Master's thesis

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Executive compensation in the US financial industry

An empirical analysis of the differences in CEO compensation between the financial and non-financial industry and the impact of the Dodd-Frank Act on such differences

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1 Executive summary

Following the financial crisis, executive remuneration has been on top of the agenda for the public, regulators and politicians. This thesis analyzes whether there are any differences in the executive compensation of financial firms relative to non-financial firms in the period 2007-2016, and whether these potential differences have changed with the Dodd-Frank Act of 2010.

The analysis applies a deductive research approach. With a solid foundation in relevant and acknowledged research, a number of pooled OLS regressions are performed to examine whether there is statistical evidence for the proposed hypotheses.

We find a number of significant differences between CEO compensation in financial firms relative to non-financial firms. The results indicate that CEOs of financial firms have a lower level of total compensation relative to CEOs of non-financial firms. In terms of pay structure, we the results suggest that financial firm CEOs receive an overall higher fraction of cash compensation and a lower fraction of options. Additionally, we find that financial firm CEOs have a similar level of pay-performance sensitivity (delta) but a lower level of pay-risk sensitivity (vega) relative to non-financial firm CEOs. Finally, the results indicate a higher vega following the implementation of the Dodd-Frank Act. However, there are no signs that the regulation has magnified or weakened the relative differences between CEO compensation in financial and non-financial firms.

Our findings imply that CEOs of financial firms may pursue strategies that are less risky relative to CEOs of non-financial firms. Also, it appears that debtholders are less relevant than expected for compensation committees of financial firms in the design of pay packages. Moreover, our results suggest that following the Dodd-Frank Act, shareholders have a bigger say on compensation matters, in line with one of the overall regulation goals.

Finally, we acknowledge that our study has certain limitations. First, the focus on large, public firms make the results apply only to firms with similar characteristics. Second, the findings cannot be generalized to other top executives as we restrict the study to CEOs. Third, the lack of complete data availability can implement biases in our findings.

Contents

2 Abbreviations and symbols

ARRA – The American Recovery and Reinvestment Act of 2009

Delta – Pay-performance sensitivity / Sensitivity of CEO wealth to a 1% change in stock price

DFA – Dodd-Frank Act (the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010)

EBIT – Earnings Before Interests and Taxes

EESA – The Emergency Economic Stabilization Act of 2008

FDIC – Federal Deposit Insurance Corporation

GFC – Global Financial Crisis in 2008

GLBA – The Gramm-Leach-Bliley Act of 1999

GSA – The Glass-Steagall Act of 1933

ISS - Institutional Shareholder Services

M – millions

Non-bank financial firms/institutions - Non-commercial bank financial institutions

NPV - Net Present Value

OLS - Ordinary Least Squares

ROA – Return on Assets

ROE - Return on Equity

SEC – Securities and Exchange Commission

SIC code - Standard Industrial Classification Code

SOX – Sarbanes-Oxley Act (Public Company Accounting Reform and Investor Protection Act) of 2002

S&P - Standard Poor's

TARP – Troubled Asset Relief Program

TBTF – too-big-to-fail

Tobin's Q - Market to book ratio of assets

Vega - Sensitivity of CEO wealth to a 1% change in stock price volatility

VIF – Variance Inflation Factor

WRDS – Wharton Research Data Services

$ - US dollar

3 Introduction

3.1 Motivation

In 2008, the CEO of Citigroup Vikram Pandit received a remuneration package worth $38.2 M. This generous pay package followed five consecutive quarters of multibillion-dollar losses and a $45 billion injection from the government through the Troubled Asset Relief Program (TARP) to Citigroup (The New York Times, 2009a). At first sight, the compensation package seems outrageous and unjust. However, by examining the structure of the pay package, it is evident that a substantial part of Mr. Pandit's compensation consisted of stock and option awards. Following a substantial drop in the Citigroup stock price after the financial crisis, these equity-based incentives lost 95% of their value, decreasing from a value of $37.3 M when granted in 2008 down to a mere $1.67 M in 2009 (MarketWatch, 2009). On the surface, the compensation of Mr. Pandit seems like a classic example of excessive pay in the financial industry. However, it also reveals an interesting aspect of executive remuneration, namely that the composition of pay significantly affects the total value of CEO compensation. In this, only salary is fixed, whereas other components vary greatly with company performance and external factors.

This thesis looks further into such particular dynamics of executive compensation by investigating industry differences in executive pay in financial firms relative to non-financial firms in the US in the period 2007-2016.

The chosen research topic is highly relevant because of the increased awareness of executive compensation as an essential governance mechanism in the past few decades. The motivation for our research is fueled by four factors which we believe make the thesis relevant. First, the amount of political attention directed towards the financial sector has increased. In the most recent election, both US presidential candidates lashed out at CEO compensation levels (The Economist, 2016). The current president Donald Trump called CEO pay "a total and complete joke", while runner-up Hillary Clinton raged over the extreme CEO to average employee pay ratio (Edmans, 2016). In the UK, prime minister Theresa May used cuts in executive pay as a central matter in her campaign.

Second, the financial crisis fueled public debate and significant media attention on executive compensation (Deloitte US, 2018). Notably, executive compensation in the financial industry is seen as a contributing factor to the outbreak of the crisis. The critique towards financial institutions includes excessive risk-taking, weak governance structures and absurd pay levels, as reflected in the initial example.

For us, the significant attention on the topic triggered an interest in the dynamics of executive compensation in the financial industry and whether the critique it has received is justified. Thereof came the desire to see how it compared to executive compensation in the relatively less criticized non-financial industry. As we dug deeper into the topic, we became aware that the public debate was and is poisoned with noise. Media tend to focus on the sensational aspects of the story, which often leads to misleading depictions of the truth. For instance, as the initial example shows, equity incentives constitute a large part of many executives' compensation packages. Thus, company performance and external factors can significantly impact the total level of pay. If such elements are disregarded, compensation can be severely over- or understated (Hall and Liebmann, 1998).

Third, the magnitude of regulatory initiatives within the financial industry and on executive compensation in the past decade emphasizes the relevance of this study. The initiatives include government bailouts of "too-big-to-fail" (TBTF) banks through the Troubled Asset Relief Program of 2008 (TARP), as well as the implementation of the American Recovery and Reinvestment Act of 2009 (ARRA) and the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (DFA). These advancements of regulation have most likely changed the dynamics of compensation within and across industries.

Lastly, the financial industry in the US is interesting for several reasons. Most importantly, the industry plays a critical role in the national and global economy. Also, the US has a special regulatory framework that emphasizes the protection of shareholders and requires that firms are transparent in their disclosure of information on finances and compensation contracts (Core et al., 2003). Moreover, US firms seem to have a stronger focus on pay for performance relative to several European countries, which focus more on putting caps on compensation (The New York Times, 2013). Finally, recent regulations on executive compensation introduced in the US appear to have inspired subsequent regulations worldwide (Adams, 2012). For example, following the Sarbanes-Oxley Act of 2002 (SOX), significantly more countries instituted similar governance reforms than in the preceding 10 years (ibid.).

3.1.1 Contribution to literature

With this thesis, we hope to contribute to the theoretical understanding of executive compensation by filling some of the gaps in literature identified in our preliminary review of existing research. Most studies either exclude financial firms due to their distinctive characteristics or focus on banks or the financial industry alone. Therefore, there is little evidence on compensation in the financial industry relative to other industries. The scarce amount of literature that does include comparisons tend to study the financial industry in relation to only one other industry. Also, literature tends to generalize findings on executive compensation for all non-financial industries. We will examine how CEO compensation in the excluded financial firms compare to these. Most research on the effect of regulation focuses on deregulation following the Gramm-Leach-Bliley Act of 1999 (GLBA) (e.g. Bai and Elyasiani, 2012; Chen et al., 2006; DeYoung et al., 2013). Moreover, studies examining changes in compensation after the financial crisis only cover a few years after its outbreak (Acrey et al., 2010; Conyon, 2013; Jaggia and Thosar, 2017; Sonenshine et al., 2016). Therefore, we will focus on the effects of the DFA and expand the time horizon forward as it is our understanding that it takes several years for the full impact of a regulation to appear.

3.2 Research question

Accordingly, the purpose of this thesis is to shed light on the differences in executive remuneration between financial firm CEOs and non-financial firm CEOs. We are specifically interested in investigating the differences in level and structure as well as differences in pay-performance and pay-risk sensitivities. Additionally, we will examine the effects of the DFA and analyze how it has impacted executive compensation in financial industries relative to that in non-financial industries as well as the differences between them. The overall goal is to contribute to an understanding of the dynamics of executive compensation in the financial industry relative to the non-financial industry and particularly following a significant regulation such as the DFA. Based on our motivational background and initial screening of existing literature within the field of executive compensation, we narrow the focus of this thesis down to the following research question:

> *To what extent does US executive compensation differ in the financial industry compared to the non-financial industry in the period 2007-2016? And how has*

the Dodd-Frank Act of 2010 affected such differences?

To answer the above research question, we will answer three sub-questions:

1. Does compensation of financial firm CEOs differ from that of non-financial firm CEOs in terms of pay level and structure?
2. Do pay-performance sensitivity (delta) and pay-risk sensitivity (vega) in CEO compensation differ between financial and non-financial firms?
3. To what extent has the Dodd-Frank Act affected executive compensation? And has it affected the differences in executive compensation between CEOs of financial and non-financial firms?

To get a more nuanced view on the dynamics of executive pay in the financial industry, we extend our analysis to differences within the industry. Specifically, we examine potential differences between commercial banks and non-commercial bank financial institutions (from now on "non-bank financial firms/institutions") as some of the main characteristics of financial firms are even more distinguished in banks.

3.3 Structure of the thesis

In order to examine the research question, the thesis will be structured into five main parts. The first three parts introduce our general research approach and describe the theoretical background and framework for our study. The remaining two parts cover our analysis, concluding remarks and suggestions for future research. An elaborate overview can be seen in figure 1.

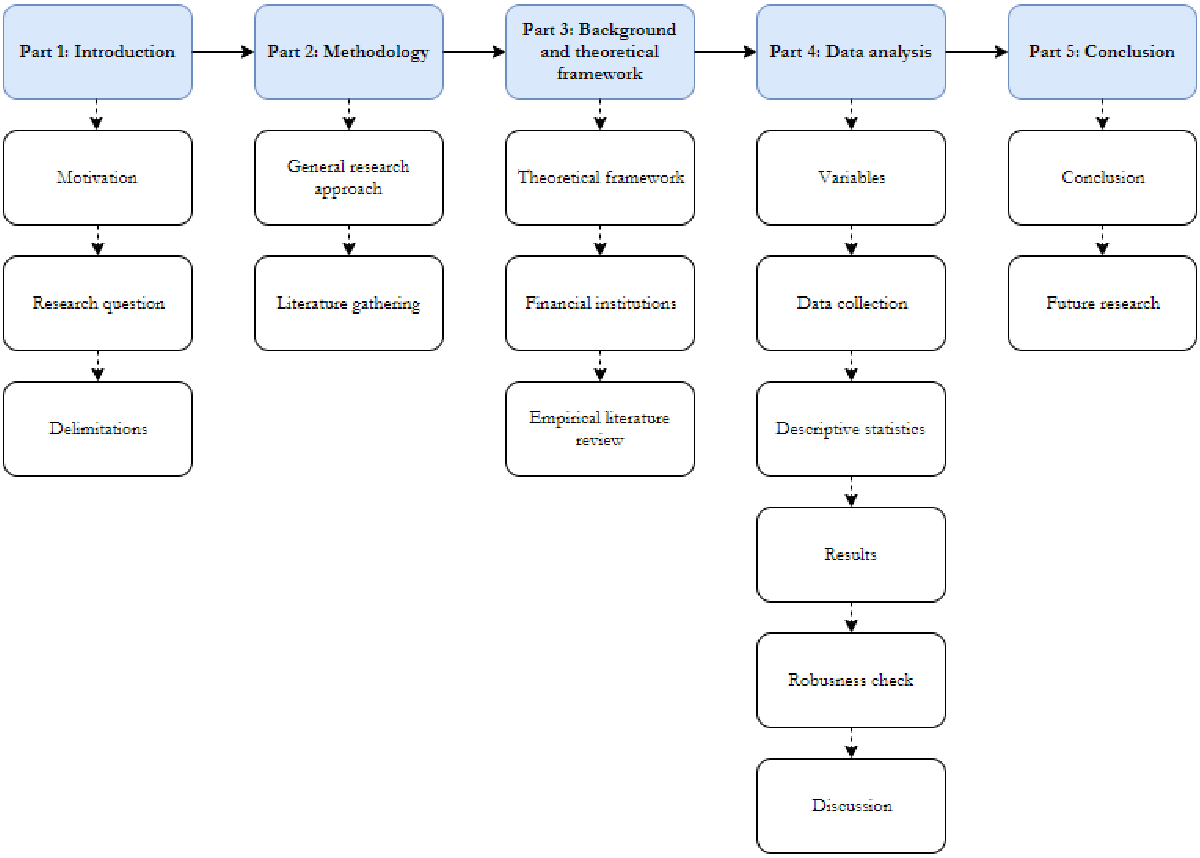


Figure 1: Thesis structure

3.4 Delimitation

In this study, we have found it necessary to make some limitations. Due to constraints imposed on the research by Copenhagen Business School, the size of the study is an evident limitation. Additionally, there is a limit on the time and resources from the authors' perspective.

3.4.1 Data availability

Further, lack of data availability represents a significant limitation. To run regressions on a full, balanced sample, we would need data on each firm for all relevant parameters and all years in our sample period. For several firms and parameters, some data and information could not be obtained. This has immediate consequences for our regressions in terms of an unbalanced panel. We have chosen not to correct for this as we believe that the disadvantages of losing a substantial number of observations in our dataset outweigh the advantages of maintaining a balanced sample. The potential pitfalls related to an unbalanced sample are elaborated under section 9.2 on statistical considerations.

3.4.2 Geographic scope

This study will focus on US firms due to the high relevance and influence of US regulations on the regulations in other countries, as mentioned in the motivation. Thus, we can only make inferences regarding US firms. However, in line with Core et al. (2003), we believe that parts of the rationales and findings from our discussion can be used to evaluate the dynamics of executive pay in other countries.

3.4.3 Industries

The study distinguishes between financial and non-financial institutions in order to examine differences in executive compensation across these industries. Within the financial industry and non-financial industries, various sub-sectors or industries can exhibit different characteristics. Thus, our results only extend to the average financial or non-financial firm CEO, but not any specific firm or particular non-financial industry.

3.4.4 Publicly listed firms

Given the information requirements for this study, we have chosen to consider only publicly listed firms in the S&P 1500. This is because we use the stock price in our calculation of stock returns, vega and delta. Further, we use the market capitalization for determining leverage and Tobin's Q. Estimating the market value of non-listed firms can be a quite comprehensive process. The estimated value will also likely soon be outdated, as it does not continuously incorporate market and firm-specific changes in the same manner as stock prices of listed firms. The calculated market value will also differ depending on the individual estimating it. The S&P 1500 criteria limits the study to larger firms. This is reflected in the minimum value of revenue in our sample of $100 M. Accordingly, we can only infer something about large, publicly listed firms.

3.4.5 The CEO

In executive compensation literature it is common to focus either on the remuneration of the CEO exclusively, a selected group of executives, the entire executive board or the board of directors. We focus this analysis on the CEO specifically since theoretical agency models suggest that the CEO is the key decision maker and other executives are reporting to them (Conyon and He, 2016). Also, CEOs are among those who have received the most critique for their compensation packages. Therefore, we will use the terms "CEO" and "executive" interchangeably. However, as the compensation committee typically sets the incentives and remuneration for the entire group of executives and not only the CEO, our study may be used to analyze some of the dynamics of top executive compensation in general.

