0.185)	(0.283)	(0.178)	(0.265)
Industry: Finance, insurance, real estate	-0.268	-0.028	-0.315*	-0.056
	(0.180)	(0.276)	(0.174)	(0.259)
Industry: Services	0.057	0.132	-0.005	0.083
	(0.184)	(0.281)	(0.177)	(0.264)
Year 2015	0.177***	0.123***	0.168***	0.117***
	(0.014)	(0.015)	(0.013)	(0.014)
Year 2014	0.160***	0.115***	0.152***	0.112***
	(0.013)	(0.014)	(0.013)	(0.014)
Year 2013	0.106***	0.076***	0.103***	0.077***
	(0.013)	(0.014)	(0.012)	(0.013)
Year 2012	0.071***	0.044***	0.067***	0.045***
	(0.013)	(0.013)	(0.012)	(0.013)
Year 2011	0.048***	0.017***	0.046***	0.016
	(0.013)	(0.013)	(0.012)	(0.013)
Intercept	6.095***	4.466***	4.939***	3.292***
	(0.216)	(0.317)	(0.208)	(0.298)
R-square	0.457	0.421	0.232	0.176

Source: Table constructed by the authors (2018). Note: Significance level p<0.1 *, p<0.05 **, p<0.01 ***. Parenthesis denotes standard error.

5.1.1 Board size

We find board size to have a positive impact on board compensation, significant at the 1% level. As the coefficients for board size suggest, an increase in board size of 1 unit (i.e. 1 director) corresponds to a 5.5% increase in board total compensation. Recalling that the median board total compensation for our sample is $2,434.5 thousands, this corresponds to an increase in board total compensation by $134.5 thousands when board size increases by 1 additional director. Thus, we find support of hypothesis *H1.1* that board size has a positive impact on board compensation. We identify two explanations for this relationship.

Firstly, as the number of directors on the board increases, so does the total compensation paid to the board, as there is a larger number of individuals receiving compensation. Secondly, we follow the argument presented by Lin & Lin (2014) that larger firms are associated with larger boards. Additionally, Lin & Lin (2014) argue that firms with larger boards are typically more complex, and therefore should provide higher compensation to the board. While we would intuitively agree with the argument that larger firms are typically more complex and require more resources (e.g. knowledge, *social capital*, time and effort) from its directors, the data of this paper does not conclusively support this argument. We see a strong correlation between board size and firm size, exemplified through a positive correlation of 0.50 between board size and firm size measured by total assets (see Appendix 3). However, we also find that our proxy for firm complexity is slightly negatively correlated with firm size, suggesting that larger firms are not necessarily more complex. We contemplate this contradiction to be due to the uncertainties and difficulties in properly measuring firm complexity, and to the fact that unobserved firm characteristics could be a considerable factor. This may also be due to our sample bias of S&P 500 firms, which exclusively is made up by large-cap firms.

Interpreting these results in relation to *resource dependence theory* (Hillman et al., 2009; Pfeffer & Salancik, 1978), we argue that an increase in board size is driven by a need to cope with challenges met by larger and more complex firms. This supports the argument that board size can provide an indication of the combined network reach of the board. Thus, a larger board can be beneficial as there are more directors to contribute with expertise and network access (Ibid.). These results could also reflect the relevance of the *Contact* and *Consulting* roles of the board, as larger boards are richer in terms of *social capital*, justifying a positive impact on board compensation (Thomsen & Conyon, 2012).

When conducting robustness tests using average director compensation and average director cash compensation as the dependent variables, we find board size to have a negative impact, at a 1% significance level. These results suggest that when the size of the board increases, the average director compensation decreases. This is the case for both the average director compensation and average director cash compensation. Thus, through the robustness tests, we are able to support the findings of previous studies (Adams & Ferreira, 2009; Andreas et al., 2012; Lin & Lin, 2014), who also find that average director compensation decreases as the number of directors on the board increases. This can be interpreted in relation to *resource dependence theory* (Donaldson & Davis, 1991). We argue that the resources of the directors on the board provide the firm with diminishing marginal value, i.e. the first three directors hired are relatively more value-adding than, for example, the fifteenth director. As the number of directors grow, so does the combined resource pool, meaning that there will be increasing resource overlaps, ceteris paribus.

Despite the negative impact on average director compensation, we do find that board size has a positive impact on our main measure, board total compensation. Consequently, we find support for hypothesis *H1.1*, suggesting that board size has a positive impact on board compensation.

5.1.2 CEO duality

We furthermore find that CEO duality has a negative impact on board compensation. We thereby do not find support for hypothesis *H1.2*. This negative relationship is statistically significant across all four measures of board compensation, including measures for both total board compensation and average director compensation. The impact of CEO duality on board total compensation is significant at a 10% level, while the results on the remaining robustness tests are significant at 5% or 1% level. Interpreting the results in dollar terms, this means that if the CEO is also the chairman of the board, this will lead to a 2.8% decrease in board total compensation. Relating this to the sample median board total compensation, this corresponds to a decrease of $68.0 thousands in board total compensation.

We hypothesized that CEO duality would positively impact board compensation based on the argument that the CEO would have a personal interest in maintaining a comfortable board and thereby vouch for higher board compensation (Brick et al., 2006). Furthermore, we theorized that CEO duality would strongly limit the independence of the board in their *Control* (monitoring) efforts (Thomsen & Conyon, 2012). However, an alternative explanation could be Lin & Lin's (2014) argument that a negative impact

of CEO duality on board compensation still reflects poor board culture. In this case, when the CEO is not chairman of the board, directors are able to obtain higher compensation, as they may have a stronger ability to affect their compensation to their own advantage (Lin & Lin, 2014).

Another argument explaining the negative impact of CEO duality on board total compensation could be the distribution of the entire compensation paid to the board. It could be the case that CEO duality leads to a certain proportion of the compensation for the chairman role is allocated to the CEO's own compensation instead. Thereby, CEO duality could have a negative impact on board compensation due to the compensation distribution of the chairman's fees (Ovans, 2014).

Although our findings do not support our hypothesis, these results are in line with findings made by Lin & Lin (2014), who likewise found CEO duality to have a negative relationship with both board total compensation and average director compensation. However, we acknowledge that there are substantial unobserved factors that could contribute to more detailed interpretations of the results.

Based on our empirical findings, we do not find support for hypothesis *H1.2* that CEO duality would have a positive impact on board compensation.

5.1.3 Board independence ratio

Based on our findings shown in Table 11, we do not find support for hypothesis *H1.3* that board independence ratio impacts board total compensation positively. In fact, our results were overall inconclusive. Board independence showed an insignificant effect across all four measures for board compensation. In terms of interpreting the coefficient of the regression output, we find that an increase of 1 percentage point in the board independence ratio leads to a 0.02% increase in board total compensation. Applying this to the median board total compensation, this suggests that increasing board independence ratio by 10 percentage points will lead to a $5.1 thousands increase in board total compensation. However, due to the results being statistically insignificant, we cannot conclude this with certainty.

Other scholars (Adams & Ferreira, 2009; Andreas et al., 2012; Ryan & Wiggins, 2004) have found a positive relationship between board compensation and the proportion of independent directors. Based on the findings from previous studies, we theorized that boards with a larger proportion of independent directors were to be compensated higher as they would be hired due to resources not otherwise available

internally in the firm. This argument was based upon *resource dependence theory*, as we expected the ratio of board independence to reflect the need for external resources (Hillman et al., 2009). These resources could include expertise on specific areas or *social capital* valuable to the firm. Andreas et al. (2012) argue that the reason for higher compensation to independent directors was their higher reservation values. However, we believe that the inconclusive results may also stem from unobserved firm characteristics or limited information on the expertise and experience of directors.

Hence, we conclude that there is no support for hypothesis *H1.3* that board independence ratio has a positive impact on board compensation.

5.2 CEO compensation

In this section, we will discuss our empirical findings regarding determinants of CEO compensation. Table 12 reports (see page 87) the findings from our regressions, with the first column showing the results when using our main measure, CEO compensation (SEC), as the dependent variable. The remaining columns presents the regression results using CEO compensation (option grants), CEO compensation (option exercised), and CEO cash compensation as dependent variables.

Table 12: Model 2 – CEO compensation

MODEL 2	Log(CEO compensation (SEC))	Log(CEO compensation (option grants))	Log(CEO compensation (option exercised))	Log(CEO cash compensation)
Excess board compensation	0.301***	0.310***	0.286***	0.022
	(0.036)	(0.037)	(0.057)	(0.017)
Board size	0.008	0.007	0.011	-0.004
	(0.005)	(0.005)	(0.008)	(0.002)
CEO duality	0.129***	0.103***	0.199***	0.084***
	(0.026)	(0.026)	(0.040)	(0.012)
CEO shareholding	-0.017***	-0.020***	-0.020***	-0.010***
	(0.004)	(0.004)	(0.006)	(0.002)
CEO gender	0.003	0.027	0.022	0.136***
	(0.073)	(0.074)	(0.112)	(0.035)
CEO tenure	0.011***	0.012***	0.033***	0.004***
	(0.002)	(0.002)	(0.003)	(0.001)
Board gender ratio	0.001	0.001	-0.002	0.001
	(0.001)	(0.001)	(0.002)	(0.001)
Board independence ratio	0.002*	0.002*	0.002	0.003***
	(0.001)	(0.001)	(0.002)	(0.001)
Log(Firm size total assets$_{t-1}$)	0.206***	0.193***	0.155***	0.128***
	(0.016)	(0.017)	(0.022)	(0.009)
Past firm performance(ROA$_{t-1}$)	0.006***	0.004**	0.008***	0.000
	(0.002)	(0.002)	(0.003)	(0.001)
Firm complexity$_{t-1}$	-0.013**	-0.010*	-0.006	-0.008***
	(0.005)	(0.005)	(0.007)	(0.003)
Industry: Agriculture, forestry, fishing	-0.134	0.055	0.112	-0.033
	(0.502)	(0.520)	(0.646)	(0.322)
Industry: Mining	-0.271	-0.129	-0.225	-0.305
	(0.302)	(0.314)	(0.390)	(0.194)
Industry: Construction	-0.360	-0.187	-0.351	-0.183
	(0.344)	(0.357)	(0.444)	(0.221)
Industry: Manufacturing	-0.213	-0.085	-0.096	-0.255
	(0.293)	(0.304)	(0.378)	(0.188)
Industry: Transp. and public utilities	-0.474	-0.367	-0.345	-0.388**
	(0.295)	(0.306)	(0.379)	(0.189)
Industry: Wholesale trade	-0.373	-0.226	-0.204	-0.201
	(0.329)	(0.341)	(0.424)	(0.212)
Industry: Retail trade	-0.383	-0.200	-0.090	-0.237
	(0.301)	(0.312)	(0.387)	(0.193)
Industry: Finance, insurance, real estate	-0.601**	-0.445	-0.416	-0.538***
	(0.293)	(0.303)	(0.377)	(0.188)
Industry: Services	-0.195	-0.030	-0.026	-0.318*
	(0.299)	(0.310)	(0.386)	(0.192)
Year 2015	0.076***	0.120***	0.232***	0.056***
	(0.025)	(0.025)	(0.041)	(0.011)
Year 2014	0.123***	0.113***	0.248***	0.046***
	(0.024)	(0.024)	(0.040)	(0.011)
Year 2013	0.043*	0.097***	0.198***	0.037***
	(0.023)	(0.024)	(0.039)	(0.011)
Year 2012	0.044*	0.030	0.172***	0.021***
	(0.023)	(0.023)	(0.039)	(0.010)
Year 2011	0.045**	0.036	0.017	0.011***
	(0.023)	(0.023)	(0.038)	(0.010)
Intercept	7.037***	6.938***	7.120	5.577***
	(0.362)	(0.374)	(0.483)	(0.222)
R-square	0.356	0.320	0.214	0.325

Source: Table constructed by the authors (2018). Note: Significance level p<0.1 *, p<0.05 **, p<0.01 ***. Parenthesis denotes standard error.

5.2.1 Excess board compensation

Excess board compensation is found to have a positive impact on CEO compensation across three out of four measures, all of them significant at a 1% level. Thus, we find strong support for hypothesis *H2.1* that excess board compensation is positively impacting CEO compensation. These results are in line with the findings of Brick et al. (2006), Chung et al. (2015), and Lin & Lin (2014), who all report a positive and significant relationship between excess board compensation and CEO compensation.

Interpreting the coefficient, our results indicate that an increase in excess board compensation of 10% leads to an increase in CEO compensation (SEC) of approximately 3%. Recalling that the median board total compensation is $2,434.5 thousands and median CEO compensation (SEC) is $10,200.9 thousands, this suggests that if the board is overcompensated by $243.5 thousands (10%), this will increase the CEO paycheck of $296.4 thousands (3%). In other words, using median values as a proxy, boards gain relatively more from excess board compensation, while the CEO gains more in absolute value.

In line with Brick et al. (2006), Chung et al. (2015), and Lin & Lin (2014), we argue that the positive impact of excess board compensation on the CEO's paycheck could be caused by a *mutual back-scratching* relationship, where both directors and CEOs are highly compensated and interested in maintaining status quo. Additionally, this could reflect poor board culture, including cronyism, which eventually leads to poor protection of shareholder interests (Brick et al., 2006; Jensen, 1993). As Brick et al. (2006) and Lin & Lin (2014) argue, this is because highly compensated boards are less likely to "rock the boat". Furthermore, besides the financial motive of preserving status quo, it may also be advantageous for directors to maintain their spot in a valuable network, obtained through board membership. Hence, this problem in board culture may reflect environments where boards do not act in the strict interests of shareholders.

Interpreting this finding in light of *agency theory* (Jensen, 1993; Jensen & Meckling, 1976) and the three-level hierarchy (Andreas et al., 2012; Kumar & Sivaramakrishnan, 2008), we argue that the positive impact of excess board compensation on CEO compensation could indicate that directors favor own interests over shareholder interests. This is because the approval of higher CEO compensation will likely affect directors' own compensation positively as well as help maintaining their seat on the board (Andreas et al., 2012; Brick et al., 2006; Kumar & Sivaramakrishnan, 2008). Conclusively, we find support for hypothesis *H2.1* that excess board compensation has a positive impact on CEO compensation.

5.2.2 Board size

We find that board size has a positive, although statically insignificant, impact on CEO compensation. The coefficient for CEO compensation (SEC) indicates that increasing board size by 1 unit (i.e. 1 director) will increase CEO compensation (SEC) by 0.8%. In terms of dollar values, this corresponds to an increase of $85.1 thousands in median CEO compensation (SEC) stemming from adding 1 additional director. However, as the findings are statistically insignificant, we cannot definitively conclude this with statistical certainty. Thus, we do not find support for hypothesis *H2.2* that the number of directors on the board has a positive impact on CEO compensation

Nevertheless, we expect that the positive coefficient of board size may be explained by board size being positively related to firm size (Lin & Lin, 2014). Similarly, firm size is generally an indicator of CEO compensation, as larger firms compensate their CEO more (Ibid.). Interestingly, the correlation matrix also reports a positive correlation of 0.50 between board size and firm size (see Appendix 4), indicating that a relatively strong correlation exists between the two variables.

Another theoretical perspective that may contribute to explaining why we find a positive, though statistically insignificant, impact of board size is related to Conyon (2014) and Core et al.'s (1999) arguments regarding free-riding problems. Conyon (2014) argues that it may be easier for CEOs to control larger boards due to free-riding problems on larger boards. This would suggest that larger boards are less effective and critical in their monitoring of the CEO, and that the CEO thereby gets to impact his/her own compensation more easily. This is in line with the *managerial power view*, arguing that the CEO will gain more power as board size increases (Bebchuk & Fried, 2004). Nonetheless, as the results are statistically insignificant, it seems more plausible that board size may simply yield as a proxy for firm size or that findings are influenced by unobserved firm characteristics.

Thus, due to statistically insignificant results, we do not find support for hypothesis *H2.2* that CEO compensation is positively impacted by the number of directors on the board.

5.2.3 CEO duality

As the results in Table 12 show, we find CEO duality to have a positive impact on CEO compensation. This is the case for all four measures of CEO compensation. As all of these results are confirmed at the 1% significance level, our findings strongly support hypothesis *H2.3* of CEO duality having a positive

impact on CEO compensation. Interpreting the coefficient value, we find that if the CEO likewise is the chairman of the board, he/she will receive 13.7% higher CEO compensation (SEC) compared to non-chairman CEOs. In terms of dollar values, using median CEO compensation (SEC) as benchmark, this suggests that CEO duality leads to $1,400.2 thousands higher CEO compensation. We expect that this positive impact can be rooted in one or more of the following factors: i) self-interests, ii) CEO power, and iii) board compensation allocated as CEO compensation.

Firstly, in line with *agency theory* (Jensen & Meckling, 1976), CEOs are assumed to be self-interested and will use the increased influence through chairmanship to affect the compensation determination process, as Lin & Lin (2014) argue. This is also in line with Harris et al. (2012), who argue that CEO duality reflects restricted monitoring and increased *information asymmetry*. Thus, CEO duality could facilitate a potential increase in the likelihood of *moral hazard*. Although the CEO is not directly involved in the compensation determination process, his/her presence as chairman is likely to affect other directors indirectly and through social ties (Thomsen & Conyon, 2012).

Secondly, as Ryan & Wiggins (2004) argue, the positive and highly statistically significant impact of CEO duality on CEO compensation may be related to CEO power. This supports the *managerial power view* (Bebchuk & Fried, 2004) that the CEO is more powerful when also chairing the board. According to this view, the CEO can better influence the board through his/her dual position. Hence, the argument is that CEO duality reflects a weaker monitoring structure, as the CEO gains more power over the board.

Thirdly, it is important to consider the possibility that higher CEO compensation as a result of CEO duality may reflect the increased workload that the chairmanship requires. Although some S&P 500 firms do not directly and explicitly compensate CEO's for their chairmanship, it is likely that this extra workload has a positive spillover on the CEO compensation (Ovans, 2014).

To conclude, based on the empirical findings, we find strong support for hypothesis *H2.3* that CEO duality has a positive impact on CEO compensation.

5.2.4 CEO shareholding

Consistent with our expectations, we find strong support for hypothesis *H2.4* that CEO shareholding will have a negative impact on CEO compensation. This finding is statistically significant at the 1% level for all four measures of CEO compensation. In terms of interpreting the coefficient, a 1 percentage point

increase in CEO shareholding corresponds to a 1.7% decrease in CEO compensation (SEC). As the median CEO compensation (SEC) is $10,200.9 thousands, this means that increasing CEO shareholding by 1 percentage point indicates a decrease in CEO compensation (SEC) of $175.9 thousands. However, one should be careful about drawing any definite conclusions regarding the effects of CEO shareholding. CEO shareholding does not account for the actual value of the shareholding, but merely provides an indication of the proportion of ownership. Thus, this measure does not take the size and market capitalization of the firm into account. Nevertheless, we argue that the decrease in CEO compensation is expected to be offset by the increased value of CEO shareholding.

Our findings support previous literature related to *agency theory* that CEOs who own a proportion of the firm's shares have incentives to improve firm value (Brick et al., 2006; Jensen & Meckling, 1976). Moreover, the negative relationship between CEO shareholding and CEO compensation could indicate that compensating CEOs using shares would reduce the potential problem of *moral hazard*. This argument is in line with the *optimal contracting view*, arguing that CEO shareholding can be utilized to reduce *information asymmetry* problems, particularly *moral hazard* (Thomsen & Conyon, 2012). Likewise, Lin & Lin (2014) argue that shareholding can act as a substitute for compensation.