3.4.6 Compensation components

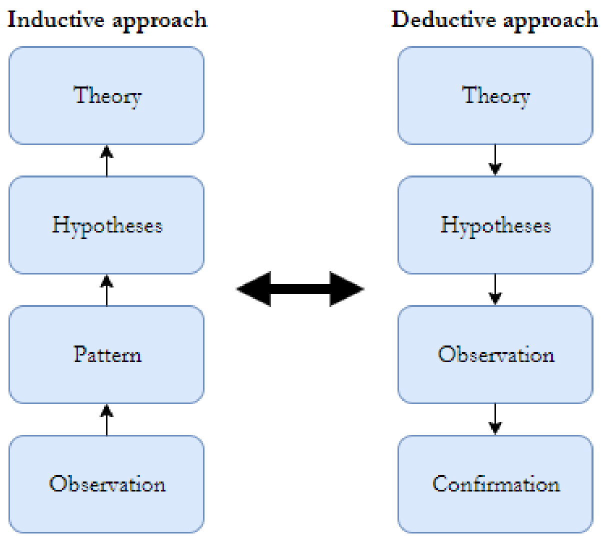
In this thesis, we focus on the compensation components salary, bonus, options, stock as well as the total pay level. However, it is common practice to also include non-equity incentive plans, pension plans, perquisites and severance pay in the executive compensation package. Due to a severe lack of data on these parameters, it is not within the scope of this paper to get an adequate overview of these features across our entire sample. However, in line with literature these parameters are included in the measure for total CEO pay.

4 Methodology

4.1 General research approach

Before conducting any type of research, it is important to consider what relationship to apply between theory and research (Bryman and Bell, 2015). Commonly, this is the choice between the inductive and deductive method.

The main difference between the two is the role of theory in the research process. The deductive approach is the most common perspective on the relationship between theory and research (ibid.). The researcher bases himself on existing theory and knowledge from which he develops a hypothesis that can be either confirmed or rejected. Inductive theory, on the other hand, takes a starting point in particular observations and the researcher aims at adding to, or creating, theories and generalizations (Flick, 2006).



Source: Flick, 2006

Figure 2: Inductive vs deductive approach

In choosing between the two approaches, one should consider several factors. One factor is the nature of the phenomenon being studied as any research methodology must be consistent with the research question at hand. Another factor is that individual research fields tend to follow a set of acknowledged research methods. As such, it is necessary to examine the general literature on the topic to determine the best research approach.

In our study, we apply the deductive approach. There is a number of reasons for this. First, it is the most common practice within the field of executive compensation. The approach makes it possible to quantitatively measure concepts, explain causal relationships between concepts of interest and to a certain extent generalize research findings (Bryman and Bell, 2015). Second, our objective is to contribute to existing theories, rather than develop new theories. Finally, the research approach is optimal in relation to the resources available. The scope of a master's thesis significantly limits the time available to perform the study. Also, there is a great availability and quality of existing data from the Wharton Research Data Services (WRDS) database. Lastly, we can base our study on a substantial amount of existing research on executive compensation.

Accordingly, we will follow the process as defined by Bryman and Bell (2015):

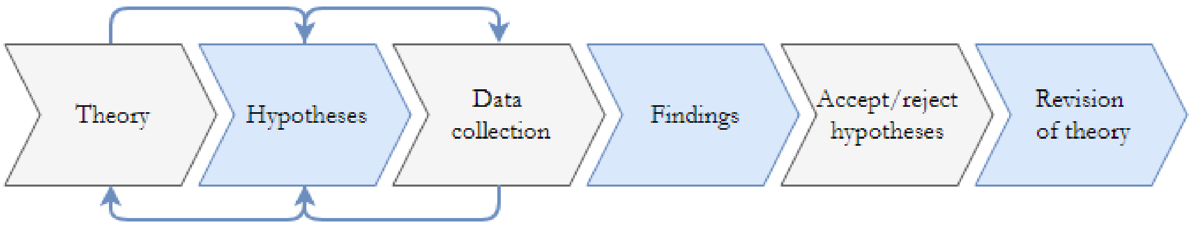


Figure 3: Deductive approach

Our research process follows an iterative approach rather than a linear sequence. The reason for this is mainly that new insights are continuously added throughout the literature review and configuration of our hypotheses. Also, limitations in the data collection force us to take a step back and revise our study design on a regular basis. The steps in the process are elaborated in the following sections.

4.1.1 Theory

We begin our research with a thorough investigation of existing literature on executive compensation. We start by defining agency costs to understand the need for compensation and how it is determined. Next, we narrow our focus to the financial industry. Here, we examine what distinguishes financial and non-financial firms and take a more in-depth look at the relevant regulations affecting the operational environment of financial firms. Finally, we describe the characteristics and determinants of key compensation components. In this section, we also elaborate on existing links described in literature on executive compensation across financial and non-industries. Accordingly, the theoretical section works as a guide to interesting statistical relationships as well as relevant variables and measures for our data analysis.

4.1.2 Hypotheses

Basing ourselves on the theoretical framework and the empirical results of previous studies in the field, we develop our hypotheses. In total, we present four main hypotheses to answer our research question. The first two hypotheses attempt to contrast the CEO compensation level and structure of financial firms with non-financial firms. The third hypothesis addresses differences in the delta and vega of CEO compensation. Lastly, our fourth hypothesis investigates the effect of the DFA on the sensitivity of CEO pay for performance and risk. Also, it examines how regulation affects the differences in pay-performance and pay-risk sensitivities between CEOs of financial and non-financial firms.

4.1.3 Data collection

The approach to data collection is elaborated in the section on data collection and methods 9.1.

4.1.4 Findings and hypothesis testing

Our results derive from a thorough analysis of the collected data. First, we look at descriptive statistics of the level and structure of CEO compensation in financial firms and how they compare to that of non-financial firm CEOs. After that, we run pooled ordinary least squares (OLS) regressions to test our hypotheses. All regressions are performed in RStudio - the codes are available from the authors upon request. Also, our models are checked and adjusted for statistical issues in line with Stock and Watson (2012) and Gujarati and Porter (2009). These issues are elaborated in section 9.2.

4.1.5 Revision of theory

Depending on our results, our hypotheses will either be confirmed, partly accepted or rejected and thus either reinforce or challenge existing research on the topic. If our results conflict with the existing research on which we build our hypotheses, this will naturally fuel a discussion. In the discussion, we will highlight key findings and opposing results as well as provide possible explanations and implications for the results.

4.2 Literature gathering

As a part of the deductive research approach, the literature review lays the foundation for our thesis. The review has a dual function in that it works as the primary source of inspiration for the selected approach and a foundation for the hypotheses development. The literature review does not cover the entire range of perspectives within the field of executive compensation but instead focuses on the most relevant and acknowledged studies. In our search for the most relevant and respected studies, we have scanned a great variety of academic research. We have used the databases Business Source Complete, Scopus, Copenhagen Business School's Libsearch and Google Scholar to search for articles relating to executive compensation, pay for performance and pay for risk sensitivities, agency problems, financial institutions, etc. Based on these results, key articles were chosen and these were examined in greater detail. Specifically, the references of key studies function as a guide to find the other relevant articles within the field. We see that two studies in particular (Conyon and He, 2016; DeYoung et al., 2013) are of interest as they examine dynamics somewhat comparable to ours. They are therefore key in our search criteria and function as a starting point for our study.

The approach to the literature gathering has resulted in an extensive overview of existing literature – recent as well as more mature. Based on this, we arrange research in terms of relevance for our study. In this way, we include only the most relevant and respected studies both in terms of theoretical foundations and empirical results.

5 Theoretical analysis of executive compensation

As a part of the outcome of this extensive literature gathering, the following section will review the theoretical foundations of the agency problem in general and in financial firms specifically. Next, recent trends within executive compensation will be examined and finally we will highlight some basic theoretical explanations for how pay is determined. The aim is to provide an understanding of the need for and the drivers behind executive compensation.

5.1 General introduction of the agency problem

In order to understand the conflicts that exist among managers, shareholders and depositors, it is relevant to examine the agency problem and the agency costs of equity and debt that follow. After this, we will elaborate on how agency costs of debt are different in financial firms.

5.1.1 Agency costs of equity

The principal-agent problem is the standard economic model for understanding executive compensation and incentives (Conyon and He, 2016; Holmstrom, 1979; Murphy, 1999). The agency relationship is defined by Jensen and Meckling (1976) as "a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision-making authority to the agent" (p. 308). Thus, agency costs can arise in any situation involving effort from more than one person.

In a business setting, the agency problem of equity arises when a manager (the agent) owns less than 100 percent of the residual claims on the firm (ibid.). Agency costs will then be generated by the divergence of interests between the manager and the outside shareholders (the principals) as the manager will only bear a fraction of the costs of any benefits he takes out to maximize his own utility. As the manager's fraction of equity ownership decreases, the agency costs of equity increase (ibid.).

The principal-agent problem is a typical characteristic of public ownership, which has a large degree of separation of ownership and control (as defined by Berle and Means in 1932). In most modern corporations, the shareholder (the principal) bears the residual risk but delegates some of the control rights to the CEO (the agent), who runs the day-to-day operations on behalf of the shareholders. The principal-agent problem arises from information asymmetry between the shareholders and the CEO. Due to bounded rationality, the shareholders cannot specify in a contract each action the executive should take in every single scenario to maximize shareholder value (Core et al., 2003). These challenges, combined with the non-observable actions of the CEO, expose the shareholder to moral hazard. Moral hazard occurs when the CEO uses his information on the firm to his advantage and behaves inappropriately on behalf of the less informed shareholder.

Specifically, according to the principal-agent model, the CEO may have goals and objectives that conflict with those of shareholders. The diverging interests may allow the CEO to take advantage of his greater knowledge to indulge himself at the shareholders' expense (Oreilly and Main, 2007). Such indulgences include agency costs like diverting profits from shareholders to his own pay through consumption of leisure or perquisites, a preference for low risk projects and activities, empire building (Bebchuk and Fried, 2004; Harjoto and Mullineaux, 2003), failing to take actions that might benefit the shareholders because of personal loss (Oreilly and Main, 2007) or failing to distribute excess cash when the firm does not have profitable investment opportunities (Bebchuk and Fried, 2004). The results are that the firm value will be substantially lower than otherwise (Jensen and Meckling, 1976).

5.1.2 Agency costs of debt

Most firms are partly financed by debt and therefore also have debtholders as principals in addition to equity holders (Bryan et al., 2006; Jensen and Meckling, 1976; Macey and O'Hara, 2003). As a consequence, it is not sufficient to consider agency costs of equity - agency costs of debt must also be evaluated (Conyon and He, 2016; Jensen and Meckling, 1976). They arise when bondholders have different interests than shareholders.

According to Jensen and Meckling (1976) there are three main agency costs of debt:

1. Incentive costs
2. Monitoring costs
3. Bankruptcy costs

First, incentive costs cover the opportunity wealth loss caused by the impact of debt on the investment decision of the firm. High levels of leverage cause risk-shifting agency problems (Jensen and Meckling, 1976; John et al., 2010; Qian and John, 2003). Risk-shifting incentives exist when risky debt is outstanding, giving equity a convex payoff structure such that shareholders gain by shifting into higher risk projects even when the incremental net present value (NPV) is negative (John and John, 1993). This means that shareholders may prefer a risky investment with a negative NPV since they capture most of the gains from the risky projects while depositors and deposit insurers bear the downside risk (Jensen and Meckling, 1967). However, the excessive risk-taking is alleviated by the fact that managers are more risk-averse than shareholders and the fact that managers have invested their non-diversifiable human capital in their jobs (Macey and O'Hara, 2003).

Second, the above-mentioned incentive costs engender monitoring costs, i.e. costs associated with debt covenants (Jensen and Meckling, 1976). Bondholders use covenants in indenture provisions to prevent the manager from taking actions which can decrease the bond value. Such covenants include restrictions on dividends, future debt issues and maintenance of working capital. However, similar to the principal-agent problem, creditors cannot specify the preferred managerial action in every possible scenario without taking over the monitoring role. Additionally, they cannot perfectly monitor the actions of stockholders and ensure that they do not increase risk (Chen et al., 2006). Therefore, the bondholders will have incentives to write and enforce such covenants up to the point where the "nominal" marginal cost of such activities just equals the marginal benefits they think they get from performing them. The costs are defined as "nominal" as the bondholders do not actually bear these costs but take them into account when deciding the price they will pay for a debt claim. Thus, the owner (seller of the claim) bears the costs (Jensen and Meckling, 1976).

Finally, bankruptcy costs cover the expenses used to write contracts representing claims and priority of claims on the firm in case of bankruptcy (ibid.). In such a situation, shareholders lose all claims on the firm. The loss equal to the difference between the face value of fixed claims and the market value is born by the debtholders.

Agency costs of debt in financial firms

As this study examines financial firms in particular, it is relevant to consider how agency costs of debt affect these differently than non-financial firms. Financial firms specifically have a number of investors which are unique to that industry. They include among others holders of irredeemable bonds or debentures, depositors and current account holders (Handley-Schachler et al., 2007). All three are usually unsecured creditors of a financial services firm and have a contractual right to interests and in most cases a loan repayment on a specified date. The highly leveraged condition and mismatch in assets and liabilities of many financial firms (further elaborated in section 6.2.3) make fiduciary duties properly extend beyond shareholders to other groups (ibid.). Additionally, financial firms - and banks in particular – have regulators as claimants in their role as deposit insurers and lenders of last resort (Macey and O'Hara, 2003).

Agency costs of debt are especially severe in financial institutions due to their high leverage ratio (ibid.). As financial firms are financed by substantial amounts of debt type claims, the shareholder will have even stronger incentives to pursue risky negative-NPV investments (Jensen and Meckling, 1976).

Banks in particular are different in that their debtholders exert less discipline over them as the Federal Deposit Insurance Corporation's (FDIC) insurance removes some of the incentives to implement restrictions on risk-taking. Thus, government regulators function as the main monitors of banks instead of public sector creditors.

5.2 The role of incentives in mitigating the agency problem

5.2.1 Alleviating agency costs of equity

According to Core et al. (2003), corporate governance is defined as "the set of complementary mechanisms that help align the actions and choices of managers with the interests of shareholders" (p.27). For instance Core et al. (1999) find that US firms with weaker governance mechanisms have greater agency problems, highlighting the importance of governance mechanisms. These can take the form of e.g. monitoring actions by the board or institutional blockholders used to align the interests between themselves and the agent. As the principals realize that the manager's interests will diverge from their own, the price they want to pay for the shares will reflect the monitoring costs and the effect of divergence between manager and shareholder interests (Jensen and Meckling, 1976).

In standard agency theory compensation packages linking managerial rewards to investment (or firm) performance are seen as a key mechanism to align interests (Oreilly and Main, 2007). Shareholders or their representatives use grants of stock and options as a tool to align the interests of shareholders and managers by tying CEO pay for firm performance and consequently maximize shareholder value. Therefore, the principal-agent theory is seen as a justification for pay for performance where the CEO is rewarded through a compensation contract with equity as a way of linking increased compensation to increased performance (Macey and O'Hara, 2003; Oreilly and Main, 2007). The key question in designing the CEO pay is how to set their incentives. In this regard, Holmstrom (1979) discusses the first best contract. The first best solution entails optimal risk sharing and can be used to guarantee that the agent selects a proper action or is perfectly penalized for dysfunctional behavior (ibid.). This contract could be used if firms could directly observe the firm's opportunities and the manager's actions and know beforehand which actions would maximize shareholder wealth in every scenario (Core et al., 2003).

In reality, complete observation of the agent's actions is either impossible or extremely costly (Holmstrom, 1979). The principal must delegate many of the action choices to agents who have superior information. In such situations, where only the payoff is observable, it is not possible to link the rewards directly to managerial effort but only to a proxy for such effort (ibid.). Therefore, the optimal contracts will be second-best contracts. This implies that the principal will use imperfect estimators of the agent's effort, thereby linking executive compensation to firm performance (ibid.).

The use of second-best contracts and imperfect measures of CEO effort imposes compensation risk on the executive (Core et al., 2003). By linking his wealth to firm performance, factors that the CEO cannot affect might influence his pay substantially. This implies that the CEO might be induced to take actions that reduce the riskiness of firm operations. This problem can, however, be addressed through compensation. As shown by Coles et al. (2006), shareholders can align the risk preferences between the CEO and the shareholders by designing the right incentives.