Based on our empirical results, we find strong support for hypothesis *H2.4* that CEO shareholding has a negative impact on CEO compensation.

5.3 Future firm performance

This section discusses the empirical findings related to the impact of excess board compensation and excess CEO compensation on future firm performance. An overview of our regression results is presented in Table 13 (see page 93). The first column shows the impact of independent variables and control variables on Tobin's Q_{t+1}. In column two, we show the results of the second market performance measure, excess $returns_{t+1}$. In the third and fourth column, we show the results when testing the impact on two accounting performance measures, ROA_{t+1} and ROE_{t+1}. As the area regarding the impact of excess compensation on future firm performance is largely unexplored in existing literature, we conduct two additional regressions, which can be found in Table 14-15. For the additional regressions, we divide the sample into two groups: i) firm-years with both negative excess board compensation and negative excess CEO compensation, and ii) firm-years with both positive excess board compensation and positive excess CEO compensation. The main purpose of conducting these additional regressions is to test whether positive excess compensation impacts future firm performance differently compared to negative excess compensation.

Table 13: Model 3 – Future firm performance

MODEL 3	Tobin's Q_{t+1}	Excess returns$_{t+1}$	ROA_{t+1}	ROE_{t+1}
Excess board compensation	-0.113**	-1.733	0.124	-0.937
	(0.048)	(1.524)	(0.332)	(1.874)
Excess CEO compensation	0.053**	-0.096	1.123***	3.421***
	(0.027)	(0.886)	(0.187)	(1.065)
CEO duality	0.025	-0.661	0.443*	1.052
	(0.035)	(1.001)	(0.238)	(1.324)
CEO gender	-0.116	0.370	-1.367**	-5.654
	(0.099)	(2.749)	(0.672)	(3.714)
CEO tenure	0.008***	-0.066	0.009	-0.007
	(0.003)	(0.079)	(0.018)	(0.103)
CEO shareholding	-0.001	0.194	0.035	-0.654***
	(0.005)	(0.155)	(0.034)	(0.192)
Board size	-0.004	-0.070	0.033	0.207
	(0.007)	(0.205)	(0.047)	(0.265)
Board gender ratio	0.001	0.011	-0.032**	-0.045
	(0.002)	(0.055)	(0.013)	(0.073)
Board independence ratio	-0.001	0.027	-0.009	0.033
	(0.002)	(0.049)	(0.012)	(0.064)
Log(Firm size total assets$_{t-1}$)	-0.328***	-1.191***	-1.019***	-1.291*
	(0.028)	(0.414)	(0.148)	(0.716)
Firm complexity$_{t-1}$	0.001	0.079	0.140***	0.055
	(0.008)	(0.140)	(0.046)	(0.234)
Industry: Agriculture, forestry, fishing	0.528	-9.573	2.667	10.036
	(1.042)	(11.028)	(4.678)	(21.350)
Industry: Mining	-0.835	-11.617*	-5.051*	-17.430
	(0.628)	(6.646)	(2.820)	(12.868)
Industry: Construction	-1.357*	-10.698	-2.778	-5.740
	(0.715)	(7.567)	(3.211)	(14.654)
Industry: Manufacturing	-0.207	-2.590	0.217	3.668
	(0.608)	(6.453)	(2.735)	(12.486)
Industry: Transp. and public utilities	-0.740	-2.441	-2.448	-2.034
	(0.612)	(6.472)	(2.747)	(12.533)
Industry: Wholesale trade	-0.534	-3.257	-0.813	3.188
	(0.684)	(7.231)	(3.070)	(14.009)
Industry: Retail trade	0.377	-1.987	2.981	5.922
	(0.624)	(6.609)	(2.803)	(12.795)
Industry: Finance, insurance, real estate	-0.694	-1.751	-3.009	-4.527
	(0.608)	(6.427)	(2.728)	(12.448)
Industry: Services	0.072	-3.392	-0.048	5.226
	(0.620)	(6.588)	(2.790)	(12.742)
Year 2015	0.464***	0.800	0.003	0.340
	(0.032)	(1.557)	(0.226)	(1.337)
Year 2014	0.430***	-1.086	-0.134	-0.352
	(0.031)	(1.545)	(0.220)	(1.308)
Year 2013	0.466***	0.209	0.434**	2.735**
	(0.030)	(1.537)	(0.215)	(1.287)
Year 2012	0.322***	2.540*	0.341	0.196
	(0.029)	(1.531)	(0.211)	(1.270)
Year 2011	0.090***	1.761	-0.175	-1.221
	(0.028)	(1.526)	(0.208)	(1.257)
Intercept	5.442***	18.246**	18.935***	30.715*
	(0.703)	(9.129)	(3.360)	(15.904)
R-square	0.369	0.023	0.280	0.072

Source: Table constructed by the authors (2018). Note: Significance level p<0.1 *, p<0.05 **, p<0.01 ***. Parenthesis denotes standard error.

5.3.1 Excess board compensation

We find support for hypothesis *H3.1* that excess board compensation has a negative impact on future firm performance. This result is statistically significant at the 5% level when using our main measure, Tobin's Q_{t+1}, as the dependent variable. We find that an increase in excess board compensation of 10% corresponds to a change in Tobin's Q_{t+1} of -0.005. This indicates that overcompensating the board leads to lower future firm performance.

These findings are in line with the findings of Brick et al. (2006) and Chung et al. (2015), who similarly find a negative relationship between excess board compensation and future firm performance. We believe this could be associated with Jensen's (1993) argument regarding problems in board culture, where highly paid directors are poorer monitors. This may be related to *information asymmetry* (Thomsen & Conyon, 2012), underlining the difficulties of ensuring that directors act strictly in the interests of shareholders. Brick et al. (2006) suggest that the negative relationship between excess board compensation and future firm performance is reflective of "suboptimal performance" of the directors who prioritize self-interests over shareholder interests. In line with Brick et al. (2006), we argue that this could be due to cronyism where directors, as a consequence, are less vigilant in their *Control* function (Thomsen & Conyon, 2012).

When measuring future firm performance as excess returns, our results are similar to the ones of Brick et al. (2006). In line with the previous scholars, we find excess board compensation to have a negative impact on excess $returns_{t+1}$, though our results for this specific result are statistically insignificant. In fact, our model explaining excess $returns_{t+1}$ has an R-square value of merely 0.02. This is relatively similar to Brick et al.'s (2006) explanatory power, who present an R-square value of 0.04. This obviously questions the validity of the results, and underlines why one should be careful about drawing any definite conclusions.

Moreover, for our two accounting measures capturing future firm performance, ROA_{t+1} and ROE_{t+1}, we find statistically insignificant results and varying impact. In addition, we obtain a relatively low R-square values for these regressions. For ROA_{t+1} we obtain an R-square value of 0.28, and a value of 0.07 for ROE_{t+1}, suggesting that the explanatory power of this model is relatively low. This underlines the measurement difficulties of estimating future firm performance.

Although our results vary depending on the measurement used for future firm performance, we reach statistically significant results when using our main measure, Tobin's Q_{t+1}. These results support Jensen's (1993) argument that problems in board culture may be related to the compensation of directors, and Brick et al.'s (2006) conclusion that excessive board compensation leads to lower future firm performance.

Based on the empirical findings, we find support for hypothesis *H3.1* that excess board compensation has a negative impact on future firm performance.

5.3.2 Excess CEO compensation

Although we expected excess CEO compensation to have a negative impact on future firm performance, our results generally suggest the opposite to be the case. Thus, we do not find support for hypothesis *H3.2* that excess CEO compensation has a negative impact on future firm performance. With the exception of excess $returns_{t+1}$, we find statistically significant support for excess CEO compensation having a positive impact on future firm performance. This is confirmed at the 5% significance level or better for Tobin's Q_{t+1}, ROA_{t+1}, and ROE_{t+1}. Interpreting the coefficient for Tobin's Q_{t+1}, this means that a 10% increase in excess CEO compensation is associated with a 0.002 increase in Tobin's Q_{t+1}. Thus, these results suggest that overcompensating the CEO will actually lead to improved future firm performance. This is in contrast to the findings of Chung et al. (2015) and Core et al. (1999) who find excess CEO compensation to have a negative impact on future firm performance, when using Tobin's Q_{t+1}, ROA_{t+1}, or ROE_{t+1} as the dependent variable.

Nevertheless, comparing our findings with Brick et al. (2006), we find similar results when measuring future firm performance as excess $returns_{t+1}$. However, as the results are statistically insignificant, and the explanatory power of the regression is very low (0.02), we question the causality of the results. Therefore, we believe that this result may be a product of unobserved firm characteristics rather than Brick et al.'s (2006) argument of a *mutual back-scratching* relationship that eventually leads to poor future firm performance.

Conversely, we find it interesting that our results for Tobin's Q_{t+1}, ROA_{t+1}, and ROE_{t+1} are positive and statistically significant. This could support the *agency* view that CEOs do perform better when being excessively financially incentivized. We argue that this is in line with the *optimal contracting view* that

CEO compensation can be utilized to attract the best talent and motivate the CEO (Thomsen & Conyon, 2012). This indicates that a link between future firm performance and CEO compensation does exist. Yet, as this finding contradicts previous research (Brick et al., 2006; Chung et al., 2015; Core et al., 1999), it is possible that our findings stem from unobserved firm characteristics. This underlines the need for further research within this area.

Based on the empirical findings, we do not find support for hypothesis *H3.2* that excess CEO compensation has a negative impact on future firm performance.

5.3.3 Additional analysis of future firm performance

In order to further investigate the impact of excess board compensation and excess CEO compensation on future firm performance, we split our sample into two groups: i) a sample consisting of 712 firm-years with negative excess board compensation and negative excess CEO compensation only (see Table 14 on page 97), and ii) a sample consisting of 680 firms-years with positive excess board compensation and positive excess CEO compensation only (see Table 15 on page 98). The reason for this is to test whether positive excess compensation impacts future firm performance differently compared to negative excess compensation. When looking only at cases of negative excess board compensation and negative excess CEO compensation, we do not find any statistically significant results related to future firm performance. However, when running regressions using the subsample with positive excess board compensation and positive excess CEO compensation, we do find that excess board compensation is positively impacting Tobin's Q_{t+1} and excess $returns_{t+1}$, with a statistical significance at a 5% and 10% level, respectively. This deviates from the findings of Model 3 incorporating the full sample. These results could indicate that the impact of excess board compensation differ depending on whether the board is compensated more or less than predicted by our model. Nevertheless, the largely mixed findings, shown in Table 14 and Table 15, underline the measurement difficulties, the potential influence of unobserved firm characteristics, and the need for future research within this area of excess compensation.

Table 14: Only negative excess compensation firm performance

	Tobin's Q_{t+1}	Excess returns$_{t+1}$	ROA_{t+1}	ROE_{t+1}
Excess board compensation	-0.081	-2.942	-0.703	-0.395
	(0.116)	(4.333)	(0.785)	(4.116)
Excess CEO compensation	-0.058	0.102	0.109	-1.949
	(0.060)	(2.311)	(0.410)	(2.142)
CEO duality	0.054	2.412	0.895**	3.642*
	(0.065)	(1.907)	(0.408)	(2.209)
CEO gender	0.098	11.850**	-0.517	-1.349
	(0.194)	(5.704)	(1.201)	(6.547)
CEO tenure	0.016***	-0.161	0.017	-0.161
	(0.005)	(0.153)	(0.031)	(0.164)
CEO shareholding	-0.002	0.290	0.033	-0.966***
	(0.005)	(0.215)	(0.036)	(0.188)
Board size	-0.009	0.135	-0.016	0.033
	(0.011)	(0.306)	(0.072)	(0.390)
Board gender ratio	-0.001	0.187*	-0.036*	0.063
	(0.003)	(0.098)	(0.021)	(0.113)
Board independence ratio	0.000	-0.151	-0.026	-0.170*
	(0.003)	(0.097)	(0.019)	(0.104)
Log(Firm size total assets$_{t-1}$)	-0.265***	-1.200*	-0.948***	-1.877
	(0.039)	(0.693)	(0.198)	(1.162)
Firm complexity$_{t-1}$	0.028**	0.173	0.197***	0.267
	(0.012)	(0.286)	(0.068)	(0.385)
Industry: Agriculture, forestry, fishing	0.537	13.905	6.151	6.758
	(1.162)	(23.974)	(5.564)	(33.224)
Industry: Mining	-0.652	-5.833	-5.580	-20.910
	(0.830)	(10.754)	(3.772)	(23.145)
Industry: Construction	-1.323	-4.228	-1.225	-6.594
	(0.932)	(13.490)	(4.277)	(26.116)
Industry: Manufacturing	-0.206	-1.683	1.284	7.736
	(0.806)	(10.293)	(3.659)	(22.475)
Industry: Transp. and public utilities	-0.637	-0.040	-1.713	-5.205
	(0.808)	(10.299)	(3.663)	(22.508)
Industry: Wholesale trade	-0.293	1.599	0.661	9.449
	(0.895)	(12.035)	(4.075)	(24.984)
Industry: Retail trade	0.518	0.363	2.870	4.612
	(0.829)	(10.813)	(3.772)	(23.140)
Industry: Finance, insurance, real estate	-0.658	-0.335	-2.259	-3.940
	(0.800)	(10.028)	(3.616)	(22.248)
Industry: Services	-0.002	3.134	1.286	5.017
	(0.817)	(10.432)	(3.708)	(22.777)
Year 2015	0.434***	9.177***	-0.007	1.853
	(0.057)	(2.888)	(0.399)	(2.055)
Year 2014	0.382***	5.630**	0.276	1.352
	(0.054)	(2.861)	(0.380)	(1.939)
Year 2013	0.403***	3.596	0.414	1.658
	(0.051)	(2.799)	(0.365)	(1.855)
Year 2012	0.289***	6.764**	0.257	-0.015
	(0.050)	(2.875)	(0.364)	(1.841)
Year 2011	0.086*	5.575*	-0.112	-2.944
	(0.050)	(2.904)	(0.364)	(1.835)
Intercept	4.313***	8.315	17.037***	44.254
	(-0.081)	(-2.942)	(4.807)	(28.589)
R-square	0.448	0.047	0.387	0.116

Source: Table constructed by the authors (2018). Note: Significance level p<0.1 *, p<0.05 **, p<0.01 ***. Parenthesis denotes standard error.

Table 15: Only positive excess compensation firm performance

	Tobin's Q_{t+1}	Excess returns$_{t+1}$	ROA_{t+1}	ROE_{t+1}
Excess board compensation	0.395**	7.574*	0.714	-7.715
	(0.162)	(4.105)	(1.003)	(5.239)
Excess CEO compensation	0.172	1.588	0.851	0.074
	(0.092)	(3.012)	(0.601)	(3.563)
CEO duality	0.052	-0.785	0.164	1.523
	(0.080)	(1.985)	(0.489)	(2.532)
CEO gender	-0.345**	-6.128	-1.614	-12.899**
	(0.175)	(4.638)	(1.109)	(5.987)
CEO tenure	0.010	0.155	0.032	-0.214
	(0.007)	(0.172)	(0.045)	(0.223)
CEO shareholding	-0.009	-0.426	-0.041	0.443
	(0.017)	(0.430)	(0.104)	(0.547)
Board size	-0.014	0.075	0.169	0.864
	(0.017)	(0.488)	(0.109)	(0.601)
Board gender ratio	-0.002	-0.263**	-0.028	0.000
	(0.005)	(0.112)	(0.028)	(0.144)
Board independence ratio	0.000	0.094	-0.016	0.087
	(0.004)	(0.107)	(0.026)	(0.135)
Log(Firm size total assets$_{t-1}$)	-0.370***	-0.548	-0.847***	-1.574
	(0.051)	(0.899)	(0.278)	(1.222)
Firm complexity$_{t-1}$	0.001	0.333	0.136**	0.078
	(0.012)	(0.248)	(0.069)	(0.327)
Industry: Agriculture, forestry, fishing	0.722	-12.236	3.771	9.796
	(1.314)	(24.218)	(6.885)	(30.081)
Industry: Mining	-0.772	-22.100**	-4.958	-14.925
	(0.913)	(11.179)	(4.610)	(17.014)
Industry: Construction	-1.417	-23.539*	-0.165	-4.420
	(1.002)	(13.213)	(5.110)	(19.574)
Industry: Manufacturing	-0.174	-3.670	-1.022	-1.859
	(0.888)	(10.762)	(4.483)	(16.479)
Industry: Transp. and public utilities	-0.567	-0.645	-3.122	-4.899
	(0.894)	(10.820)	(4.511)	(16.578)
Industry: Wholesale trade	-0.483	2.467	-1.368	-1.371
	(0.998)	(13.228)	(5.077)	(19.349)
Industry: Retail trade	0.159	-0.072	2.850	5.480
	(0.909)	(11.072)	(4.592)	(16.917)
Industry: Finance, insurance, real estate	-0.617	-0.159	-3.635	-4.178
	(0.889)	(10.736)	(4.486)	(16.470)
Industry: Services	0.203	-5.675	-0.771	2.525
	(0.908)	(11.178)	(4.590)	(16.995)
Year 2015	0.486***	-4.824*	-0.065	3.070
	(0.074)	(2.932)	(0.487)	(3.123)
Year 2014	0.464***	-2.222	-0.556	-3.568
	(0.073)	(2.941)	(0.484)	(3.126)
Year 2013	0.545***	-2.971	0.367	4.455
	(0.072)	(2.906)	(0.475)	(3.084)
Year 2012	0.411***	2.419	0.346	0.272
	(0.067)	(2.825)	(0.451)	(2.970)
Year 2011	0.100	1.529	-0.468	-1.140
	(0.066)	(2.871)	(0.447)	(2.993)
Intercept	5.971***	12.847	17.651***	34.373
	(1.085)	(16.937)	(5.724)	(23.757)
R-square	0.386	0.093	0.185	0.068

Source: Table constructed by the authors (2018). Note: Significance level p<0.1 *, p<0.05 **, p<0.01 ***. Parenthesis denotes standard error.

5.4 Robustness tests

To further test the validity of our findings, we conduct a number of robustness tests. The detailed robustness regression outputs for the models explaining board compensation, CEO compensation, and future firm performance can be found in Appendix 6-8, respectively.

For Model 1 regarding board compensation (see Appendix 6), we substitute our control variables of firm size (total $assets_{t-1}$) and past firm performance measure (ROA_{t-1}) with alternative measures. We find that $revenue_{t-1}$ yields nearly identical results as when measuring firm size as total $assets_{t-1}$. We also find that other measures for past firm performance have a positive impact on board total compensation, although the majority of those measures are statistically insignificant. Accordingly, our robustness tests regarding board total compensation support our main findings.

In terms of robustness tests for Model 2 and CEO compensation (see Appendix 7), we similarly substitute control variables of firm size (total $assets_{t-1}$) and past firm performance measure (ROA_{t-1}) with alternative measures. Supporting our main findings, we find firm size to have a similar impact on CEO compensation when using $revenue_{t-1}$. However, the alternative measures for past firm performance report ambiguous findings, underlining the difficulties of estimating firm performance.