5.2.2 Alleviating agency costs of debt

In highly leveraged firms such as financial firms where creditors are the primary claimholders, the objective of incentives is not only to align interests of top management closely with those of equity holders. As a matter of fact, CEO compensation in the form of equity which promotes shareholder value and interests can accentuate agency costs of debt (John and John, 1993). Such a situation is also unfavorable to shareholders as debtholders may impose additional covenants or charge higher rates in contexts where they expect debtholder wealth expropriation.

Incentives should therefore also be adjusted to encourage acting on behalf of debtholders (Qian and John, 2003). The reason is that shareholders and debtholders may have quite different preferences. Where shareholders prefer volatility and have short-term incentives, debtholders and regulators prefer lower-volatility investments and have longer-term perspectives due to the risk-shifting incentives mentioned above. If the compensation structure is less aligned with shareholders' interests (such that there is a lower focus on shareholder value maximization) and rewards are tied to e.g. stability and size of total cash flows in line with debtholder interests, the agency costs of debt will be reduced (John and John, 1993).

Thus, when designing compensation schemes in financial firms, the compensation committee is forced to balance agency costs of equity and debt.

5.3 The key facts about how the pay looks in the US

In order to see whether the theoretical arguments are in line with the empirical facts, we will now explore the overall trends and developments in executive pay. This is relevant in order to understand the historical background and be able to form predictions on the dynamics of compensation in our sample.

Historically, the overall level of CEO pay was growing at a modest rate from the 1940s to the mid-1970s (Frydman and Saks, 2010). Subsequently, the growth of CEO pay accelerated up until 2001 with annual rates reaching more than 10 percent (ibid.). From then, overall levels have continued to grow but at a lower rate (Conyon, 2013). The overall increase is partly fueled by an upward bias where boards are incentivized to pay CEOs at or above the average to signal above average ambitions to CEO candidates and investors (The Economist, 2016). This produces a ratchet effect where firms constantly increase the benchmark against which they measure themselves.

Additionally, the overall increase in CEO pay differs depending on the specific context. First, CEO pay has especially increased in larger firms indicating that the premium for managing larger firms has increased (Frydman and Jenter, 2010). For CEOs of S&P 500 firms, the median level of pay climbed from \$2.3 M in 1992 to a peak of \$7.2 M in 2001 (ibid.) - and in recent years, the median CEO pay has increased slightly from \$8.9 M in 2011 to \$10.4 M in 2015 (Meridian, 2016). Core and Guay (2010) and Lord and Saito (2010) find a similar trend. Second, Conyon and He (2016) find that total compensation differs between industries. In the 1990s and early 2000s, CEOs of financial firms received a higher total compensation than other CEOs. Contrarily, in the past decade the tables have turned (Conyon and He, 2016; Core and Guay, 2010). In terms of structure, Lord and Saito (2010) find that at the outset of the financial crisis, financial firm CEOs had the largest equity holdings as they had the most valuable stock portfolios while their option holdings were on par with managers in other industries.

The structure of executive pay has changed dramatically in the past years. Before the 1950s, compensation consisted primarily of salaries and annual bonuses, whereas long-term incentive plans only began to play a role in executive remuneration from the 1960s

(Frydman and Saks, 2010). In the 1980s, the surge in stock option compensation started which further fueled the growth in total pay (Lord and Saito, 2010). However, after the stock market decline in 2000-2001, restricted stock grants replaced stock options as the most popular equity-based compensation type (Frydman and Jenter, 2010; Lord and Saito, 2010). Overall equity compensation has decreased from 56 percent in 2000 to 52 percent in 2008 (Frydman and Saks, 2010). In recent years, the changes to salary and bonuses have been minimal with levels around $1 M and $2 M respectively (Meridian, 2016). Performance-based awards are the most prevalent form of compensation with over 70% of companies across sectors using this compensation type (ibid.). Stock grants have returned as the main component of CEO pay with levels rising from $3.3 M in 2011 to $5.1 M in 2015 (ibid.). This increase is partly due to a change in accounting rules for expensing equity in 2006 and the push to align executives with shareholders through equity ownership (ibid.).

5.4 Theoretical explanations for how pay is determined

Following the section on the development of compensation, the question of what drives these changes still remains unanswered. To understand this, it is necessary to comprehend how pay is determined. A number of theoretical explanations have been proposed in literature with regards to the observed trends in the size and structure of executive pay. At one end of the spectrum, CEO pay is viewed as a result of the manager's ability to set his own pay and extract rents from the firm (i.e. the managerial power theory). At the other end of the spectrum, executive compensation is seen as the efficient outcome of a labor market in which firms optimally compete for managerial talent (i.e. the optimal contracting theory) (Frydman and Jenter, 2010).

5.4.1 Managerial power theory

The managerial power theory claims that high levels of CEO compensation are a result of powerful managers extracting rents from firms and setting their own pay (ibid.). Thus, CEO pay is viewed as a result of the manager's ability to extract rents from the firm. In this view, executive compensation is seen not only as a potential instrument for addressing the agency problem but as a part of the agency problem itself. Some features of compensation packages seem to reflect managerial rent-seeking rather than providing efficient incentives (Bebchuk and Fried, 2004). Managerial influence on pay can impose substantial costs on shareholders – beyond the excessive compensation itself – by diluting and distorting manager incentives and thereby negatively impacting firm performance (ibid.). As a result, contracts are not chosen by the board to maximize shareholder value, but by executives to maximize rents (Edmans and Gabaix, 2016). Therefore, managers obtain compensation packages that are much more favorable than those they could obtain by bargaining at arm's length (Bebchuk and Fried, 2004). The managers' possibility to influence their pay is defined by two factors, i.e. 1) outrage costs, which limit the managers' ability to extract high pay due to negative reactions from stakeholders and 2) the possibility of camouflaging rent extraction, which enhances the managers' ability to raise their own pay (ibid.).

Besides the increase in the executive pay, the managerial power theory can also explain the growth in the use of options. It is indeed easier for executives to extract rent from shareholders in the form of option remuneration, as it is harder for the shareholder to determine the value of such awards (Frydman and Saks, 2010). Accordingly, powerful managers can use their influence to increase the level of options without giving up cash compensation (Bebchuk and Fried, 2004).

5.4.2 Optimal contracting theory

According to the optimal contracting theory, compensation level and structure are seen as the efficient outcome of optimal contracting in a labor market in which firms compete for scarce managerial talent (Frydman and Jenter, 2010).

In this view, larger firms have higher pay levels. Therefore, variation in compensation over time should be positively correlated with increases in aggregate firm size. There are several reasons for this. First, larger firms require more talented managers whose talent is scalable (Edmans and Gabaix, 2016). Second, as the number of potential employers increases, the competition for talented managers raises the equilibrium level of pay (Gabaix and Landier, 2008). Third, because of the scale of operations under CEO control, small increments in CEO talent can imply large increments in firm value and compensation (Himmelberg and Hubbard, 2000). Lastly, moral hazard problems may be more severe in larger firms, resulting in stronger incentives for CEOs as firms grow. The consequence is that these higher-powered incentives have to be accompanied by higher levels of expected pay to compensate managers for the greater risk in their compensation (Frydman and Jenter, 2010).

Bebchuk and Fried (2004) offer several points of critique to the optimal contracting theory. First, they claim that market forces are not strong enough to ensure optimal contracting outcomes. For instance, in the corporate control's market, firms have substantial defense mechanisms against takeovers including substantial premiums and a long bureaucratic takeover process – both leaving managers with a great ability to extract private benefits. Second, they emphasize that substantial empirical evidence against the optimal contracting theory is found. The evidence includes the failure of options to filter out "windfalls" where stock prices rise due to general industry trends unrelated to managerial performance because the compensation contraction contracts are not indexed (Holmstrom, 2005). Also, Bebchuk and Fried (2004) claim that the possibility to unload options and shares weakens managerial incentives or forces firm to give managers new equity to reinforce incentives.

5.4.3 Alternative explanations

A third set of theories explain the rise in CEO pay by a change in the skills being demanded from firm-specific to general managerial skills (Frydman and Jenter, 2016; Frydman and Saks; 2010; Murphy, 2013). This change intensifies the competition for talent as managers can be employed across industries and national borders. Greater mobility has led to an increase in the level of CEO pay as firms compete for the same talent pool (Frydman and Jenter, 2010; Murphy, 2013).

The growth in CEO pay can also be seen as a result of stricter corporate governance and improved monitoring of CEOs by boards and large shareholders. Higher degrees of governance expose managers to higher risk as it involves a higher risk of being laid off. Thus larger firms may have a higher CEO turnover and a stronger link between CEO turnover and firm performance (Frydman and Jenter, 2010)

5.5 Summary of the theoretical analysis on executive compensation

In sum, firms can be exposed to agency costs of equity and debt, with the latter comprising a bigger problem in highly leveraged financial firms. Therefore, compensation committees have to balance the fraction of equity-based incentives when designing remuneration packages. Overall, the level of compensation has increased in the past decades with stock grants as the main driver. The managerial power theory explains the high levels of pay by the managers' ability to extract rents, while the optimal contracting theory argues that pay should optimally be determined by factors such as firm size and the competition for managerial talent.

6 Theoretical analysis of the financial industry and its regulations

Having laid out a solid understanding of executive compensation, the focus of this section is specifically on financial institutions. The aim is to understand how regulations have shaped the business environment for financial firms as well as to elaborate on the distinctive characteristics of financial institutions.

6.1 Regulations in the financial industry

In order to understand the business environment that financial firms operate in, this section provides an overview of the most important regulatory developments for financial firms in the US during the past century. Additionally, we will elaborate on the implications of the DFA to better grasp its effect on executive compensation and on the differences in compensation between financial and non-financial firms.

US regulation of the financial sector reaches back to the Glass-Steagall Act of 1933 (GSA) when a series of bank failures in the 1920s ended in the Wall Street Crash of 1929. These events further initiated new market failures, decreased public confidence and cries for government intervention (Cuaresma, 2002). In order to reduce incentives for banks to engage in risky behavior, the GSA separated commercial banks from investment banks by prohibiting commercial banks to offer investment banking services (Alai, 2010). The separation was driven by a belief that the direct involvement of commercial banks with corporate securities was "detrimental to the stability of the financial system" (Kroszner and Rajan, 1994, p. 810). Also, the lack of separation between lending and underwriting activities allowed banks to engage in speculative investments that arguably were a contributing reason to the stock market crash in 1929 (Cuaresma, 2002). The combination of the two was argued to create significant conflicts of interest and to increase the riskiness of banks and the financial system (Kroszner and Rajan, 1994).

The revoking of the GSA came almost 70 years later with the Gramm-Leach-Bliley Act of 1999 (GLBA), also known as the Financial Services Modernization Act. Its primary objective was to increase the competition of the financial services industry through a statutory framework (Cuaresma, 2002). The removal of certain banking barriers in the market was said to modernize banking, and banks and other financial institutions were now permitted to offer other financial services as part of their normal operations. Such services included insurance underwriting, securities brokerage and investment banking (Conyon and He, 2016). Thus, the enactment of the GLBA meant a significant deregulation of the financial sector.

Three years later, the Sarbanes-Oxley Act of 2002 (SOX) was passed as a reaction to a number of corporate scandals and bankruptcies of renowned companies such as Enron and Worldcom. The objective was to enhance the auditing of public companies in the US by preventing fraudulent accounting and executive misconduct (Coates, 2007; Zhang, 2007). The SOX did this primarily by increasing disclosure requirements. Additionally, as the first legislation to do so, it introduced considerable requirements on corporate governance, e.g. by imposing greater penalties for executive malpractice and dealing with potential conflicts of interest for the executive (Zhang, 2007).

In 2008, the economic crisis in the financial services industry triggered a number of events such as the government bailout of AIG, the freeze of credit markets, the plummeting of the stock markets and the collapse of large and recognized investment houses including among others Lehman Brothers, Merrill Lynch and Bear Sterns (Schneider, 2009). This, together with the fact that financial institutions all over the world had to be bailed out by their governments at the same time as they were paying multi-million dollar year-end bonuses to their executives, resulted in an all-time low investor and consumer confidence and significant negative reactions from the public and their elected representatives. An example of this was provided in the introducing remarks (section 3.1).

Excessive remuneration and poor corporate governance have been pointed to as part of the reasons for the Global Financial Crisis (GFC) in 2008. Kirkpatrick (2009), for instance, argues that corporate governance systems failed because of 1) failure of risk management systems, 2) a lack of consistency between strategy and the monitoring of its implementation, 3) insufficient accounting standards and regulatory requirements and lastly, 4) not being closely related to "the strategy and risk appetite of the company and its longer-term interests" (p. 62). The failure of compensation systems as a reason for the financial crisis was supported by the The Financial Crisis Inquiry Commission (2011), which partly concluded that:

> *"Compensation systems – designed in an environment of cheap money, intense competition, and light regulation – too often rewarded the quick deal, the short-term gain – without proper consideration of long-term consequences. Often, those systems encouraged the big bet – where the payoff on the upside could be huge and the downside limited."*
> Source: The Financial Crisis Inquiry Commission (2011, p. 24)

In the years following the financial crisis, several regulations were passed through, further tightening the grasp on executive compensation. According to DeYoung et al. (2013), direct government interference in the compensation of private firm executives has historically been rare in the US. This, however, changed along with the GFC, when the government implemented TARP as a part of the Emergency Economic Stabilization Act of 2008 (EESA). The $700 billion bailout funds made available by the federal government as part of this program imposed considerable restrictions on the executive compensation of firms who received the package. This also involved a push towards equity-based compensation in order to better align the interests of shareholders and executives. The restrictions included regulations on the timing, form and amount of compensation that could be paid to executives employed by financial and other institutions receiving government assistance under TARP until the bailout loans were repaid (Schneider, 2009). The stated objective was to "align compensation with long-term value creation and financial stability" (Core and Guay, 2010, p. 16).

The American Recovery and Reinvestment Act of 2009 (ARRA), also known as the stimulus bill, further amended the EESA executive compensation requirements. The application of the bill was limited to entities that had received or would receive financial assistance under TARP. It would continue to apply for as long as the entity had outstanding obligations from the financial assistance program provided under TARP (Schneider, 2009).

In 2010, many of the provisions initially reflected in EESA and ARRA were expanded to apply to all public corporations when the DFA was signed by president Obama in July 2010 (Schneider, 2011). The DFA focuses on 1) systemic regulation of the national economy and on fostering international coordination, 2) the creation of a financial stability oversight council in order to eliminate gaps in the current regulatory structure and 3) on increased regulation of financial services in order to protect consumers and investors (ibid.). In terms of executive compensation, some of the main objectives of the DFA were to:

- increase the accountability of managers to shareholders
- close the gap between executive remuneration and actual performance
- decentralize the power related to determining executive remuneration
- inform and empower public shareholders so that they easier can influence the decisions of the corporate directors and executives that they select as their representatives

Source: Dunning, 2010

Some of the provisions from the previous bills passed and that became legislated with the DFA were:

1. "Say on Pay" votes: Non-binding annual shareholder votes on executive compensation plans which allow the shareholders to express an opinion on the CEO pay
2. Compensation committee independence: All members of a covered company's compensation committee must be independent directors
3. "Pay for performance" and internal pay equity: Clear pay for performance disclosure and ratio of CEO annual compensation to median employee annual compensation
4. Incentive compensation reporting for financial institutions.
5. Clawback policy: The recovery of erroneously awarded compensation if performance-pay was based on wrongful measures, such as materially inaccurate statements
6. Disclosure of executive and director hedging: Requires covered companies to disclose whether executives or directors are allowed to purchase financial instruments designed to hedge or offset decreases in market value of the covered company's equity securities granted as compensation or held by the executive or director
7. Disclosure regarding chairman and CEO structure

Source: Conyon and He 2016; Schneider 2011

6.1.1 Implications of the Dodd-Frank Act

The DFA imposed restrictions on the executive compensation of all firms, but even more so on that of financial firms. Therefore, the following provides an overview of implications of the DFA on compensation structures.