Lastly, for Model 3 and future firm performance (see Appendix 8), we substitute only our control variable of firm size (total $assets_{t-1}$) with $revenue_{t-1}$ across all of our dependent variable measuring for future firm performance. We overall find similar results, and conclude that our robustness tests, to a large extent, are supporting our main findings.

6 Conclusion

In the aftermath of the 2007-2008 financial crisis, the compensation packages of boards and CEOs have come under greater scrutiny. In particular, it has been discussed whether the compensation structures enable effective corporate governance of US firms, hereunder S&P 500 firms.

This paper investigates the determinants of board compensation using a range of corporate governance characteristics, while controlling for firm characteristics. We find that larger boards receive higher compensations. We argue that this is connected to the relationship between board size and firm size, with larger firms typically requiring a wider range of competences on the board. Contrary to our expectations, we find that CEO duality is associated with lower board compensation. This contradicts the argument that less independence between boards and CEOs would lead to higher board compensation.

Moreover, this study analyzes how CEO compensation is impacted by corporate governance characteristics, including the impact of excess board compensation. We find that excess board compensation has a positive impact on CEO compensation. This supports the claim of the existence of a *mutual back-scratching* relationship between boards and CEOs, as our results suggest it to be mutually beneficial for both the CEO and the board to allow for higher compensation. Furthermore, we find that CEO compensation is positively impacted by board size. We expect the primary cause of this to be that larger firms typically have larger boards, and that CEOs of larger firms generally receive higher compensation. Moreover, we argue that the CEO, to a higher degree, can control a larger board due to board inefficiencies and coordination issues. We also conclude that CEOs holding the role as chairman of the board are compensated significantly higher. This may be explained by the CEO's dominant position on the board enabling him/her to affect the CEO compensation. In addition, the chairmanship possibly involves a greater workload for the CEO, which could justify higher compensation. Furthermore, we find support for CEO shareholding resulting in lower CEO compensation, as CEO shareholding can act as a substitute for other compensation elements.

Finally, this study investigates how excess compensation of boards and CEOs impact future firm performance, while controlling for a number of corporate governance and firm characteristics. We find that excess board compensation has a negative impact on future firm performance. This supports the argument that overcompensated directors are poorer monitors, possibly as a result of cronyism.

Conversely, in contrast to previous literature, we find that excess CEO compensation has a positive impact on future firm performance. This suggests that excessive financial incentives for CEOs constitute effective mechanisms that can be used to improve future firm performance.

7 Suggestions for future research

This paper provides empirical findings that contribute to the existing literature within corporate governance, particularly to the scarce literature on excess compensation of boards and CEOs, and how these measures impact future firm performance. Nevertheless, given the scope of this paper, we suggest future studies to investigate these relationships on other samples, for instance from other countries than the US. We acknowledge that our findings regarding the impact of excess CEO compensation on future firm performance deviate from previous studies (Brick et al., 2006; Chung et al., 2015; Core et al., 1999). This noteworthy deviation raises the question of whether there has been a shift in recent years, following the financial crisis of 2007-2008. Thus, we recommend future research to investigate this using other sample periods, including data after the 2007-2008 financial crisis.

Moreover, based on our search for relevant literature, we identified a number of relevant characteristics used in previous research that we do not incorporate. These include variables regarding ownership structures (e.g. Anderson & Reeb, 2003) and interlinked directors and CEOs (e.g. Core et al., 1999). This could be beneficial for future research to include in order to better explain board compensation, CEO compensation, and future firm performance.

Additionally, in terms of the scope of this paper, our results reveal interesting findings that are not explicitly addressed. These are primarily related to three control variables: i) CEO gender, ii) firm size, and iii) firm complexity. Firstly, we find that male CEOs receive higher cash compensation (i.e. base salary) compared to female CEOs. This finding is statistically significant at the 1% level, suggesting that CEO gender does affect CEO cash compensation. We argue that this finding may be influenced by few outlying observations, as our sample consists of 97% male CEOs. Secondly, our findings suggest that firm size is negatively impacting future firm performance. This could indicate that larger firms perform relatively worse compared to smaller firms. We argue that this finding could be due to our sample bias of only investigating large S&P 500 firms, or simply because of unobserved firm characteristics. Lastly, we find that firm complexity is negatively impacting CEO compensation. We acknowledge that the measure for firm complexity used in this paper may not comprehensively capture the complexity of firms. Thus, it is possible that this relationship may be due to the difficulties of proxying firm complexity. Conclusively, we recommend that future research look into these areas.