"Say on Pay" led to a shift in power structures for a number of stakeholders. The power of proxy advisory firms, such as Institutional Shareholder Services (ISS) and Glass-Lewis, has increased significantly (Larcker et al., 2013). The reason is that many investors – and large asset managers, such as Blackrock or Vanguard – hold large and diverse holdings. Thus, it can be impractical for such investors to thoroughly evaluate all the firms in their portfolio in order to place a well-considered vote in shareholder voting matters. However, it is their fiduciary duty under US law as a steward of their customers' money to vote their shares (ibid.). Accordingly, third party recommendations from proxy advisory firms enhance decision-making on compensation by improving the information flow between issuers and investors (ibid.). Such proxy firms are highly influential and it is proven that a negative ISS recommendation on management proposals can influence 19% of the vote (Cai et al., 2009). The influence of the politics and guidelines from the proxy advisory firms is also evident from the fact that over 70% of managers and directors report that these guidelines influence their compensation programs (The Conference board, NASDAQ and the Stanford Rock Center for Corporate Governance, 2012).

Another implication of the DFA is the increased power of shareholders. Through the "Say on Pay" clause and increased disclosure, public shareholders are more informed and can better influence the decisions of the corporate directors and executives they elect (Dunning, 2010).

6.2 How are financial firms different from non-financial firms?

Distinguishing financial and non-financial firms is a common practice when analyzing firm dynamics such as executive compensation (Ertugrul and Hedge, 2008; Minhat and Dzolkarnaini, 2016; Ortiz-Molina, 2007). This is because financial institutions distinguish themselves from non-financial institutions in three key areas - 1) leverage, 2) regulation and 3) asset-liability mismatches (Conyon and He, 2016). Several studies argue that these main differences give rise to different governance structures in financial firms relative to non-financial firms (Adams, 2012; Conyon and He, 2016). Bai and Elyasiani (2012) argue

that, for banks, the investment opportunity set is more restrictive compared to industrial firms because of deposit insurance, the highly regulated nature of the industry as well as a greater degree of leverage in the banking industry.
Thus, we identify leverage, regulation and the mismatch between assets and liabilities as key differences between the financial and commercial banks compared to the non-financial industry. These concepts will be discussed in the following subsections.

6.2.1 Leverage

The leverage ratio in the financial industry is typically much greater than that of non-financial firms (Conyon and He, 2016). The common practice of excluding financial firms when examining executive compensation is to a large extent due to these differing levels of leverage. Fama and French (1992) argue that "the high leverage that is normal for these firms [financial firms] probably does not have the same meaning as for non-financial firms, where high leverage more likely indicates distress" (p. 429). This can be explained by the fact that leverage in financial firms works as an input to value creation as well as to fulfill their role as producers of liquid financial claims (DeAngelo and Stulz, 2013). Contrarily, leverage merely serves as a means of financing in non-financial institutions. The unique capital structure has a number of implications on the incentives of the firm's executives, which will be elaborated in the section on "Implications for incentives" below (section 6.2.4).

Despite the generally high leverage levels in the financial industry, some sectors within the financial industry exhibit lower leverage levels that are more comparable to the levels of non-financial firms. Typically, these are in the sectors "investment advisers", "insurance agents, brokers and service agents", "patent owners and lessors" and "security and commodity brokers". However, as these sectors only constitute around 14% of our sample of financial firms, we believe that it is reasonable to specify a relatively higher level of leverage for financial firms as a main characteristic of the industry. As such, when we mention leverage effects in the following sections, it is with these considerations in mind.

6.2.2 Regulation

Financial firms have historically been subject to a high degree of regulation as discussed above. This is due to their importance to the wider macroeconomy, as providers of capital, financial liquidity and economic confidence (Adams and Mehran, 2003). The loss of confidence in financial institutions easily implies negative externalities in the economy justifying government intervention.

Several governing bodies have an interest in regulating the environment of financial institutions. For banks, one of these is the FDIC, which insures a large portion of firm debt in the form of deposit contracts (DeYoung et al., 2013). FDIC insurance also carries some implications for the incentives of debtholders, which will be discussed in the section on implications below. Other institutions with incentives to monitor and govern financial institutions in general are, amongst others, the Office of the Comptroller of Currency, the Federal Reserve and the Federal Financial Institutions Examination Council.

As boards of financial firms have pressures to satisfy a higher number of stakeholders in addition to shareholders, regulator and owner interests are likely to diverge (Adams and Mehran, 2003). The higher number of parties with an interest and say in the firm's operations and governance naturally complicates the governance mechanisms of financial institutions. One of the main objectives of regulations is thus to ensure that the interests of other stakeholders are not at the expense of depositors, consumers or monetary and financial stability (Spong, 2000).

6.2.3 Mismatch between assets and liabilities

A key characteristic of financial institutions is the specific structure of their liabilities and balance sheets. For banks, their liabilities are in the form of deposits. These are available to their depositors/creditors on demand. On the other side of the balance sheet, their assets largely take the form of loans with longer maturities (Macey and O'Hara, 2003). This leads to significant mismatches in their assets and liabilities. Thus, banks produce liquidity in financial claims for the economy by holding illiquid assets and issuing liquid liabilities. For insurance companies, these mismatches are an important part of the business model as their liability to pay the insured must be backed by assets. Asset-liability mismatches are also actively used by pension funds and derivative dealers in general. Accordingly, "controlled mismatches" are often a central part of the business model for financial institutions.

6.2.4 Implications for incentives of financial firms

The above-mentioned characteristics of financial firms have a number of implications which are elaborated below.

The leverage levels in financial institutions emphasize the relative importance of debtholders as the primary claimholders in the firm. As elaborated in section 5.1.2, corporate governance should rather than to primarily align executive incentives with equity holders, give their executives incentives to act on behalf of debtholders (Qian and John, 2003). Several studies find that leverage has a significant impact on the structure and level of compensation. High leverage levels can increase the fraction of options (Agarwal and Nagarajan, 1990; Coles et al., 2006) and decrease the fraction of shares (Agarwal and Nagarajan, 1990; Coles et al., 2006; John and John, 1993; John et al., 2010; Minhat and Dzolkarnaini, 2016; Qian and John, 2003). Further, Coles et al. (2006) find that riskier policies, such as higher leverage levels, implies compensation structures with higher vega and lower delta. Similarly, studies find a negative relationship between delta and leverage in general (John and John, 1993) and in banks specifically (John et al., 2010; Minhat and Dzolkarnaini, 2016; Qian and John, 2003).

A key example of the implications of regulations for compensation practices in the financial sector is the repeal of the GSA of 1933 that came with the introduction of the GLBA of 1999. The new act changed the competitive environment in the financial industry. For example, commercial banks had to compete in the labor market for investment bankers, which meant offering remuneration packages similar to those in investment banking (Bai and Elyasiani, 2012). Several studies highlight the effect of deregulation on the structure of executive compensation packages. Chen et al. (2006) discover that the use of stock-option based compensation in banks increases both in absolute terms and relative to total compensation following deregulation. Bai and Elyasiani (2012) and DeYoung et al. (2013) find similar results for the relative importance of options when comparing banks to industrial firms and non-banks respectively.
The increased vega is explained by boards providing their CEOs with the incentives they need to exploit new growth opportunities in new product markets (Crawford et al., 1995; DeYoung et al., 2013; Hubbard and Palia, 1995). Smith and Watts (1992) find that with more growth opportunities, it is harder to monitor managers directly. As such, a higher vega and delta are needed to tie personal wealth to firm performance by increased levels of equity ownership.

Another implication of operating in a highly regulated environment is that regulation and regulatory initiatives might substitute for monitoring and incentivizing managers (Qian and John, 2003; Adams and Mehran, 2003). Thus, it should be considered an important factor when examining compensation and incentive pay in the financial industry. Supporting this, Adams and Mehran (2003) argue that the presence of regulation should affect the design of corporate governance mechanisms and that regulation is likely to affect the structure of executive compensation. Specifically, regulatory bodies such as the Office of the Comptroller of the Currency and the Federal Reserve System monitor financial institutions to ensure systemic stability and protect taxpayer interests. Combined with perceived TBTF-policies, incentives for debtholders to monitor financial firms may be weaker.

Similarly for banks, perceived TBTF-policies and FDIC insurance can decrease the incentives of debtholders to monitor banks (Sierra et al., 2006). Thus, banks can continue to attract liquidity in the form of government-insured deposits despite being nearly insolvent (Macey and O'Hara, 2003). Webb (2008) argues that the overall effect of a lack of monitoring behavior by primary debtholders to a certain extent is outweighed by monitoring incentives of regulators. Furthermore, Adams and Mehran (2003) outline the possibility of regulatory requirements playing a general monitoring role. This could for instance be bank supervision imposed by governing bodies. They also find that fewer institutions hold shares in BHCs (bank holding companies) compared to manufacturing firms and that their percentage shares of equity in BHCs compared to manufacturing firms is smaller. These results are in line with the theory that regulation reduces blockholders' incentives to monitor financial institutions.

The unique structure of the balance sheet in many financial firms makes it critical for them to maintain the confidence of their creditors. This implies that fiduciary duties and responsibilities apply not only to shareholders but to non-shareholder groups as well (Handley-Schlachler et al., 2007). The long-term assets of the financial institutions imply that they depend on the confidence of their clients (depositors/creditors) to be able to run their operations. In order to maintain this trust and satisfy their clients, CEOs may receive less equity incentives to act risky as this increases the incentives of shifting risk towards debtholders.

6.3 Summary of the theoretical analysis of the financial industry and its regulations

In sum, the DFA is the most recent major regulation impacting executive compensation with a focus on more regulation of financial services. Further, it is shown that the most distinctive characteristics of financial firms are the high level of leverage, regulatory scrutiny as well as the specific structure of their balance sheets. These characteristics indicate that executives in financial firms may need less equity-based incentives than non-financial firms. Such characteristics are even more distinguished in commercial banks where regulators, to some degree, take the role and risk on behalf of primary debtholders.

7 Empirical literature review

To examine more in depth how executive compensation differs between financial and non-financial firms, the following section will provide a review of the existing literature on the topic. The aim is to lay out a solid foundation for the subsequent hypotheses development.

In our review of literature, we find only a few studies that compare financial and non-financial firms (e.g. Conyon and He, 2016; Gregg et al., 2012, Jaggia and Thosar, 2017). While this is a part of the motivation behind this study, it has also made it difficult to base our literature review solely on studies comparing compensation in financial and non-financial institutions. The literature on compensation in banks is however more comprehensive. As banks and financial firms share many of the same characteristics (as described in section 6.2), we will also apply relevant studies focusing on the banking industry alone and other comparing banks to non-banks or non-financial industries. These studies will be used to describe differences between the financial and non-financial industry where it makes sense, i.e., where the arguments of the bank studies are based on argumentation that naturally can be extended to financial firms. When we believe the argument only holds for banks, this will be emphasized clearly.

7.1 Theoretical links: Compensation level and structure

The following section examines the potential differences in level and structure of compensation in the financial industry relative to the non-financial industry. Compensation packages can consist of some or all of the following; base salary, annual bonus, stock awards, option awards, insurance, pension benefits and severance pay. The specific level and mix of compensation can be an important mean to incentivize executives or align interests between managers and shareholders (Goergen and Renneboog, 2011; Murphy, 1999). We will cover the compensation components salary, bonus, stock awards and option awards as they are the most relevant to our study.

7.1.1 Cash compensation

Cash compensation consists of fixed compensation (salary) and variable pay (bonus).

Salary The base salary is decided by a compensation committee based on the executive's tasks, seniority, experience and salary of peers (Goergen and Renneboog, 2011).

Several studies find that salary levels tend to be lower in the financial industry relative to non-financial firms (Conyon and He, 2016; Lord and Saito, 2010). However, literature finds mixed evidence on salary levels within the financial industry. Conyon and He (2016) find no significant differences in salary levels between commercial and non-bank financial firms. On the other hand, Tian and Yang (2014) find significant differences in CEO compensation levels, in that CEOs of commercial banks receive more fixed compensation than non-bank financial firms.

For financial firms, one explanation for the lower level of fixed compensation is that financial executives have a lower marginal productivity than executives do in other industries. The differences in the marginal productivity of executives in the financial industry relative to the non-financial industry could derive from the CEO's abilities as well as the nature of the firm's assets, the business model of financial firms and their investment opportunity set (Houston and James, 1995; Jaggia and Thosar, 2017). This is because the asset base consists mainly of financial rather than physical assets and they have a more restrictive investment opportunity set (Bai and Elyasiani, 2012). As discussed in section 6.2 these are part of financial firms' distinctive characteristics.

In terms of structure, Conyon and He (2016) find that salary as a percentage of total pay is higher in the financial industry relative to non-financial industries. They find a similar pattern with respect to a higher salary in commercial banks relative to non-bank financial institutions. Similarly, Core and Guay (2010) show that bank CEOs receive a larger proportion of their total pay in cash relative to non-bank CEOs.

Bonus Annual bonus is usually set based on performance measures and performance standards. A combination of 2-3 performance measures such as earnings per share, net income, earnings before interest and taxes (EBIT) or profit margin is the most common way to determine managerial effort for bonus calculations (FW Cook, 2017). Frydman and Jenter (2010) find that bonuses in the US are typically non-discretionary and tied to one or more firm performance measures.

Conyon and He (2016) find that CEO bonuses in financial institutions compared to non-financial institutions only vary slightly. However, when comparing commercial banks to non-bank financial firms, they find that bonuses in commercial banks are significantly lower. However, a previous study by Conyon (2013) shows that, before the GFC, bonuses of bank CEOs were higher than those of non-bank CEOs. In terms of structure, Conyon and He (2016) find that bonus as a percentage of total pay is higher for CEOs in the financial industry relative to that of CEOs in non-financial industries.

7.1.2 Equity-based incentives

Option awards Option awards give the executive the right, but not the obligation, to buy a firm stock. While the option maturity for executives is usually around 10 years, options tend to be exercisable after 3 years (Goergen and Renneboog, 2011). An important feature of stock options is that they only generate value if the share price increases. So even if they appear valuable on paper, this value only reflects a future possible (but uncertain) payoff. However, when granted, the realizable value of the option is always zero.

Options used for executive compensation include 1) performance-vested options, which the executive can exercise e.g., when a certain stock price is met, 2) purchase options where the executive pays a fraction of the strike price when granted, 3) reload options where additional options are granted upon exercise of previously granted options (ibid.)

or 4) service-vested options, which the CEO can exercise after a certain period of employment within the firm (Meridian, 2011).Stock options are used to address the risk aversion of managers and avoid underinvestment, i.e. when managers do not invest in positive-NPV projects (Berk and DeMarzo, 2017). Thus, stock options are used to incentivize riskier projects that increase shareholder wealth (Goergen and Renneboog, 2011).

Adams and Mehran (2003) argue that the value of stock options in the banking industry is lower due to its low stock-return volatility. As financial firms tend to have lower volatility levels than non-financial firms, this can also be applied to financial firms. They explain that the lower value makes it more difficult for less volatile firms to award a given amount of option compensation to its top executives because the same amount of compensation requires a relatively larger number of options. In terms of structure, Conyon and He (2016) find that options as a percentage of total CEO pay are significantly lower in financial firms compared to non-financial firms. It is also found that following a deregulation, banks respond by employing relatively more stock option-based compensation (Chen et al., 2006).

The use of options has a number of drawbacks. Goergen and Renneboog (2011) find evidence that option backdating where management chooses the grant day of an option ex-post is a substantial problem. Also, Yermack (1997) finds positive abnormal stock returns after option grants – supporting the hypothesis that the returns occur because CEOs delay the disclosure of good news and accelerate the release of bad news prior to stock option award periods.

Stock awards Stock awards used for executive remuneration can either be in the form of unrestricted or restricted stock. Goergen and Renneboog (2011) find that the latter is most common. Restricted stock are shares for which ownership rights are transferred to the executive after he has met certain conditions. As opposed to options, shares have a positive value when granted. In publicly listed firms, shares are valued based on the annual closing share price. The manager's wealth is tied up to the share price and is therefore linked to both upside and downside development in share price.