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9 Appendices

Appendix 1: List of sample firms

3M Company MMM

A. O. Smith Corporation AOS

Abbott Laboratories ABT

Accenture plc ACN

Activision Blizzard, Inc. ATVI

Acuity Brands, Inc. AYI

Adobe Systems Incorporated ADBE

Advance Auto Parts, Inc. AAP

Aetna Inc. AET

Affiliated Managers Group, Inc. AMG

Aflac Incorporated AFL

Agilent Technologies, Inc. A

Air Products and Chemicals, Inc. APD

Alaska Air Group, Inc. ALK

Albemarle Corporation ALB

Alexandria Real Estate Equities, Inc. ARE

Alexion Pharmaceuticals, Inc. ALXN

Allergan plc AGN

Alliance Data Systems Corporation ADS

Alliant Energy Corporation LNT

Alphabet Inc. GOOGL

Altria Group, Inc. MO

Amazon.com, Inc. AMZN

Ameren Corporation AEE

American Airlines Group Inc. AAL

American Electric Power Company, Inc. AEP

American Express Company AXP

American Tower Corporation REIT AMT

American Water Works Company, Inc. AWK

Ameriprise Financial, Inc. AMP

AmerisourceBergen Corporation ABC

AMETEK, Inc. AME

Amgen Inc. AMGN

Amphenol Corporation APH

Anadarko Petroleum Corporation APC

Analog Devices, Inc. ADI

Andeavor ANDVAnsys, Inc. ANSS

Anthem, Inc. ANTM

Aon plc AON

Apache Corporation APA

Apartment Investment and Management Company AIV

Apple Inc. AAPL

Applied Materials, Inc. AMAT

Assurant, Inc. AIZ

AT&T Inc. T

Autodesk, Inc. ADSK

Automatic Data Processing, Inc. ADP

AutoZone, Inc. AZO

AvalonBay Communities, Inc. AVB

Avery Dennison Corporation AVY

Ball Corporation BLL

Bank of America Corporation BAC

Baxter International Inc. BAX

BB&T Corporation BBT

Becton, Dickinson and Company BDX

Biogen Inc. BIIB

BlackRock, Inc. BLK

BorgWarner Inc. BWA

Boston Properties, Inc. BXP

Bristol-Myers Squibb Company BMY

Broadcom Limited AVGO

C.H. Robinson Worldwide, Inc. CHRW

CA, Inc. CA

Cabot Oil & Gas Corporation COG

Cadence Design Systems, Inc. CDNS

Campbell Soup Company CPB

Cardinal Health, Inc. CAH

CarMax Inc. KMX

Carnival Corporation CCL

Caterpillar Inc. CAT

CBS Corporation CBS

Celgene Corporation CELG

Centene Corporation CNC

CenterPoint Energy, Inc. CNP

CenturyLink, Inc. CTL

Cerner Corporation CERN

CF Industries Holdings, Inc. CF

Charter Communications, Inc. CHTR

Chesapeake Energy Corporation CHK

Chevron Corporation CVX

Chipotle Mexican Grill, Inc. CMG

Chubb Limited CB

Church & Dwight Co., Inc. CHD

Cigna Corporation CI

Cimarex Energy Co. XEC

Cincinnati Financial Corporation CINF

Cintas Corporation CTAS

Cisco Systems, Inc. CSCO

Citigroup Inc. C

CME Group Inc. CME

CMS Energy Corporation CMS

Cognizant Technology Solutions Corporation CTSH

Colgate-Palmolive Company CL

Comcast Corporation CMCS.A

Comerica Incorporated CMA

Conagra Brands, Inc. CAG

Concho Resources Inc. CXO

ConocoPhillips COP

Consolidated Edison, Inc. ED

Constellation Brands, Inc. STZ

Corning Incorporated GLW

Costco Wholesale Corporation COST

Crown Castle International Corp. REIT CCI

CVS Health Corporation CVS

Danaher Corporation DHR

Darden Restaurants, Inc. DRI

DaVita Inc. DVA

Deere & Company DE

Delta Air Lines, Inc. DAL

DENTSPLY SIRONA Inc. XRAY

Devon Energy Corporation DVN

Discovery Communications, Inc. DISC.A

DISH Network Corporation DISH

Dollar General Corporation DG

Dollar Tree, Inc. DLTR

Dominion Energy, Inc. D

Dover Corporation DOV

Dr Pepper Snapple Group, Inc. DPS

DTE Energy Company DTE

Duke Realty Corporation DRE

E*TRADE Financial Corporation ETFC

Eastman Chemical Company EMN

Eaton Corporation plc ETN

eBay Inc. EBAY

Ecolab Inc. ECL

Edison International EIX

Edwards Lifesciences Corporation EW

Electronic Arts Inc. EA

Eli Lilly and Company LLY

Emerson Electric Co. EMR

EOG Resources, Inc. EOG

EQT Corporation EQT

Equifax Inc. EFX

Equinix, Inc. REIT EQIX

Equity Residential EQR

Essex Property Trust, Inc. ESS

Everest Re Group, Ltd. RE

Eversource Energy ES

Exelon Corporation EXC

Expedia, Inc. EXPE

Expeditors International of Washington, Inc. EXPD

Express Scripts Holding Company ESRX

Extra Space Storage Inc. EXR

Exxon Mobil Corporation XOM

F5 Networks, Inc. FFIV

Fastenal Company FAST

Federal Realty Investment Trust FRT

FedEx Corporation FDX

FirstEnergy Corp. FE

Fiserv, Inc. FISV

FLIR Systems, Inc. FLIR

Flowserve Corporation FLS

Fluor Corporation FLR

FMC Corporation FMC

Foot Locker, Inc. FL

Ford Motor Company F

Franklin Resources, Inc. BEN

Freeport-McMoRan Inc. FCX

Garmin Ltd. GRMN

Gartner, Inc. IT

General Dynamics Corporation GD

General Electric Company GE

General Mills, Inc. GIS

Genuine Parts Company GPC

GGP Inc. GGP

Halliburton Company HAL

Hanesbrands Inc. HBI

Harley-Davidson, Inc. HOG

Harris Corporation HRS

Hasbro, Inc. HAS

HCP, Inc. HCP

Helmerich & Payne, Inc. HP

Henry Schein, Inc. HSIC

Hess Corporation HES

Honeywell International Inc. HON

Hormel Foods Corporation HRL

HP Inc. HPQ

Humana Inc. HUM

Huntington Bancshares Incorporated HBAN

IDEXX Laboratories, Inc. IDXX

Illinois Tool Works Inc. ITW

Illumina, Inc. ILMN

Incyte Corporation INCY

Ingersoll-Rand Plc IR

Intel Corporation INTC

Intercontinental Exchange, Inc. ICE

International Business Machines Corporation IBM

International Flavors & Fragrances Inc. IFF

International Paper Company IP

Intuit Inc. INTU

Intuitive Surgical, Inc. ISRG

Invesco Ltd. IVZ

Iron Mountain Incorporated IRM

J.B. Hunt Transport Services, Inc. JBHT

Jacobs Engineering Group Inc. JEC

Johnson & Johnson JNJ

Johnson Controls International plc JCI

JPMorgan Chase & Co. JPM

Juniper Networks, Inc. JNPR

Kansas City Southern KSU

Kellogg Company K

KeyCorp KEY

Kimberly-Clark Corporation KMB

Kimco Realty Corporation KIM

KLA-Tencor Corporation KLAC

Kohl's Corporation KSS

L Brands, Inc. LB

L3 Technologies, Inc. LLL

Laboratory Corporation of America Holdings LH

Lam Research Corporation LRCX

Leggett & Platt, Incorporated LEG

Lennar Corporation LEN

Leucadia National Corporation LUK

Lincoln National Corporation LNC

Lockheed Martin Corporation LMT

Loews Corporation L

Lowe's Companies, Inc. LOW

M&T Bank Corporation MTB

Macerich Company MAC

Macy's, Inc. M

Marathon Oil Corporation MRO

Marriott International, Inc. MAR

Marsh & McLennan Companies, Inc. MMC

Martin Marietta Materials, Inc. MLM

Masco Corporation MAS

Mastercard Incorporated MA

Mattel, Inc. MAT

McCormick & Company, Incorporated MKC

McDonald's Corporation MCD

McKesson Corporation MCK

Medtronic plc MDT

Merck & Co., Inc. MRK

MetLife, Inc. MET

Mettler-Toledo International Inc. MTD

MGM Resorts International MGM

Microchip Technology Incorporated MCHP

Micron Technology, Inc. MU

Microsoft Corporation MSFT

Mid-America Apartment Communities, Inc. MAA

Mohawk Industries, Inc. MHK

Molson Coors Brewing Company TAP

Mondelez International, Inc. MDLZ

Monsanto Company MON

Monster Beverage Corporation MNST

Moody's Corporation MCO

Motorola Solutions, Inc. MSI

Nasdaq, Inc. NDAQ

National Oilwell Varco, Inc. NOV

NetApp, Inc. NTAP

Netflix, Inc. NFLX

Newfield Exploration Company NFX

Newmont Mining Corporation NEM

NextEra Energy, Inc. NEE

NIKE, Inc. NKE

NiSource Inc. NI

Noble Energy, Inc. NBL

Nordstrom, Inc. JWN

Norfolk Southern Corporation NSC

Northern Trust Corporation NTRS

Northrop Grumman Corporation NOC

NRG Energy, Inc. NRG

Nucor Corporation NUE

NVIDIA Corporation NVDA

Occidental Petroleum Corporation OXY

Omnicom Group Inc. OMC

ONEOK, Inc. OKE

Oracle Corporation ORCL

O'Reilly Automotive, Inc. ORLY

PACCAR Inc PCAR

Packaging Corporation of America PKG

Parker-Hannifin Corporation PH

Pentair plc PNR

People's United Financial, Inc. PBCT

Pepsico, Inc. PEP

PerkinElmer, Inc. PKI

Pfizer Inc. PFE

PG&E Corporation PCG

Philip Morris International Inc. PM

Pinnacle West Capital Corporation PNW

Pioneer Natural Resources Company PXD

PPG Industries, Inc. PPG

PPL Corporation PPL

Praxair, Inc. PX

Principal Financial Group, Inc. PFG

Prologis, Inc. PLD

Prudential Financial, Inc. PRU

Public Service Enterprise Group Incorporated PEG

Public Storage PSA

PulteGroup, Inc. PHM

PVH Corp. PVH

QUALCOMM Incorporated QCOM

Quanta Services, Inc. PWR

Quest Diagnostics Incorporated DGX

Ralph Lauren Corporation RL

Range Resources Corporation RRC

Raymond James Financial, Inc. RJF

Raytheon Company RTN

Realty Income Corporation O

Red Hat, Inc. RHT

Regency Centers Corporation REG

Regeneron Pharmaceuticals, Inc. REGN

Regions Financial Corporation RF

Republic Services, Inc. RSG

ResMed Inc. RMD

Robert Half International Inc. RHI

Rockwell Automation Inc. ROK

Rockwell Collins, Inc. COL

Roper Technologies, Inc. ROP

Ross Stores, Inc. ROST

Royal Caribbean Cruises Ltd. RCL

S&P Global Inc. SPGI

Salesforce.com, inc. CRM

SCANA Corporation SCG

Schlumberger Limited SLB

Scripps Networks Interactive, Inc. SNI

Seagate Technology plc STX

Sealed Air Corporation SEE

Sempra Energy SRE

Signet Jewelers Limited SIG

Simon Property Group, Inc. SPG

Skyworks Solutions, Inc. SWKS

SL Green Realty Corp. SLG

Snap-on Incorporated SNA

Southwest Airlines Co. LUV

Stanley Black & Decker, Inc. SWK

Starbucks Corporation SBUX

State Street Corporation STT

Stericycle, Inc. SRCL

SunTrust Banks, Inc. STI

Synopsys, Inc. SNPS

Sysco Corporation SYY

T. Rowe Price Group, Inc. TROW

Target Corporation TGT

TE Connectivity Ltd. TEL

Texas Instruments Incorporated TXN

Textron Inc. TXT

The AES Corporation AES

The Bank of New York Mellon Corporation BK

The Boeing Company BA

The Charles Schwab Corporation SCHW

The Clorox Company CLX

The Coca-Cola Company KO

The Cooper Companies, Inc. COO

The Estée Lauder Companies Inc. EL

The Gap, Inc. GPS

The Goodyear Tire & Rubber Company GT

The Hartford Financial Services Group, Inc. HIG

The Hershey Company HSY

The Home Depot, Inc. HD

The Interpublic Group of Companies, Inc. IPG

The J. M. Smucker Company SJM

The Kroger Co. KR

The PNC Financial Services Group, Inc. PNC

The Priceline Group Inc. PCLN

The Progressive Corporation PGR

The Sherwin-Williams Company SHW

The Southern Company SO

The TJX Companies, Inc. TJX

The Travelers Companies, Inc. TRV

The Walt Disney Company DIS

The Western Union Company WU

The Williams Companies, Inc. WMB

Thermo Fisher Scientific Inc. TMO

Tiffany & Co. TIF

Time Warner Inc. TWX

Torchmark Corporation TMK

Total System Services, Inc. TSS

Tractor Supply Company TSCO

TransDigm Group Incorporated TDG

Twenty-First Century Fox, Inc. FOXA

Tyson Foods, Inc. TSN

U.S. Bancorp USB

UDR, Inc. UDR

Under Armour, Inc. UAA

Union Pacific Corporation UNP

United Continental Holdings, Inc. UAL

United Parcel Service, Inc. UPS

United Rentals, Inc. URI

United Technologies Corporation UTX

UnitedHealth Group Incorporated UNH

Universal Health Services, Inc. UHS

Unum Group UNM

V.F. Corporation VFC

Valero Energy Corporation VLO

Varian Medical Systems, Inc. VAR

Ventas, Inc. VTR

VeriSign, Inc. VRSN

Verisk Analytics, Inc. VRSK

Verizon Communications Inc. VZ

Vertex Pharmaceuticals Incorporated VRTX

Visa Inc. V

Vornado Realty Trust VNO

Vulcan Materials Company VMC

W.W. Grainger, Inc. GWW

Waste Management, Inc. WM

Waters Corporation WAT

WEC Energy Group, Inc. WEC

Wells Fargo & Company WFC

Welltower Inc. HCN

Western Digital Corporation WDC

Whirlpool Corporation WHR

Wyndham Worldwide Corporation WYN

Wynn Resorts, Limited WYNN

Xcel Energy Inc. XEL

Xerox Corporation XRX

Xilinx, Inc. XLNX

XL Group Ltd XL

Yum! Brands, Inc. YUM

Zimmer Biomet Holdings, Inc. ZBH

Zions Bancorporation ZION

Appendix 2: Retrieved data

Category:	Data retrieved:	Source:
Board characteristics	Board size	WRDS
	Board gender ratio	Datastream
	Board independence ratio	Datastream
	Total compensation to board	WRDS
	Total cash compensation to board	WRDS
CEO characteristics	CEO duality	WRDS
	CEO gender	WRDS
	CEO tenure	WRDS
	CEO shareholding	WRDS
	CEO cash compensation	WRDS
	CEO total compensation as reported in SEC Filings	WRDS
	CEO total compensation (salary + bonus + other annual + restricted stock grants + LTIP payouts + all other + value of option grants)	WRDS
	CEO total compensation (salary + bonus + other annual + restricted stock grants + LTIP payouts + all other + value of option exercised)	WRDS
Firm characteristics	Total assets	S&P Capital IQ
	Revenue	S&P Capital IQ
	Net income	S&P Capital IQ
	R&D expenses	S&P Capital IQ
	Adjusted year-end share price	Yahoo Finance
	Tobin's Q	WRDS
	Industry	S&P Capital IQ
	Year	S&P Capital IQ

Source: Table constructed by the authors (2018).

Appendix 3: Model 1 board compensation correlation matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Log(Board total comp.)	1.00																
2	Log(Avg. director comp.)	0.80	1.00															
3	Log(Board cash comp.)	0.54	0.22	1.00														
4	Log(Avg. director cash comp.)	0.34	0.29	0.89	1.00													
5	CEO duality	0.01	-0.09	0.02	-0.05	1.00												
6	CEO tenure	-0.08	0.04	-0.22	-0.17	0.21	1.00											
7	Board size	0.54	-0.04	0.56	0.14	0.12	-0.16	1.00										
8	Board gender ratio	0.15	0.01	0.21	0.13	0.12	-0.12	0.19	1.00									
9	Board independence ratio	0.22	0.03	0.19	0.06	0.18	-0.21	0.26	0.25	1.00								
10	Log(Firm size total assets$_{t-1}$)	0.46	0.19	0.49	0.33	0.15	-0.13	0.50	0.21	0.15	1.00							
11	Log(Firm size revenue$_{t-1}$)	0.47	0.26	0.43	0.30	0.17	-0.10	0.40	0.26	0.14	0.71	1.00						
12	Past firm perf.(ROA$_{t-1}$)	-0.03	0.06	-0.08	-0.02	-0.05	0.04	-0.14	-0.01	-0.02	-0.27	0.09	1.00					
13	Past firm perf.(ROA$_{\text{average past 3-years}}$)	-0.02	0.04	-0.06	-0.02	-0.03	0.05	-0.10	-0.01	0.00	-0.22	0.13	0.82	1.00				
14	Past firm perf.(ROE$_{t-1}$)	0.01	0.01	0.03	0.04	0.01	0.07	0.00	0.05	-0.01	0.00	0.04	0.07	0.05	1.00			
15	Past firm perf.(ROE$_{\text{average past 3-years}}$)	0.02	0.00	0.06	0.05	0.03	0.04	0.02	0.05	0.00	0.02	0.06	0.03	0.04	0.47	1.00		
16	Past firm perf.(Tobin's Q$_{t-1}$)	-0.04	0.14	-0.28	-0.21	-0.08	0.12	-0.24	-0.03	-0.06	-0.46	-0.21	0.44	0.42	0.04	0.02	1.00	
17	Firm complexity$_{t-1}$	0.08	0.21	-0.15	-0.11	-0.13	0.01	-0.14	-0.05	0.04	-0.19	-0.11	0.19	0.14	-0.01	-0.02	0.23	1.00

Source: Table constructed by the authors (2018) based on regression outputs.

Appendix 4: Model 2 CEO compensation correlation matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Log(CEO cash comp.)	1.00																			
2	Log(CEO comp. (SEC))	0.62	1.00																		
3	Log(CEO comp. (option grants))	0.59	0.96	1.00																	
4	Log(CEO comp. (option exercised))	0.43	0.72	0.75	1.00																
5	Excess board comp.	0.16	0.27	0.29	0.22	1.00															
6	CEO duality	0.23	0.21	0.18	0.20	-0.06	1.00														
7	CEO gender	-0.05	-0.08	-0.06	-0.03	0.02	-0.05	1.00													
8	CEO tenure	0.02	0.05	0.07	0.21	0.04	0.21	0.08	1.00												
9	CEO shareholding	-0.12	-0.11	-0.11	-0.04	-0.09	0.04	0.05	0.38	1.00											
10	Board size	0.31	0.27	0.23	0.11	0.07	0.12	-0.07	-0.16	-0.18	1.00										
11	Board gender ratio	0.16	0.13	0.10	0.05	0.01	0.12	-0.24	-0.12	-0.08	0.19	1.00									
12	Board independence ratio	0.16	0.19	0.17	0.10	0.07	0.18	-0.05	-0.21	-0.26	0.26	0.25	1.00								
13	Log(Firm size total assets$_{t-1}$)	0.42	0.42	0.38	0.20	-0.02	0.15	-0.08	-0.13	-0.11	0.50	0.21	0.15	1.00							
14	Log(Firm size revenue$_{t-1}$)	0.48	0.48	0.44	0.29	0.06	0.17	-0.10	-0.10	-0.05	0.40	0.26	0.14	0.71	1.00						
15	Past firm perf.(ROA$_{t-1}$)	-0.04	0.00	-0.01	0.10	0.00	-0.05	-0.01	0.04	0.05	-0.14	-0.01	-0.02	-0.27	0.09	1.00					
16	Past firm perf.(ROA$_{\text{average past 3-years}}$)	-0.03	-0.01	-0.01	0.10	-0.02	-0.03	-0.02	0.05	0.05	-0.10	-0.01	0.00	-0.22	0.13	0.82	1.00				
17	Past firm perf. (ROE$_{t-1}$)	0.04	0.04	0.03	0.02	0.00	0.01	-0.09	0.07	0.03	0.00	0.05	-0.01	0.00	0.04	0.07	0.05	1.00			
18	Past firm perf.(ROE$_{\text{average past 3-years}}$)	0.06	0.05	0.05	0.05	-0.02	0.03	-0.08	0.04	0.03	0.02	0.05	0.00	0.02	0.06	0.03	0.04	0.47	1.00		
19	Past firm perf.(Tobin's Q$_{t-1}$)	-0.17	-0.04	-0.02	0.09	0.15	-0.08	0.02	0.12	0.10	-0.24	-0.03	-0.06	-0.46	-0.21	0.44	0.42	0.04	0.02	1.00	
20	Firm complexity$_{t-1}$	-0.16	-0.08	-0.05	-0.01	0.10	-0.13	0.04	0.01	0.09	-0.14	-0.05	0.04	-0.19	-0.11	0.19	0.14	-0.01	-0.02	0.23	1.00

Source: Table constructed by the authors (2018) based on regression outputs.

Appendix 5: Model 3 future firm performance correlation matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Excess returns$_{t+1}$	1.00															
2	Tobin's Q$_{t+1}$	0.16	1.00														
3	ROA$_{t+1}$	0.07	0.64	1.00													
4	ROE$_{t+1}$	0.05	0.26	0.46	1.00												
5	Excess board comp.	-0.02	0.11	0.05	0.01	1.00											
6	Excess CEO comp.	-0.01	0.07	0.07	0.07	0.17	1.00										
7	CEO duality	-0.03	-0.08	-0.04	0.01	-0.06	0.01	1.00									
8	CEO gender	0.00	0.01	-0.02	-0.07	0.02	-0.04	-0.05	1.00								
9	CEO tenure	-0.01	0.14	0.06	-0.04	0.04	0.01	0.21	0.08	1.00							
10	CEO shareholding	0.03	0.11	0.05	-0.03	-0.09	-0.01	0.04	0.05	0.38	1.00						
11	Board size	-0.04	-0.26	-0.16	0.00	0.07	0.00	0.12	-0.07	-0.16	-0.18	1.00					
12	Board gender ratio	0.00	-0.01	-0.02	0.07	0.01	-0.01	0.12	-0.24	-0.12	-0.08	0.19	1.00				
13	Board independence ratio	-0.01	-0.06	-0.06	0.04	0.07	0.03	0.18	-0.05	-0.21	-0.26	0.26	0.25	1.00			
14	Log(Firm size total assets$_{t-1}$)	-0.08	-0.50	-0.36	-0.09	-0.02	0.02	0.15	-0.08	-0.13	-0.11	0.50	0.21	0.15	1.00		
15	Log(Firm size revenue$_{t-1}$)	-0.04	-0.22	0.01	0.12	0.06	0.10	0.17	-0.10	-0.10	-0.05	0.40	0.26	0.14	0.71	1.00	
16	Firm complexity$_{t-1}$	0.03	0.27	0.22	0.04	0.10	-0.03	-0.13	0.04	0.01	0.09	-0.14	-0.05	0.04	-0.19	-0.11	1.00

Source: Table constructed by the authors (2018) based on regression outputs.