Conyon and He (2016) find that restricted stock grants as a percentage of total CEO pay are significantly lower in financial firms compared to non-financial firms. Adams (2012) finds that bank CEOs receive less incentive pay in terms of stock awards relative to non-financial CEOs.

Overall equity-based compensation Smith and Watts (1992) show that low-growth industries rely less on equity-based compensation. They argue that these industries should rely relatively more on fixed compensation as opposed to equity-based compensation. One of the arguments provided is that CEOs of low-growth opportunity firms and industries are easier to monitor than those with high-growth opportunities. As financial firms are more regulated, they have fewer growth opportunities indicating a lower level of equity-based compensation.

Houston and James (1995) find a similar relation in commercial banks relative to non-bank financial firms. This is supported by the findings of Adams and Mehran (2003), who find that CEO compensation packages in BHCs rely less on long-term incentive-based compensation, such as stock options and grants, than that of manufacturing firms. Also, Tian and Yang (2014) compare commercial banks and non-bank financial firms and find that non-bank financial firm CEOs have more variation in their components of incentive pay.

Adams and Mehran (2003) argue that the implications of a resolution of a financially distressed condition or insolvency in the banking industry are likely to have important effects on the incentive structures of executives: financial distress in an unregulated environment usually leads to reorganization and the manager being given a chance to turn the company around. This is not the case in the banking industry, where distress usually leads to liquidation and the removal of the incumbent CEO from management. In the unregulated case, the executive is likely to get paid according to his or her compensation contracts, even in bankruptcy. The executive CEO is however likely to lose much of their long-term compensation such as stock options as depositors' claims have seniority over management compensation contracts. Thus, it can be expected that CEOs of banks are likely to demand more cash compensation relative to equity-based compensation.

7.1.3 Total compensation

Total CEO compensation tends to be lower in financial institutions compared to non-financial institutions (Conyon and He, 2016). Murphy (1999) explains that levels of pay are lower in regulated utilities than in industrial firms. As financial firms are subject to stricter regulations, one could infer that financial firms offer lower pay levels relative to less regulated industries. Also, within the financial sector, there are differences. Conyon and He (2016) find evidence of a variation in pay levels and structure between CEOs of banks and non-bank financial firms. Their findings suggest that CEOs of commercial banks receive less compensation relative to CEOs of non-bank financial firms, in line with literature (Adams and Mehran, 2012; Adams, 2012; Core and Guay, 2010). However, DeYoung et al. (2013) find that, in the 1990s and 2000s, CEO total annual compensation at banks is not significantly different from that of non-banks.

7.1.4 Drivers of compensation level and structure

In order to understand what drives the structure and level of compensation and subsequently determine the relevant control variables for our model specification in section 10.3.1, we next look into their most important determinants.

Firm size Generally, literature finds a positive correlation between firm size and level of executive compensation (Bebchuk and Grinstein, 2005; Conyon, 2013; Conyon and He, 2016; Gabaix et al., 2013; Gregg et al., 2012; Harjoto and Mullineaux, 2003; Murphy, 1999; Sierra et al, 2006). Several studies explain that larger firms require more talented managers who require a higher pay. Jensen and Murphy (1990) propose that talented managers have a higher value added to larger firms. Conyon and He (2016) explain this association with the complexity of large organizations. Frydman and Saks (2010) estimate the relationship between firm size and pay to be linear. Further, Harjoto and Mullineaux (2003) argue that reputable senior executives with high managerial capital tend to self-select into careers where their marginal productivity and thus remuneration is high.

In line with this, Frydman and Saks (2010) argue that the importance of firm size for compensation is increasing. They find that from 1936 to 1975 firm size explains 2% of the variation in executive pay compared to 34% from 1976 to 2005.

Performance Literature identifies a positive correlation between performance and growth in CEO pay (Barro and Barro, 1990; Conyon, 2013; Conyon and He, 2016). Murphy (1999) finds that this link between pay and firm performance is driven by the use of stock options and other types of firm equity.

Leverage As elaborated in section 6.2.1, leverage is a key characteristic of financial firms and can, following the arguments in the mentioned section, lead to a higher fraction of option awards, a lower fraction of stock awards, a higher delta and a lower vega.

Investment opportunities Generally, literature finds that more investment opportunities lead to higher pay levels (Harjoto and Mullineaux, 2003; Sierra et al., 2006). The underlying assumption is that boards provide higher compensation for CEOs in contexts where there are potential growth opportunities (Conyon and He, 2016).

Human capital Literature frequently uses age as a proxy for human capital (e.g. Cole and Mehran, 2010; Conyon and He, 2016). Its quadratic effect is significant in both referenced studies, and Cole and Mehran (2010) show that executive pay reaches a maximum at age 55 and then declines. Such findings indicate that older executives are more conservative and risk-averse and thus prefer to leave earnings in the firm. Further, the life-cycle consumption model suggests that older executives require less current income to meet consumption needs.

Risk Firm risk refers to the volatility of stock returns and is seen as a main determinant of executive compensation (Core et al., 1999). For instance, Chen et al. (2006) find that risk impacts compensation structure. Other studies have found that CEO compensation is higher in firms with a greater stock return volatility (Core, 2000; Core et al., 1999; Smith and Watts, 1992). Smith and Watts (1992) explain this dependence in that manager's equilibrium compensation will depend on the risk-aversion of the manager and hence also on firm risk. This assumes that executives are risk-averse with firm-specific human capital and that they therefore cannot diversify their compensation risk completely (as mentioned in section 5.1.2). As such, higher firm risk will increase the risk of CEO compensation and thus increase the manager's equilibrium compensation to compensate for the additional exposure of the CEO to firm volatility.

7.2 Theoretical links: Delta and vega

7.2.1 Delta - pay sensitivity to performance

Pay-performance sensitivity is defined as the change in CEO wealth in response to a 1% change in stock price ("delta") in line with Coles et al. (2006). Higher levels of stock compensation - and to some extent options - increase the level of delta (DeYoung et al., 2013).

In terms of the overall impact of pay-performance sensitivity on compensation, it has been shown that there is a significant, positive correlation between changes in stockholder wealth and the general compensation level (Cooper and Kish, 2014; Qian and John, 2003). Any change in stock price results in direct changes in CEO wealth. Higher levels of delta make the manager more exposed to reductions in stock returns thereby accentuating his risk aversion (Bodolica and Spraggon, 2015). A higher sensitivity of CEO wealth to stock price is seen as a way to align incentives of managers with shareholders (Coles et al., 2006; DeYoung et al., 2013; Jensen and Meckling, 1976). A higher pay-performance sensitivity can imply that managers work harder or more effectively since managers and shareholders share gains and losses (Coles et al., 2006; DeYoung et al., 2013). However, high deltas can also reinforce managerial risk aversion and make managers skip positive-NPV projects that have higher levels of risk (DeYoung et al., 2013). Thus, an optimal contract balances the provision of incentives against exposing risk-averse managers to too much volatility in their pay (Frydman and Jenter, 2010).

There is conflicting evidence on the difference in the CEO pay-performance sensitivity in financial institutions relative to non-financial firms. One part of literature shows that there are no differences in the sensitivity of overall CEO compensation to firm performance in financial firms compared to non-financial firms (Gregg et al., 2012). Oppositely, another branch of studies finds that there are in fact differences in the CEO pay-performance relationship in financial firms relative to non-financial firms. Chen et al. (2006) observe that CEO compensation tend to be less responsive to firm performance in regulated industries than in unregulated industries indicating that CEOs of financial firms, which operate in a regulated environment, should have a lower pay-performance sensitivity. Within the financial industry, Qian and John (2003) find that commercial bank executives have a lower level of delta relative to executives of firms in the manufacturing industry. Similarly, Houston and James (1995) and Core and Guay (2010) find that bank CEOs receive a smaller percentage of their total compensation in the form of options and stock than CEOs of non-banks, indicating a lower delta.

Determinants of delta When examining pay-performance sensitivity, it is relevant to clarify the drivers of the phenomenon in order to decide on the proper control variables for the model specification.

Literature finds several determinants of delta. First, leverage seems to be negatively associated with delta (John and John, 1993; Minhat and Dzolkarnaini, 2016; Qian and John, 2003). Higher levels of leverage imply higher risk-shifting incentives of the manager. Second, higher levels of risk in terms of market risk (DeYoung et al., 2013) and variability in returns (Frydman and Jenter, 2010; Harjoto and Mullineaux, 2003) seem to decrease pay-performance sensitivity. Contrarily, Coles et al. (2006) find that higher stock return volatility increases levels of delta. Third, several studies find that delta decreases in firm size (Frydman and Saks, 2010; Qian and John, 2003), while Gregg et al. (2012) find a stronger pay for performance relationship in larger firms. Fourth, Webb (2008) finds that CEOs in highly monitored environments require a strong link between incentives and bank performance in order to perform optimally. In line with these findings, literature suggests that better growth opportunities are related to a higher pay-performance sensitivity (Core and Guay, 1999; Frydman and Saks, 2010). Finally, DeYoung et al. (2013) also use CEO tenure and vega to control for differences in these two parameters across banking firms when finding the determinants of delta.

7.2.2 Vega - pay sensitivity to volatility

Pay-risk sensitivity is defined as the change in CEO wealth in response to a 0.01 change in stock price volatility ("vega") in line with Coles et al. (2006). Increases in vega are typically linked to larger amounts of stock options in compensation packages (Bodolica and Spraggon, 2015; DeYoung et al., 2013).

Literature proposes that vega has an impact on several parameters. Coles et al. (2006) find that higher levels of vega in non-financial firms lead to investments in riskier assets and a more aggressive debt policy in terms of more R&D investments, fewer investments in plant, property and equipment, more focused investments and higher levels of leverage. Also, higher levels of vega in banks seem to induce riskier policies (Bai and Elyasiani, 2012; DeYoung et al., 2013) Jensen and Meckling (1976) explain the relation between vega and firm risk by the fact that vega rewards stock return volatility. As such, high vegas make risk more valuable to managers and mitigate potential managerial risk aversion (Bodolica and Spraggon, 2015). However, Belkhir and Chazi (2010) argue that there is a concave effect of vega on risk-taking. They find that CEOs limit themselves to a certain level of risk even when they have very high incentives to assume risk (i.e. high vega).

Studies generally find that the level of vega is lower for executives of financial firms relative to executives of non-financial firms (Belkhir and Chazi, 2010; Core and Guay, 2010). First, financial firms are more regulated which limits their growth opportunities. Second, most financial firms are highly leveraged creating a risk-shifting problem. While shareholders are interested in higher levels of equity-based compensation, depositors want the opposite as elaborated in section 5.1.2. Generally, a smaller percentage of total compensation is received in the form of stock and options, likely due to the stronger presence of debtholders in banks firms (Houston and James, 1995; Qian and John, 2003). Due to the high level of leverage in financial firms, this may also hold for financial firms. As discussed in section 6.2.4, following a deregulation vega appears to increase more in banks compared to non-financial firms (Core and Guay, 2010). Also, several studies find higher levels of vega following a deregulation in the financial industry (Bai and Elyasiani, 2012; Crawford et al., 1995; Hubbard and Palia, 1995). The effect of deregulation indicates that interests are becoming more aligned with shareholders by shifting the risk to depositors, bondholders and deposit insurers (Jensen and Meckling, 1976).

Determinants of vega When examining pay-risk sensitivity, it is relevant to clarify the drivers of the phenomenon in order to decide on the proper control variables for the model specification.

Literature finds several determinants of vega. First, size seems to be positively associated with vega - both in banks (Bai and Elyasiani, 2012; Belkhir and Chazi, 2010; DeYoung et al., 2013) and non-banks (Coles et al., 2006). Bai and Elyasiani (2012) argue that managers of the largest banks have the greatest incentives to take risks (i.e. higher vega) because they benefit from increased government guarantees as they can be deemed TBTF. Further, Belkhir and Chazi (2010) argue that larger banks are better diversified and thus have a greater capacity to take on more risk. Second, it is found that vega is positively associated with investment opportunities (Belkhir and Chazi, 2010; Coles et al., 2006; DeYoung et al., 2013; Guay, 1999). If the manager is risk-averse and his compensation is not a convex function of firm value, he may reject risky positive-NPV projects. In order to exploit a larger presence of investment opportunities, the board can increase the convexity of the manager's payoff structure by increasing vega (Belkhir and Chazi, 2010). Third, Belkhir and Chazi (2010) find that banks have a higher vega following a deregulation (with the GLBA of 1999 as a proxy for deregulation). They argue that with increased competition and more investment opportunities, boards reward and incentivize managers to search for profitable investments. Several studies support this finding (Bai and Elyasiani, 2012; DeYoung et al., 2013). On top of this, a number of additional control variables are typically included when examining vega. These are leverage (Bai and Elyasiani, 2012; Belkhir and Chazi, 2010; DeYoung et al., 2013), delta, CEO tenure (DeYoung et al, 2013) and risk in terms of stock return volatility (Bai and Elyasiani, 2012, Coles et al., 2006).

7.2.3 Summary of the empirical literature review

In summary, a large stream of studies argues for significant differences in CEO pay between financial and non-financial firms in terms of level, structure and the sensitivity of pay for performance and risk. Also, there appear to be differences in how the firms react to regulation and deregulation. The suggested differences will be examined further in the following sections.

8 Hypotheses development

Combining the general theories on executive compensation and financial firms, outlined in the previous sections, we next construct a number of testable hypotheses linked to the main research question. These hypotheses are then subject to empirical tests presented in the subsequent sections. The hypotheses focus on the differences between financial and non-financial firms in terms of the overall level and structure of CEO compensation, the level of vega and delta, as well as the effect of the DFA.

8.1 Overall compensation level

The first hypothesis is related to the overall level of compensation. On the one hand, a branch of literature suggests that the CEOs of financial firms may have higher pay levels because of a higher premium. First, a larger firm size implies a higher complexity of firm operations, thus requiring a higher effort from the CEO, for which he needs to be compensated (through higher pay) (Frydman and Jenter, 2010). Moreover, theories on optimal contracting suggest that larger firms require more talented managers with scalable talent to manage complex organizations, and more talented managers need to be paid more (Conyon and He, 2016; Edmans and Gabaix, 2016). Accordingly, several studies show that larger firms on average have higher pay levels (Bebchuk and Grinstein, 2005; Conyon, 2013; Conyon and He, 2016; Gabaix et al., 2013; Gregg et al., 2012; Harjoto and Mullineaux, 2003; Murphy, 1999; Sierra et al., 2006). Second, Edmans and Gabaix (2016) explain that large firms have tighter governance structures, as they for instance are more exposed to the public eye. The tighter governance in turn increases the risk of the CEO being laid off; to compensate for this higher risk, the CEO demands a higher risk premium. Consequently, under the assumption that financial firms are larger and have stricter governance, compared to non-financial firms, the CEOs of financial firms would on average have higher compensation than the CEO of non-financial corporations.

On the other hand, it can be argued that the CEOs of financial firms might actually be paid less than the CEOs of non-financial firms. First, financial institutions, and banks especially, are subject to a high level of regulatory monitoring (Conyon and He, 2016; Mayers and Smith, 1992; Smith and Watts, 1992). According to the managerial power theory, the strict monitoring can decrease CEO power and thus also the room for rent extraction, ultimately lowering pay levels. Further, several articles indicate that regulations may substitute incentives in terms of monitoring (Adams and Mehran, 2003; Qian and John, 2003; Sierra et al., 2006; Webb, 2008). The reason is that managers do not have the same opportunities to exploit shareholder wealth as regulation limits their actions. Second, according to the contracting theory, strict regulations can limit the firm's growth opportunities. As Houston and James (1995) find that firms with more investment opportunities are more difficult to manage and require a higher premium, one could expect that CEOs of firms such as financial institutions with fewer growth opportunities would have lower compensation levels. Accordingly, a stream of studies documents that, indeed, financial firms or banks pay their CEOs less than other firms (Adams, 2010; 2012; Conyon and He, 2016; Core and Guay, 2010).

Comparing these two sets of contradicting arguments, we hypothesize that the CEOs in financial firms are paid less than those in non-financial firms, thus assuming that the negative effect of stricter regulation (through limiting rent extraction and growth opportunities) is stronger than the positive effect of firm size on pay. Indeed, while the effect of regulation applies to all firms in financial industries, not necessarily all financial firms are large or well governed. Consequently, we form the following hypothesis:

> *H1: CEOs of financial firms have a lower level of total compensation relative to CEOs of non-financial firms*

More specifically, the lower level of total compensation is expected to be driven by lower levels of fixed compensation, as found by Conyon and He (2016) in financial firms and by Houston and James (1995) in banks. This is because the CEOs of financial firms, and of banks in particular, have lower marginal productivity than executives in other industries, due to the nature of the firm's assets and investment opportunity set.

Also, we expect that the equity-based incentives of financial firms' CEOs are lower than those of the CEOs of non-financial firms. The lower amount of growth opportunities make financial firms easier to monitor (Smith and Watts, 1992) and this reduces the need for equity-based compensation as argued in section 6.2.4. Accordingly, Adams and Mehran (2003) find that commercial banks rely less on long-term incentive-based compensation, such as options and stock awards, than manufacturing firms. Similar findings are reported by Houston and James (1995). Finally, the lower value of total pay can also be influenced by lower values of shares in the financial industry (as explained in section 7.1.2) or generally lower levels of CEO ownership (Conyon and He, 2016).

8.2 Compensation structure

The second hypothesis is related to the structure of compensation, namely the share of specific incentives in the total CEO compensation. The vast majority of studies indicate that we can expect less equity-based compensation in financial firms relative to non-financial firms.

First, as mentioned in section 5.2, a general solution to the principal-agent problem is to align the interests of the executives with those of shareholders by using equity incentives. However, as depositors are typically the primary claimholders in financial institutions (Smith and Watts, 1992; Qian and John, 2003), agency costs of debt are likely to be of higher relevance than agency costs of equity. High levels of leverage can cause risk-shifting problems. As such, equity incentives link the interests of the CEO closer to the interests of the shareholder and might thus accentuate the agency costs of debt in financial institutions (Jensen and Meckling, 1976; John and John, 1993). Following these arguments, we hypothesize that the compensation of the CEOs in financial firms will contain a smaller share of equity incentives compared to the compensation of CEOs in non-financial firms.

Second, as discussed in section 6.2.2, regulators have stronger incentives to monitor financial firms due to the importance of financial institutions, and banks especially, to the wider economy as providers of capital, financial liquidity and economic confidence (Adams and Mehran, 2003; 2012; Macey and O'Hara, 2003). The presence of regulation, governing bodies (the Office of the Comptroller of Currency, the Federal Reserve and the Federal Financial Institutions Examination Council) and regulatory instruments (such as deposit insurance and perceived TBTF-policies) reduces the monitoring incentives and downside risk of primary debtholders (Macey and O'Hara, 2003; Sierra et al., 2006). This implies that regulators, to some degree, take the role and risk on behalf of primary debtholders and should thus promote lower equity incentives in financial institutions (Adams and Mehran, 2003; Sierra et al., 2006; Webb, 2008; Qian and John, 2003). Based on the assumption that financial firms are subject to stricter monitoring, the fraction of equity-based incentives is likely lower in financial firms relative to non-financial firms.

Third, as argued in H1, the lower availability of growth opportunities in the financial industry may reduce the need to rely on equity-based incentives otherwise used to take advantage of such opportunities.

In line with the three main theoretical arguments stated above, a number of findings indicates that the fraction of equity incentives to CEOs in banks (Adams and Mehran, 2003; Houston and James, 1995) and financial firms (Conyon and He, 2016) is relatively lower than the fraction of equity in the compensation of CEOs in non-banks and non-financial firms respectively.

Fourth, in terms of cash compensation, empirical studies show that the fraction of salary is relatively higher for CEOs in financial firms (ibid.) and banks (Core and Guay, 2010) than for CEOs in non-financial firms. The higher reliance on salary could be explained by the fact that financial firms answer to several important stakeholders, such as regulators and debtholders. While options and stock incentives are only linked to firm performance in the form of stock price, the use of equity incentives normally does not directly link the CEO pay to debtholder value. As such, a higher reliance on cash compensation, particularly in terms of variable pay, might be justified more easily by its specific characteristics, as it allows the board of directors to structure the rewards to the CEOs based on a number of performance measures, including those capturing the value created for the debtholders and society.

In conclusion, we expect the CEOs in financial firms to receive a higher fraction of salary and bonus and a lower fraction of equity incentives relative to CEOs in non-financial firms. This is because of 1) the relative importance of debtholders to equity holders in financial firms, 2) the governance effect of regulation, 3) fewer growth opportunities and 4) the characteristics of cash compensation. Accordingly, the following hypothesis is proposed:

> *H2: Cash compensation (salary and bonus) takes up a larger part of total pay and equity incentives take up a smaller part of total pay in the CEO compensation of financial firms relative to that of non-financial firms*

8.3 Vega and delta

The following two hypotheses are related to the general differences in the levels of delta and vega for CEOs in financial and non-financial firms. We argue that delta is lower in financial firms. First, the relative importance of debtholders is higher in financial firms due to the high levels of leverage and the specific activities in financial firms. This should also be reflected in the CEO incentives, i.e. lower delta and lower vega. Indeed, several studies find that highly leveraged firms (such as financial firms) have a lower delta relative to less leveraged firms (Coles et al., 2006; John and John, 1993; John et al., 2010; Minhat and Dzolkarnaini, 2016; Qian and John, 2003). Second, following the rationale from H1, the level of delta in financial firms should be lower as it can be assumed that incentives are in part provided through strict regulation in the financial industry. Accordingly, it can be argued that based on 1) the relative importance of debtholders and 2) the substitution of incentives with regulation, CEOs of financial firms may have lower levels of pay for performance sensitivity than CEOs of non-financial firms. This suggests the following hypothesis:

> *H3a: CEO compensation delta is lower in financial firms relative to non-financial firms*

The level of vega can be expected to be lower. First, the high level of leverage in banks and financial firms emphasizes the high relevance of debtholders. Following the arguments in H1, to mitigate the risk-shifting problem a lower level of options can be expected which can impact the pay-risk negatively, i.e. lead to a lower vega. Second, due to the importance of financial institutions to the overall economy, it is assumed that financial firm boards are less likely to reward managers for risk. This suggests the following hypothesis:

H3b: CEO compensation vega is lower in financial firms relative to non-financial firms

8.4 The effect of the Dodd-Frank Act

The final hypotheses relate to the effect of the DFA. Generally, we argue that the regulation led to a reduction in the use of stock options paid to the CEOs but also an increase in the use of stock grants. We attribute this effect to 1) an increased level of transparency required by the regulation, 2) a higher focus on stability in financial institutions and 3) a reduction in the number of growth opportunities. First, the purpose of the DFA was, among other things, to increase the transparency in executive compensation. This was done e.g. by increasing the disclosure of executive hedging and of the link between pay and performance. Assuming that compensation committees wish to prove the link between pay and performance to shareholders, the level of delta is expected to increase. Second, the focus on long-term value creation and financial stability in recent regulations could have led compensation committees to focus on reducing managerial risk-taking. The risk-taking can generally be decreased by making managers relatively more exposed to downside risk through granting them stock rather than options. However, this effect is likely weaker in the presence of debtholders, as also holding stock might lead the CEOs to take on excessive risk. Third, studies find that deregulation increases the growth opportunities of firms, which make boards set more risk-taking incentives (Guay, 1999). This indicates that regulation can have the opposite effect. For instance, several studies find higher levels of vega following deregulation in the financial industry (Bai and Elyasiani, 2012; Crawford et al., 1995; Hubbard and Palia, 1995) or for firms in general when they operate in a deregulated environment (Belkhir and Chazi, 2010). This could imply lower levels of vega following a regulation like the DFA. Similarly, Chen et al. (2006) find that banks rely more on option-based compensation following deregulation, suggesting a lower focus on options after a regulation, which may further decrease vega.

We assume that the focus on financial stability and long-term value creation through reducing risk-taking will increase the CEO compensation delta in general. We expect this effect to be weaker in financial firms due to the effect of risk-shifting incentives on debtholders, which are the primary claimholders. This suggests the following hypothesis:

> *H4a: Following the Dodd-Frank Act in 2010, CEO delta is higher. This effect is weaker in financial firms relative to non-financial firms*

We assume that the DFA reduced the availability of growth opportunities of firms, increased transparency requirements as well as the attention and responsibility of the boards when setting CEO compensation. Accordingly, we should observe a decrease in option incentives following the introduction of the DFA. Given the specifics of the financial industry (i.e. the importance of debtholders, stricter regulations, relevance for the stability of the entire economy), we might expect that the effects of the DFA will be stronger for financial firms. This suggests the following hypothesis.

> *H4b: Following the Dodd-Frank Act in 2010, CEO vega is lower. This effect is stronger in financial firms relative to non-financial firms*

9 Data collection and methods

To test our hypotheses, we need to evaluate our approach to data collection as well as consider a number of statistical issues related to performing the analysis. Next, we look into considerations that should be made when applying the Black-Scholes option valuation model. Finally, we evaluate the reliability and validity of our research.

9.1 Approach to data collection

Data availability is important for the quality and outcome of our analysis. It depends to a large degree on the data sources used and their limitations. Accordingly, this section will begin with a short overview of our data sources, the limitations of these and the approach to collecting the data from our initial criteria. The initial data undergoes a trimming process to exclude data not meeting our requirements which is also described below.

9.1.1 Data sources

In our data collection, we have used three different data sources. Data on CEO compensation is obtained from ExecuComp, which is a part of the WRDS database from the Wharton School at the University of Pennsylvania. This data is merged with fundamental financial information from the WRDS Compustat Capital IQ database which includes information on financial metrics, such as firm debt, firm size and financial performance. Additionally, interest rates used for calculation of vega and delta are obtained from historical data provided by the Federal Reserve.

WRDS is an award-winning research platform and is based on data compiled from a number of highly esteemed sources such as CRSP, S&P, Thomson Reuters and NYSE (WRDS, 2018). Additionally, the Compustat database is commonly used in literature, has excellent credentials and very few mistakes reported throughout the years, making us confident that it is a good source for our data collection. Compustat primarily draws its data from SEC filings, which are then standardized to facilitate best possible comparisons (ibid.). The ExecuComp database is derived from Compustat and is also a well-known and standard data source in the literature on executive compensation (e.g. Conyon and He, 2016; DeYoung et al., 2013; Murphy, 1999). The database contains detailed information on executive compensation collected directly from the companies' annual proxies from 1992 and up to today's date (WRDS, 2018). However, we do not neglect the risk of the database containing incorrect information, which is why we have made double checks with individual firms' annual reports and compared them to the data from WRDS. The data proved to be consistent in all cases. Thus, we trust that errors will seldom appear in WRDS. Lastly, as the historical database on Treasury securities is provided by the Federal Reserve (i.e. the central bank of the US), we consider this a highly trustworthy source of data.

9.1.2 Limitations related to data collection

Changes in reporting rules on executive compensation have contributed to a restriction in our sample period. As of 2006, a new reporting format took effect, making data reported in similar formats available only from 2007 and onwards. Due to a limitation in time and resources as well as to maintain consistency in our dataset, we choose to exclude data from before 2007. Additionally, as we start the data collection for our analysis at the beginning of 2018, the availability of information for year 2017 is limited. Therefore, we exclude 2017 data from our sample. Thus, we limit our final sample to the period 2007-2016.

Differing company identifiers across databases have posed challenges in terms of merging data from different sources. Our first choice was the Compustat firm identifier GVKEY, a permanent identifier which incorporates a firm's entire history and thus can identify a firm despite fundamental changes in firm characteristics, such as following a merger or an acquisition. However, this identifier was only available for Compustat data making it impossible to merge with ExecuComp data. Another option was to use CUSIP as an identifier. However, CUSIP can contain from 6-9 numbers with the amount of numbers differing between Compustat and ExecuComp. For these reasons, we selected a third option and ended up using the ticker symbol as a firm identifier. This identifier has the weakness that it changes frequently and is reused over time, possibly introducing errors in our dataset. However, we approach this issue by performing a cross-check by eliminating firms which we know have merged over the time period. The exclusion of these firms did not change the conclusion of our results.

9.1.3 Sample selection

Overall sample selection The initial observations from our merged dataset of ExecuComp and Compustat consisted of 2,467 unique firms. We start by excluding observations on non-CEO executives from our sample. This is done by cross-checking various CEO identifiers provided by ExecuComp, such as the annual CEO flag, indicator of current CEO, as well as the executive's annual title – in which we removed all titles which did not include the words "CEO", "Chief Executive Officer" or its equivalents.

Next, we base our study on firms that are listed on the S&P 1500. The index consists of the three leading indices namely the S&P SmallCap 600, S&P MidCap 400 and S&P 500. Together, they cover approximately 90% of the US market capitalization (S&P Global, 2018). However, Compustat contains data on firms listed on several different indices, as well as on selected unlisted firms. Thus, we choose to exclude firms that are not listed in either of the mentioned S&P indices. As a double check on the listed status, we ensure that excluded firms do not have a stock price. In this process, we eliminate two firms that are listed but do not have any stock price observations.

Finally, 1,441 companies are excluded due to inferior information quality. These firms lack information on our control variables and the variables for compensation structure and level. The above-mentioned steps result in a final sample size of 1,024 unique firms, which corresponds to a retention rate of 41.5% of the firms in our initial dataset. We do this to make the dataset as unbiased as possible. The total number of firm-year observations is 5,741. In the calculation of vega and delta, an additional number of observations are eliminated due to a lack of information on the number of granted options, exercise price, expiration date, exercise price or time to maturity. After eliminating these observations, 913 firms are left. As we do not have complete information for all variables for all firm-years and as not all firms are present in all years, the total number of firm-year observations run in the regressions with vega and delta as dependent variables is 4,309. Finally, the total number of observations on bonus is substantially lower, at 1,036 due to the substantial amount of missing observations on the bonus variable.

9.2 Statistical considerations

Our sample consists of panel data (longitudinal data), that is, observations on several entities over a time period. An advantage of longitudinal data is that one can learn about economic relationships from many different firms in a data set and from the evolution of the variables of interest in each firm over time (Stock and Watson, 2012). Thus, we can better detect and measure effects that cannot be observed in pure cross-sectional data (several units at one point in time) or pure time series data (one subject at several points in time) (Gujarati and Porter, 2009). By studying changes in the dependent variable over time, it is possible to eliminate the effect of omitted variables that differ across firms but are constant over time (Stock and Watson, 2012). Also, advantages of using panel data include larger data sets with more variability, more degrees of freedom and ability to control for individual heterogeneity leading to more unbiased estimators (Baltagi, 1998). On the other hand, it also comes with a number of issues including the occurrence of heteroskedasticity, multicollinearity and autocorrelation which affects the efficiency of the estimators (Gujarati and Porter, 2009).

In the following sections, we briefly discuss some of the issues related to statistical methodology and explain how we have chosen to deal with these in the analysis of our data. Further elaborations on several of the topics are available in the appendix (sections 14.1-14.6).

9.2.1 Unbalanced panel data

We study a "short panel" as the number of cross-sectional subjects (firms) is greater than the number of periods (years) (ibid.). A balanced panel has all its observations for each entity and each time period. Thus, each firm has the same number of observations over time. However, due to limited data availability, we have chosen to study an unbalanced panel where some data is missing for at least one time period for at least one entity (Stock and Watson, 2012). If the reason why we have unbalanced panel data is uncorrelated with the idiosyncratic errors, the unbalanced panel causes no problems. If the reason a firm leaves the sample (attrition) is correlated with this error (i.e., the unobserved factors that change over time and affect compensation) - the resulting sample selection problem can cause biased estimators (Wooldridge, 2012) and inflated error terms (Baltagi, 2015). We would assume that the sample would be subject to attrition following the GFC, but as only a few firms leave our sample in 2008 and 2009, our data set does not reflect this. Also, we did not find any pattern in the characteristics of the firms leaving and entering the sample set over time, and our estimators are therefore not expected to be biased because of this.