Appendix 6: Model 1 board compensation robustness tests

	Log(Board total compensation)			
CEO duality	-0.028*	-0.028*	-0.028*	-0.029**
	(0.015)	(0.015)	0.015	(0.015)
CEO tenure	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	0.001	(0.001)
Board size	0.056***	0.056***	0.056***	0.057***
	(0.003)	(0.003)	0.003	(0.003)
Board gender ratio	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	0.001	(0.001)
Board independence ratio	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	0.001	(0.001)
Log(Firm size revenue)$_{t-1}$	0.116***	0.115***	0.116***	0.118***
	(0.009)	(0.009)	0.009	(0.009)
Past firm perf.(ROE$_{t-1}$)	0.000			
	(0.000)			
Past firm perf.(ROA$_{\text{average past 3-years}}$)		0.000		
		(0.001)		
Past firm perf.(ROE$_{\text{average past 3-years}}$)			0.000	
			0.000	
Past firm perf.(Tobin's Q$_{t-1}$)				0.023***
				(0.006)
Firm complexity$_{t-1}$	0.005*	0.005*	0.005*	0.005*
	(0.003)	(0.003)	0.003	(0.003)
Industry: Agriculture, forestry, forestry	-0.131	-0.135	-0.131	-0.151
	(0.304)	(0.303)	0.304	(0.301)
Industry: Mining	0.106	0.105	0.106	0.116
	(0.184)	(0.183)	0.184	(0.182)
Industry: Construction	-0.185	-0.185	-0.185	-0.172
	(0.208)	(0.207)	0.208	(0.206)
Industry: Manufacturing	-0.108	-0.110	-0.107	-0.116
	(0.177)	(0.176)	0.177	(0.176)
Industry: Transp. and public utilities	-0.222	-0.223	-0.222	-0.215
	(0.179)	(0.178)	0.179	(0.177)
Industry: Wholesale trade	-0.276	-0.277	-0.276	-0.280
	(0.198)	(0.198)	0.198	(0.197)
Industry: Retail trade	-0.289	-0.292	-0.289	-0.310*
	(0.181)	(0.180)	0.181	(0.179)
Industry: Finance, insurance, real estate	-0.139	-0.139	-0.138	-0.127
	(0.178)	(0.178)	0.178	(0.177)
Industry: Services	0.019	0.016	0.020	0.005
	(0.181)	(0.180)	0.181	(0.179)
Year 2015	0.180***	0.180***	0.180***	0.166***
	(0.014)	(0.014)	0.014	(0.014)
Year 2014	0.163***	0.163***	0.163***	0.152***
	(0.013)	(0.013)	0.013	(0.013)
Year 2013	0.105***	0.105***	0.105***	0.100***
	(0.013)	(0.013)	0.013	(0.013)
Year 2012	0.068***	0.068***	0.068***	0.065***
	(0.013)	(0.013)	0.013	(0.013)
Year 2011	0.047***	0.047***	0.047***	0.044***
	(0.013)	(0.013)	0.013	(0.013)
Intercept	6.188***	6.190***	6.188***	6.116***
	(0.209)	(0.208)	0.209	(0.208)
R-square	0.468	0.468	0.468	0.478

Source: Table constructed by the authors (2018). Note: Significance level p<0.1 *, p<0.05 **, p<0.01 ***. Parenthesis denotes standard error.

Appendix 7: Model 2 CEO compensation robustness tests

	Log(CEO compensation (SEC))			
Excess board compensation	0.274***	0.275***	0.274***	0.254***
	(0.036)	(0.036)	(0.036)	(0.036)
CEO duality	0.131***	0.131***	0.131***	0.130***
	(0.026)	(0.026)	(0.026)	(0.026)
CEO gender	0.009	0.010	0.008	0.012
	(0.073)	(0.073)	(0.073)	(0.072)
CEO tenure	0.011***	0.011***	0.011***	0.011***
	(0.002)	(0.002)	(0.002)	(0.002)
CEO shareholding	-0.018***	-0.018***	-0.018***	-0.018***
	(0.004)	(0.004)	(0.004)	(0.004)
Board size	0.012	0.012	0.012	0.013
	(0.005)	(0.005)	(0.005)	(0.005)
Board gender ratio	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Board independence Ratio	0.002**	0.003**	0.002**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
Log(Firm size revenue$_{t-1}$)	0.205***	0.207***	0.205***	0.211***
	(0.016)	(0.016)	(0.016)	(0.016)
Past firm perf.(ROE$_{t-1}$)	0.000			
	0.000			
Past firm perf.(ROA$_{\text{average past 3-years}}$		-0.002		
		(0.002)		
Past firm perf.(ROE$_{\text{average past 3-years}}$)			0.000	
			(0.000)	
Past firm perf.(Tobin's Q$_{t-1}$)				0.047***
				(0.011)
Firm complexity$_{t-1}$	-0.010**	-0.010**	-0.010**	-0.010**
	(0.005)	(0.005)	(0.005)	(0.005)
Industry: Agriculture, forestry, forestry	-0.211	-0.197	-0.211	-0.251
	(0.501)	(0.500)	(0.502)	(0.503)
Industry: Mining	-0.222	-0.219	-0.222	-0.201
	(0.303)	(0.302)	(0.303)	(0.304)
Industry: Construction	-0.544	-0.544	-0.545	-0.516
	(0.343)	(0.342)	(0.343)	(0.344)
Industry: Manufacturing	-0.307	-0.298	-0.307	-0.322
	(0.292)	(0.292)	(0.293)	(0.293)
Industry: Transp. and public utilities	-0.484*	-0.482	-0.484	-0.468
	(0.294)	(0.294)	(0.295)	(0.295)
Industry: Wholesale trade	-0.742**	-0.735**	-0.742**	-0.750**
	(0.327)	(0.327)	(0.328)	(0.328)
Industry: Retail trade	-0.618**	-0.605**	-0.618**	-0.661**
	(0.298)	(0.298)	(0.299)	(0.300)
Industry: Finance, insurance, real estate	-0.375	-0.373	-0.375	-0.349
	(0.294)	(0.294)	(0.295)	(0.295)
Industry: Services	-0.249	-0.239	-0.250	-0.276
	(0.298)	(0.298)	(0.299)	(0.299)

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Year 2015	0.083***	0.085***	0.084***	0.053**
	(0.024)	(0.025)	(0.024)	(0.025)
Year 2014	0.131***	0.133***	0.131***	0.109***
	(0.024)	(0.024)	(0.024)	(0.024)
Year 2013	0.044*	0.046*	0.044*	0.034
	(0.023)	(0.023)	(0.023)	(0.023)
Year 2012	0.041*	0.042*	0.041*	0.034
	(0.023)	(0.023)	(0.023)	(0.023)
Year 2011	0.045**	0.045**	0.045**	0.038*
	(0.023)	(0.023)	(0.023)	(0.023)
Intercept	7.197***	7.184***	7.198***	7.040***
	(0.356)	(0.355)	(0.356)	(0.358)
R-square	0.364	0.366	0.364	0.365

Source: Table constructed by the authors (2018). Note: Significance level p<0.1 *, p<0.05 **, p<0.01 ***. Parenthesis denotes standard error.

Appendix 8: Model 3 future firm performance robustness tests

	Tobin's Q_{t+1}	Excess returns$_{t+1}$	ROA_{t+1}	ROE_{t+1}
Excess board compensation	-0.102**	-1.461	0.163	-1.107
	(0.048)	(1.526)	(0.336)	(1.875)
Excess CEO compensation	0.062**	-0.048	1.149***	3.266***
	(0.027)	(0.891)	(0.189)	(1.066)
CEO duality	0.020	-0.883	0.355	0.570
	((0.035)	(1.000)	(0.241)	(1.320)
CEO gender	-0.121	0.429	-1.368**	-5.465
	(0.100)	(2.753)	(0.679)	(3.707)
CEO tenure	0.008***	-0.054	0.013	0.020
	(0.003)	(0.079)	(0.019)	(0.102)
CEO shareholding	0.000	0.190	0.038	-0.655***
	(0.005)	(0.156)	(0.034)	(0.191)
Board size	-0.013*	-0.236	-0.039	-0.089
	(0.007)	(0.197)	(0.047)	(0.258)
Board gender ratio	0.001	0.002	-0.036***	-0.072
	(0.002)	(0.055)	(0.013)	(0.073)
Board independence ratio	-0.001	0.031	-0.010	0.029
	(0.002)	(0.049)	(0.012)	(0.064)
Log(Firm size revenue$_{t-1}$)	-0.215***	-0.551	-0.314**	1.435**
	(0.028)	(0.412)	(0.150)	(0.708)
Firm complexity$_{t-1}$	0.000	0.067	0.148***	0.107
	(0.008)	(0.140)	(0.047)	(0.233)
Industry: Agriculture, forestry, forestry	0.854	-8.199	4.107	14.213
	(1.094)	(11.030)	(4.812)	(21.169)
Industry: Mining	-0.671	-11.089*	-3.931	-12.788
	(0.660)	(6.666)	(2.907)	(12.790)
Industry: Construction	-0.838	-8.914	-0.612	-0.059
	(0.748)	(7.547)	(3.292)	(14.481)
Industry: Manufacturing	0.194	-1.138	1.996	8.790
	(0.637)	(6.440)	(2.807)	(12.350)
Industry: Transp. and public utilities	-0.530	-1.658	-1.289	2.092
	(0.643)	(6.482)	(2.828)	(12.437)
Industry: Wholesale trade	0.149	-1.050	1.405	6.542
	(0.715)	(7.198)	(3.142)	(13.817)
Industry: Retail trade	0.965	-0.045	5.138*	10.437
	(0.652)	(6.575)	(2.867)	(12.612)
Industry: Finance, insurance, real estate	-0.784	-1.923	-2.508	0.168
	(0.642)	(6.481)	(2.826)	(12.434)
Industry: Services	0.464	-2.048	1.799	11.005
	(0.650)	(6.584)	(2.866)	(12.617)
Year 2015	0.421***	0.626	-0.238	-0.535
	(0.032)	(1.559)	(0.227)	(1.337)
Year 2014	0.392***	-1.266	-0.353	-1.166
	(0.031)	(1.547)	(0.221)	(1.309)
Year 2013	0.442***	0.073	0.269	2.062
	(0.030)	(1.540)	(0.217)	(1.290)
Year 2012	0.312***	2.464	0.239	-0.305
	(0.029)	(1.533)	(0.213)	(1.274)
Year 2011	0.085***	1.719	-0.228	-1.490
	(0.028)	(1.528)	(0.210)	(1.260)
Intercept	4.055***	12.337	11.475***	4.762
	(0.722)	(9.058)	(0.163)	(15.614)
R-square	0.304	0.020	0.244	0.079

Source: Table constructed by the authors (2018). Note: Significance level p<0.1 *, p<0.05 **, p<0.01 ***. Parenthesis denotes standard error.