9.2.2 Dealing with panel data

To deal with panel data, a number of regression models can be applied. We discuss three of them, namely the pooled OLS regression model, the fixed effects model and the random effects model, and justify our choice of model, namely the pooled OLS model.

Many choose to apply a variation of the OLS regression model that allows for differences across entities, i.e. the fixed effects model. This model gives each entity its own intercept value by including a dummy for each firm. However, the intercept of each firm does not vary over time. This poses a challenge in the application to our study as the model is not able to identify the impact of time-invariant variables, such as our categorization of financial and non-financial firms. Therefore, we cannot apply this model to our regressions.

Another possible approach to dealing with panel data is the random effects model. This model assumes that the intercept of an individual unit is a random drawing from a much larger population with a constant mean value (Stock and Watson, 2012). This model can be run with time-invariant variables (Gujarati and Porter, 2009). Using the Breusch and Pagan Lagrange Multiplier test against the final alternative, namely the pooled OLS model, we find that the random effects model seems to a statistically better fit. However, a critical assumption of the random effects model is that the time-invariant heterogeneity between groups is uncorrelated with the error term. As we are not certain that we have perfectly excluded the possibility of omitted variable bias (further described in section 9.2.7), this model is not appropriate.

Accordingly, in line with Gregg et al. (2012), we choose to apply a pooled OLS regression as we evaluate that our data and research question best fit with its assumptions. Unfortunately, the pooled regression model has several drawbacks. Primarily, the model assumes that all regression coefficients are the same for all firms, i.e. the regression coefficients are assumed to be the same for all firms and over time (Stock and Watson, 2012). This is likely not the case, as firms and industries usually vary greatly in a number of aspects (size, risk, growth opportunities, managerial style/philosophy, type of market served, etc.). Since the model does not capture differences across firms and over time, such potential differences are instead captured by the error term. Thus, it is possible that the error term is correlated with some of the regressors in the model (ibid.).

Consequently, we have applied the pooled OLS regression model in our study. In the model we include year dummies to control for time-specific fixed effects, such as unobserved events that impact the observations in a given time-period in our sample. We also apply several control variables based on literature to control for differences in firm-specific characteristics.

Also, to mitigate some of the drawbacks mentioned above, we apply a number of statistical tools, which are described in the following sections.

9.2.3 Gauss-Markov theorem

As mentioned above, we have applied the OLS regression method to analyze executive compensation. A number of assumptions have to hold for the OLS estimator to be the "Best Linear conditionally Unbiased Estimator" (BLUE). These are further elaborated in the appendix (section 14.1). The fundamental assumptions and how we deal with them are described in the following sections.

9.2.4 The error term

In an OLS regression, a main assumption on the error term is that it should be normally distributed with a constant variance. However, this may not hold in our sample and can therefore lead to potential problems of heteroscedasticity and autocorrelation. In the following, we will introduce our solution to both problems. Further statistical theories and background can be found in the appendix (section 14.2 and 14.3).

Heteroskedasticity In the presence of homoskedasticity, one assumes that the variance is constant for all observations. This implies that the data is equally spread out over the entire sample. However, this is not the case for our sample as we confirm the presence of heteroskedasticity through a White's General Heteroskedasticity Test. Heteroskedasticity is a typical concern when using panel data as the data typically involves heterogeneous units.

Autocorrelation In panel data, serial correlation in the error term often arise. In our data, we expect the residuals for a given firm to be correlated with previous and future years as we observe the same firm over several years. This is confirmed by a Breusch-Godfrey/Wooldridge test identifying serial correlation in our panel data model (Torres-Reyna, 2010).

Solution to heteroskedasticity and autocorrelation In our results, we have adjusted for heteroskedasticity and autocorrelation in the error term simultaneously. We do this by using heteroskedasticity-and-autocorrelation-consistent standard errors, specifically clustered standard errors. The clustered standard errors are used to account for the possible correlation within a cluster (Stock and Watson, 2012). With these standard errors, the regression errors can have an arbitrary correlation within a firm, but at the same time it is assumed that the regression errors are uncorrelated across firms. Therefore, there can be heteroskedasticity and arbitrary autocorrelation within a firm, while the errors across firms should still be uncorrelated. The clustered standard errors will be valid whether or not there is heteroskedasticity, autocorrelation or both (ibid.). We have clustered the standard errors by company and as a robustness check also by fiscal year. This is because we either expect the model errors for a given firm in different time periods to be correlated or the model errors within a year to be correlated.

9.2.5 Multicollinearity

Multicollinearity is present when there is a linear relationship between the explanatory variables. A way of detecting multicollinearity is to examine the correlations between the independent variables or the variance inflation factor (VIF). The VIF indicates how much of the variance of an estimator is inflated because of multicollinearity. Along with a correlation matrix, the VIFs will be tested in section 10.2.3. Further theoretical considerations, as well as sources and consequences of multicollinearity, can be found in the appendix (section 14.4).

9.2.6 Outliers

An outlier is an observation with a large residual in comparison with other residuals in the regression. To adjust for extreme outliers, we have chosen to winsorize the outliers at the 1st and 99th percentiles in line with literature (Coles et al., 2006; Core and Guay, 1999; Guay, 1999). Thus, we have modified the value of the most extreme observations to the 1st and 99th percentiles respectively. This is done to avoid dropping firms from our sample because of a single extreme observation. Further statistical considerations of outliers and potential solutions can be found in appendix 14.5.

9.2.7 Model specification bias

Before running a regression, one must determine which variables to test for - that is, determine the model specification. A further description of statistical sources and consequences of model specification bias can be found in the appendix (section 14.6). Unfortunately, there are no single rules that apply in all situations, so that, when deciding which explanatory variables to include in the model, it is not possible to know whether or not they are all included. However, there are some precautionary measures one can undertake.

A first step should be to consider possible sources of omitted variable bias. In this, one should rely on knowledge of the empirical problem by using a combination of expert judgment, economic theory and knowledge of the data collection (Stock and Watson, 2012). To address this, we have conducted a thorough literature review where we examine the statistical methods of previous literature within the same field of research and study the variables identified as relevant by academics and practitioners. Our model specification and variables of choice are based on these considerations. For instance, our key variable of interest is the dummy for financial/non-financial firms. We do not have a lot of discretion in this definition as it is based on a limited range of Standard Industrial Classification (SIC) codes that are well defined in literature. Also, our control variables are included to hold constant factors that, if neglected, could lead the estimated causal effect of interest to suffer from omitted variable bias. However, it is still possible that the regressions suffer from some unobserved heterogeneity and the financial firm dummy could be reflecting something else which we are not controlling for (e.g. firm size).

Another way to optimize the model specification and thus minimize the chance of e.g. unobserved heterogeneity is to set up several model specifications. First, a base specification should be chosen based on economic theory and knowledge of the empirical problem and its determinants. Thereafter, one should run several alternative specifications with different regressors. If these estimates yield somewhat similar numerical results, one can infer that the estimates from the base specification are reliable (ibid.). If not, there is likely a case of omitted variable bias. The different model specifications we applied yielded similar results, increasing the confidence in our base specification.

9.3 Valuation of options using Black-Scholes

In line with literature, we follow the steps of Core and Guay (2002) and Guay (1999) to find vega and delta values. Their method is based on the Black-Scholes (1973) formula for valuing European call options as modified by Merton (1973) to account for dividends. Also, many firms use this method to value the options which are reported in our database of choice, WRDS.

As the firm encounters opportunity costs by awarding stock options to the CEO rather than issuing them in the market, using the Black-Scholes method should in theory be a reasonable approximation of this foregone cost (Conyon and He, 2016). However, the method contains a number of limitations including overstating option value, assumptions on no short-selling and assumptions in executives having to forfeit options when leaving the firm (Goergen and Renneboog, 2011). Also, literature disagrees on whether this method is a good measure of actual employee stock option value as they are nontransferable and because employees are risk-averse and therefore do not hold the options until expiration (Coles et al., 2006). To account for this, Coles et al. (2006) perform a robustness check to see if their results are still robust if the maturities of all options are only 70% of the stated maturity. They find that the results are qualitatively the same. Thus, we believe that Black-Scholes is an overall good method to value options in our sample.

The formula applied to estimate the option value is given by the following equation:

Option value $= [Se^{-dT}N(Z) - Xe^{-rT}N(Z - \sigma T^{(1/2)})]$
$Where:$
$Z = [ln(S/X) + T(r - d + \sigma^2]/\sigma T^{(1/2)})$
N = cumulative probability function for the normal distribution
S = price of the underlying stock
X = exercise price
σ = expected stock-return volatility over the life of the option
r = natural logarithm of the risk-free interest rate
T = time to maturity of the option in years
d = natural logarithm of expected dividend yield over the life of the option

9.4 Quality of our research

The reliability of our thesis deals with how well our results can be replicated by other researchers. As we have used WRDS' databases Compustat and Execucomp for information related to financials and compensation for the individual firms as well as the Federal Reserve for data on interest rates, it is easy for other researchers to replicate our study using similar data.

The validity of our study deals with whether the inferences and conclusions from our study are valid and can be extended to other settings. We estimate that our study has a substantial level of internal validity and therefore that the conclusions we have made are valid for the populations being studied, namely financial and non-financial firms listed on the S&P1500 index. We also believe that the study has some external validity and some of the arguments behind our inferences about the population of interest can be applied to other populations (countries, industries) and settings (non-executive compensation).

9.4.1 Endogeneity: Direction of causality

When performing an OLS regression, a common problem is reverse causality. Reverse causality arises when the dependent variable explains one or more of the independent variables. Such a phenomenon can lead to a correlation between the regressor and the error term (Stock and Watson, 2012). Reverse causality in corporate governance is a well-known issue (Bai and Elyasiani, 2012; Coles et al., 2006). It can be hard to find the direction of causality, so when corporate governance research indicates that a particular firm characteristic affects executive compensation, it is also possible that the direction of causality is reverse. One source of endogeneity can be unobserved heterogeneity as described in section 9.2.7. Another source of endogeneity can be that e.g. the current level and structure of executive compensation are affected by earlier years' firm performance (Wintoki et al., 2012). A solution to such endogeneity issues is to use an instrument, which is a variable that is correlated with X_i but not correlated with any other determinants of the dependent variable (Stock and Watson, 2012). However, we have not included an instrument as it is highly difficult to find a proper instrument that is correlated with an explanatory variable, but uncorrelated with the error term (i.e. not have an effect on the dependent variable). The latter assumption is also untestable, making the identification of the variable even harder. Alternatively, we could have used the difference-in-differences model as a way to address the endogeneity issue, but this would have required a control group which we do not have.

Accordingly, we do acknowledge that our research can suffer from endogeneity and therefore our research cannot claim causality. Instead, it can only be used descriptively, to outline differences in CEO compensation across the financial and non-financial industry.

10 Data analysis

With a foundation in the theoretical and empirical literature review, the following section covers the empirical part of our study, including an empirical testing of our hypotheses.

10.1 Variables

In order to perform our analysis, we need to select the measures of each element applied to our regression. In the following section, we provide an overview of dependent and independent variables that have commonly been used in literature to define the key components related to executive compensation followed by a definition of the variables we have chosen to use in our analysis.

10.1.1 Dependent variables

Variables used to measure: Level

Total compensation Measures of total compensation typically include the sum of salary, annual bonus, value of stock options, performance plans, phantom stock and restricted stock (Core et al., 1999). Conyon and He (2016) also differentiate between total expected compensation and total realized compensation, where the latter includes the gains made from the exercising of options that were granted several in previous years.

Several studies define total executive compensation or CEO pay share via ExecuComp's TDC1 variable (Bebchuk and Grinstein, 2005; Bebchuk et al., 2007; Frydman and Jenter, 2010). However, this measure is calculated based on the 1992 reporting format and is therefore only relevant for time series ranging before and after the change in accounting standards. Since we do not use data prior to 2006, we prefer newer compensation measures that can be used consistently throughout our entire sample. As such, we will use ExecuComp's TOTAL_SEC variable as a measure of total compensation (WRDS, 2018):

> *Total compensation = sum of the executive's salary, bonuses, stock awards, option awards, non-equity incentive plan compensation, change in pension value and all other compensation received by the executive including perquisites and severance pay*

Cash compensation: Salary and bonus Several studies measure the different components of executive compensation separately. Core et al. (1999) define cash compensation as the sum of salary and annual bonus. Other studies separate bonus and salary into two different variables (Conyon and He, 2016; Harjoto and Mullineaux, 2003).

In line with literature (Conyon and He, 2016; Murphy, 1999; 2013) we use:

$Salary = ln(salary_t)$

Option awards To measure stock options, we use the variable OPTION_AWARDS_FV from ExecuComp. This is a measure of the fair value of all options granted to the CEO during the year. Its valuation is based on the grant-date fair value in line with FAS 123R accounting standards of 2006 (WRDS, 2018). Accordingly, we define:

Stock options = ln(fair value of option awards$_t$*)*

Stock awards To measure stock awards, we have chosen ExecuComp's STOCK_AWARDS _FV variable. This measures the fair value of all shares granted to the CEO during the year (ibid.). The valuation is, as with stock options, based on the grant-date fair value, in line with the FAS 123R accounting standards of 2006 (ibid.). Accordingly, we define:

Stock awards = ln(fair value of stock awards$_t$*)*

Variables used to measure: Structure In order to examine the structure of pay, common measures include CEO pay mix variables as CEO salary, bonus, options and grants divided by total pay (Conyon and He, 2016). We follow literature and use the same variables in our analysis:

Salary fraction of total pay = salary$_t$*/total compensation*$_t$

Bonus fraction of total pay = bonus$_t$*/total compensation*$_t$

Stock grant fraction of total pay = stock grant value$_t$*/total compensation*$_t$

Option grant fraction of total pay = option grant value$_t$*/total compensation*$_t$

It should be noted that as total compensation also includes other types of compensation (non-equity incentive plan compensation, change in pension value and all other compensation received by the executive including perquisites and severance pay as described in the total compensation variable), the four variables above will not sum to 100%.

Variables used to measure: Vega and delta Delta is generally measured in one of two ways. One branch of literature measures delta as "the dollar change in CEO compensation for a one percentage point change in stock price" (Coles et al., 2006; DeYoung et al., 2013; Hall and Liebman, 1998). This is equivalent to the value of equity-at-stake (Frydman and Jenter, 2010). Another branch of literature measures delta as the dollar change in CEO compensation/wealth for a $1,000 (Qian and John, 2003) or $1 (Jensen and Murphy, 1990a) change in firm value. This is a measure of the fractional equity ownership (Frydman and Jenter, 2010).

Different measures of delta can lead to very different views on the magnitude of incentives. Baker and Hall (2004) show that the appropriateness of CEO pay-performance incentives depend on how CEO behavior affects firm value. When CEO actions have the same dollar impact across firms regardless of their size, the fractional equity ownership is the correct measure. Conversely, equity-at-stake is the right measure of incentives when CEO actions affect percentage returns on firm value and thus scale with firm size, e.g. in the case of corporate reorganization.

As previously defined, and in line with literature that investigates delta in executive compensation (Bai and Elyasiani, 2012; Belkhir and Chazi , 2010; Coles et al., 2006; Core and Guay, 2002; DeYoung et al., 2013; Hall and Liebman, 1998), we apply:

Delta = the change in CEO wealth (defined as the sum of option and equity portfolio value) for a 1% change in stock price

For vega, we use the vega of the CEO's option portfolio because the aggregate sensitivity of the CEO's stock-based wealth to volatility is primarily driven by stock options (Bai and Elyasiani, 2012; Guay, 1999). As previously defined, and in line with literature (Bai and Elyasiani, 2012; Belkhir and Chazi, 2010; Coles et al., 2006; Core and Guay, 2002; DeYoung et al., 2013; Guay, 1999), we apply:

Vega = the change in CEO wealth (defined as the option portfolio value) for a 1% change in the annualized standard deviation of stock returns

Our delta and vega variables are considerably skewed to the left. To counteract this skewness, we follow literature in taking the natural logarithms of the two variables (Belkhir and Chazi, 2010; DeYoung et al., 2013).

Calculation of vega and delta In the calculation of vega and delta, we have followed the overall approach of Coles et al. (2013) and Core and Guay (2002). These studies follow the Black-Scholes (1973) method as modified by Merton (1973) to account for dividend payouts.

The calculation method requires several inputs including an estimation of sigma and dividend yield as well as the matching of risk-free rates with option time-to-maturities. We will describe our approach to these calculations in the following. All steps below are in line with literature (Coles et al., 2013; Core and Guay, 2002).

We exclude unearned awards as ExecuComp does not provide the data required to calculate the incentives for these awards. In particular, the availability of information from a firm's proxy statement on the performance metrics that are to be reached to earn the equity award is also limited. Hence, we only use the vested and unvested shares and options in our calculations. The sum of these shares and options for each fiscal year make up the vega and delta. It is important to note that this definition implies an underestimation of the true vega and delta. The unearned shares will instead be registered as shares or options when they are earned, and in that way be included at a later point instead.

When calculating sigma, we find the annualized standard deviation of stock returns estimated over the 60 months prior to the beginning of the fiscal year, given that we have at least 12 months of returns data. If we do not have at least 12 months of returns data, we use the mean volatility across all firms for that year. Finally, we winsorize the variables at the 1st and 99th percentile.

Next, we calculate the dividend yield which is defined as the average of the current year and the two preceding years. The value is divided by 100 to apply it in the Black-Scholes (1973) model. The average of the current year and the prior year is used if only observations from one prior year are available, and the current value of dividend yield is used if there are no prior observations. The resulting dividend yields are winsorized at the 1st and 99th percentile. Lastly, we apply the natural logarithm of the dividend yield in order to use it as an input in the Black-Scholes formula.

Risk-free rates are the "Treasury Constant maturities" obtained from the Federal Reserves' annual series of historical data (Federalreserve.gov, 2018). Here, we gain access to data for 1, 2, 3, 5, 7 and 10-year Treasury securities. To get the remaining rates, we interpolate the missing rates up until a 10-year maturity. The risk-free rates are matched with the time-to-maturity of the options as of the fiscal year-end. For instance options with an expiration date in the current fiscal year, we set the risk-free rate equal to the 1 year Treasury rate, and so on. For option maturities higher than 10 years, we use the 10-year rate. Finally, the rates are divided by 100 and we apply the natural logarithm of the values to use them as inputs in the Black-Scholes (1973) formula.

We obtain the option values by inserting all the needed inputs in the Black-Scholes formula (as seen in section 9.3). Next, we calculate the option delta and vega values for each option as follows:

Delta: The sensitivity with respect to a 1% change in stock price is defined as:

$$[\partial((\text{option value})/\partial(\text{price})] * (\text{price}/100) = e^{-dT}N(Z) * (\text{price}/100) \quad (10.1)$$

Vega: The sensitivity with respect to a 0.01 change in stock-return volatility is defined as:

$$[\partial((\text{option value})/\partial(\text{stock volatility})] * 0.01 = e^{-dT}N'(Z)ST^{(1/2)} * (0.01) \quad (10.2)$$

where N' is the normal density function.

Next, the delta of the portfolio of shares is calculated by multiplying the number of shares owned by the executive (restricted and unrestricted) with the share price at the fiscal year-end and divide this value by 100.

The total delta is then found by summing the delta of the share portfolio and the delta of the option portfolio. For vega, we assume that the vega of the share portfolio is zero. Therefore, total vega is equal to the vega of the option portfolio. Lastly, as mentioned in the above section, we take the natural logarithm of vega and delta.

10.1.2 Independent variables

Financial industry In order to examine the differences in CEO compensation between financial and non-financial firms, literature uses one of two approaches. Either researchers use a dummy for financial firms (Adams, 2012; Conyon and He, 2016; Gregg et al., 2012) or they run two separate regressions and then a joint regression with a dummy (Choe et al., 2014; DeYoung et al., 2013; Jaggia and Thosar, 2017). We will use the first approach as our aim is to explain relative differences between the two industries - and not their respective determinants.

The financial services industry is commonly defined using the industry SIC codes 6000-6999 (Bai and Elyasiani, 2012; Conyon and He, 2016; Jaggia and Thosar, 2017; Murphy, 1999), SIC codes 6060-66 (Dong, 2014) or SIC codes 6000-6299 (Tian and Yang, 2014). Alternatively, Gregg et al. (2012) use FTSE's industry group 9 (Financials – banks, insurance, real estate, specialty finance).

Finally, a few studies narrow the focus even more, i.e. to banks. Some studies define the banking industry using broader SIC codes 6000-6999 (Cooper and Kish, 2014). A number of studies focuses on BHCs using SIC codes 6021-22 (Belkhir and Chazi, 2010; Harjoto and Mullineaux, 2003), while others focus on commercial banks using SIC codes 6021-29 (Qian and John, 2003), SIC code 6020 (Conyon and He, 2016; DeYoung et al., 2013) or Forbes' definition of commercial banks (Houston and James, 1995). Webb (2008) defines the banking industry using Execucomp's SPIndex 4010 (banks). We define:

Financial firms = SIC codes 6000-6999

Commercial banks = SIC codes 6020-6029

To control for industry-specific effects in our robustness check, we have used the 12 standard SIC code categories (Siccode.com, 2018)[1].

Regulation dummy In order to determine the effect of the DFA, we include a dummy for the years 2011-2016. This is in line with Belkhir and Chazi (2010) who also include a dummy for the deregulation following the GLBA of 1999 with a dummy covering the years 2000-2005 (end of the sample).

Control variables Several different firm-specific variables are commonly used as control variables for measuring executive compensation, pay-performance sensitivity and pay-risk sensitivity. For a number of variables, we have applied the natural logarithm to follow literature, adjust for skewness in the data and limit the effect of outliers (Bebchuk and Grinstein, 2005; Core et al., 1999). For the variables size, performance, leverage and

[1]SIC codes: 0100-0999 – Agriculture, Forestry and Fishing, 1000-1499 – Mining, 1500-1799 – Construction, 2000-3999 – Manufacturing, 4000-4999 – Transportation, Communications, Electric, Gas and Sanitary service/Utilities, 5000-5199 – Wholesale Trade, 5200-5999 – Retail Trade, 7000-8999 – Services, 9100-9729 – Public Administration

risk we apply a one-year lag. This is common practice as the amount of compensation paid in one year is established at the beginning of that fiscal year (except for bonus, which is determined at the end of the fiscal year). This allows boards to adjust the incentives of the executive in response to the size, leverage, performance and the market's assessment of the firm's riskiness in the preceding year (t-1) (DeYoung et al., 2013).

In line with literature, we have chosen the control variables described below.

Size Size is usually measured either based on sales or assets. Some studies define size as log $sales_{t\text{-}1}$ (Bebchuk and Grinstein, 2005; Core et al., 1999). Others use log $assets_{t\text{-}1}$ (Acrey et al., 2010; Bai and Elysiani, 2012; Belkhir and Chazi, 2010; Conyon and He, 2016; DeYoung et al., 2013; Harjoto and Mullineaux, 2003). Alternative measures include EBIT, sales and equity value (Gabaix et al., 2013) or an S&P 500 indicator (Conyon and He, 2016). In this study, we will use the natural logarithm of sales modified to the natural logarithm of revenues as banks do not have sales per se. Additionally, as a robustness check, we apply the natural logarithm of assets in section 10.3.4. As such, we will apply:

$$Size = ln(revenue_{t-1})$$

Performance Performance is generally measured based on stock returns or ROA. Several studies use $return_{t\text{-}1}$ (Barro and Barro, 1990; Harjoto and Mullineaux, 2003). Bebchuk and Grinstein (2005) use $\log(1+return_{t\text{-}1})$ and $\log(1+return_{t\text{-}2})$. Other studies include accounting measures such as $\log(1+ROA_{t\text{-}1})$ (Bebchuk and Grinstein, 2005; Core et al., 1999). Return on equity (ROE) is also often used as a proxy for performance, but as opposed to ROA it has the advantage that it is less sensitive to leverage (Berk and DeMarzo, 2017). Conyon and He (2016) use a variation of these measures and measure firm performance as the logarithm of the firm's market capitalization at t-1 multiplied by one year total shareholder returns from t-1 to t. In this study we use:

$$Performance = ln(return_{t-1})$$

Leverage Harjoto and Mullineaux (2003) include leverage as (1 – total equity/total assets) while DeYoung et al. (2013) include the ratio of book equity to assets (equity ratio). However, because of the difficulty in interpreting the book value of equity, this ratio is not very useful (Berk and DeMarzo, 2017). However, it is argued that it is more informative to compare the firm's debt to the market value of its equity (Berk and

DeMarzo, 2017). Conyon and He (2016) do exactly this and define market leverage as the sum of short and long-term debt divided by total debt plus market capitalization. This is a type of debt to capital ratio and indicates the fraction of the firm financed by debt (Berk and DeMarzo, 2017). Our study will apply the following definition in line with Conyon and He (2016):

$$Leverage = ((short\text{-}term + long\text{-}term\ debt)\ /\ (total\ debt + market\ capitalization))_{t-1}$$

Firm growth opportunities In order to take differences in investment opportunities into account, DeYoung et al. (2013) use the market to book equity ratio$_{t-1}$ while other studies use Tobin's Q (equal to the market to book ratio of assets) (Conyon and He, 2016; Harjoto and Mullineaux, 2003). Both measures explain the relation between a firm's market value and the book value listed on the balance sheet. Thus it includes both a market factor and a factor linked to the balance sheet. Accordingly, in line with literature (Conyon and He, 2016; Harjoto and Mullineaux, 2003), the study will apply the following definition:

Leverage = (Firm growth opportunities = Tobin's Q = market to book ratio of assets

If the ratio is above (below) one, it means that the market believes that the ability of the firm's management to utilize the assets is better (worse) than other firms (Tobin, 1969).

Risk Relevant measures for firm risk are different variance measures and Core et al. (1999) use the standard deviation of ROA and of stock returns over the prior five years. In line with literature, we define:

$$Risk = Sigma_{t-1} = (Standard\ deviation\ of\ annualized\ stock\ returns)_{t-1}$$

The measure used for sigma is equivalent to sigma from the calculation of vega and delta.

Age To control for differences in human capital between CEOs, Conyon and He (2016) include CEO age. A quadratic specific is used to reflect potential age earnings profiles (Cole and Mehran, 2010; Conyon and He, 2016).

Other studies use CEO tenure as a proxy for accumulated human capital (DeYoung et al., 2013; Harjoto and Mullineaux, 2003). Due to a lack of data available on CEO tenure, we will only apply the following measure for human capital in line with previous studies on financial firms (Cole and Mehran, 2010; Conyon and He, 2016):

$CEO\ age = Age\ \&\ Age^2$

10.2 Descriptive statistics

This section covers descriptive statistics of our key variables and the differences of these between the financial and non-financial industry. This is followed by an extension of the analysis to account for potential differences in the financial industry. Finally, an analysis of potential multicollinearity will follow.

The primary purpose of the section on descriptive statistics is to provide a quantitative description of the main features of our data. Descriptive statistics help to describe, show and summarize the data in a meaningful way so that we can observe patterns in our data. In this, we hope to gain a deeper insight into our data before performing the more comprehensive regression analyses. It is, however, important to note that descriptive statistics alone do not allow us to make any conclusions about our stated hypotheses. Along the way, we will put our results from the mean-difference tests in context with the findings of literature. We do however acknowledge that they are not directly comparable. Our results will be further tested in regressions in section 10.3, where we control for other factors and robust standard errors.

10.2.1 Summary statistics

In the total sample, financial firms comprise 21% of the sample (1,205 firm-year observations). Of the financial firm observations, 321 observations belong to commercial banks. Although the number of financial firms in the sample is smaller relative to the entire financial industry in the US, the financial firms in this sample represent a large fraction of total US financial industry assets. For instance, according to Statista (2018), in 2015, US financial institutions had a total of $59.87 trillion in assets (excluding pension funds, as they are not a part of our sample). In 2015, the financial firms in our sample have assets comprising 44.33% ($26.54 trillion) of total financial institution assets. Also, in 2015 the commercial banks in our sample have assets comprising 49.29% ($10.5 trillion) of total commercial bank assets in this year (Statista, 2018). Thus, although the comparisons we make and the conclusions we draw not necessarily apply for all financial institutions or banks, they are relevant for understanding executive compensation at the financial institutions and banks that are likely to matter the most for society.

The variables included in the regressions are the following:

Variables	Description
Dependent variables	
Total compensation	The natural logarithm of the sum of the executive's salary, bonuses, stock awards, option awards, non-equity incentive plan compensation, change in pension value and all other compensation received by the executive including perquisites and severance pay
Salary	The natural logarithm of salary paid to the CEO
Bonus	The natural logarithm of bonus paid to the CEO
Stock awards	The natural logarithm of the value of stock awards granted to the CEO during the year
Option awards	The natural logarithm of the value of stock options granted to the CEO during the year
Salary %	Salary as a percentage of total annual compensation
Bonus %	Bonus as a percentage of total annual compensation
Stock %	Stock awards as a percentage of total annual compensation
Option %	Option awards as a percentage of total annual compensation
Delta	The natural logarithm of the sensitivity of CEO compensation to a 1% change in stock price
Vega	The natural logarithm of the sensitivity of CEO compensation to a 0.01 unit change in stock price volatility
Independent variables	
Dummy variables	
Financial	1 if the firm is financial (SIC codes 6000-6999), 0 otherwise
Commercial	1 if the firm is a commercial bank (SIC codes 6020-6029), 0 otherwise
Regulation	1 for fiscal years 2011-2016, 0 otherwise
Interaction variables	
Regulation * financial	1 if the firm is financial and in fiscal years 2011-2016, 0 otherwise
Regulation * commercial	1 if the firm is a commercial bank and in fiscal years 2011-2016, 0 otherwise
Control variables	
Size	The natural logarithm of the firm's revenue in the previous year
Performance	The natural logarithm of the firm's stock price return over the previous year
Leverage	The firm's total liabilities divided by total firm value (liabilities plus market capitalization)
Firm growth opportunities	The market capitalization divided by the book value of the firm's assets in the previous year
Age	The age of the CEO
Risk	The standard deviation of annualized stock returns of the firm in the previous year
Delta	The natural logarithm of the sensitivity of CEO wealth to a 1% change in stock price
Vega	The natural logarithm of the sensitivity of CEO wealth to a 0.01 unit change in stock price volatility

Figure 4: Selected variables

Table 1 contains descriptive statistics for the numeric values and the natural logarithms of CEO total compensation, salary, bonus, stock awards and option awards. Table 2 includes summary statistics of salary, bonus, stock awards and option grants as fractions of total CEO pay. Table 3 contains descriptive statistics on the numeric values and the natural logarithms of delta and vega. Finally, table 4 contains descriptive statistics on relevant independent variables: firm size, return, leverage, firm growth opportunities, CEO age and risk. For all variables, we include a Welch two sample t-test which is testing the significance of the difference between the mean values in the financial and the non-financial firms respectively (see appendix 14.7-14.8).

Compensation variables First, this section provides a general overview of the development within compensation level and structure in our sample before moving on to the specifics on the summary statistics and differences between the financial and non-financial industries.

Yearly comparisons Over the sample period, there has been a substantial shift in the level and structure of compensation (Figures 5 and 6). In the financial sector, total pay has almost doubled from \$3.6 M in 2007 to \$6.5 M in 2016 (Figure 5). While salary levels have increased slightly throughout the period, the main driver behind the increase in compensation seems to be the escalation in the use of stock awards. The increase in "other compensation" also seems to contribute to the rise in total compensation. Similarly, for the non-financial industry, total pay has risen from \$3.8 M in 2007 to \$6.1 M in 2016 (Figure 6). The main drivers behind this development appear to be a decrease in the level of option awards and an increase in the level of stock awards. Similarly, the level of "other compensation" has increased for non-financial firms over the period.

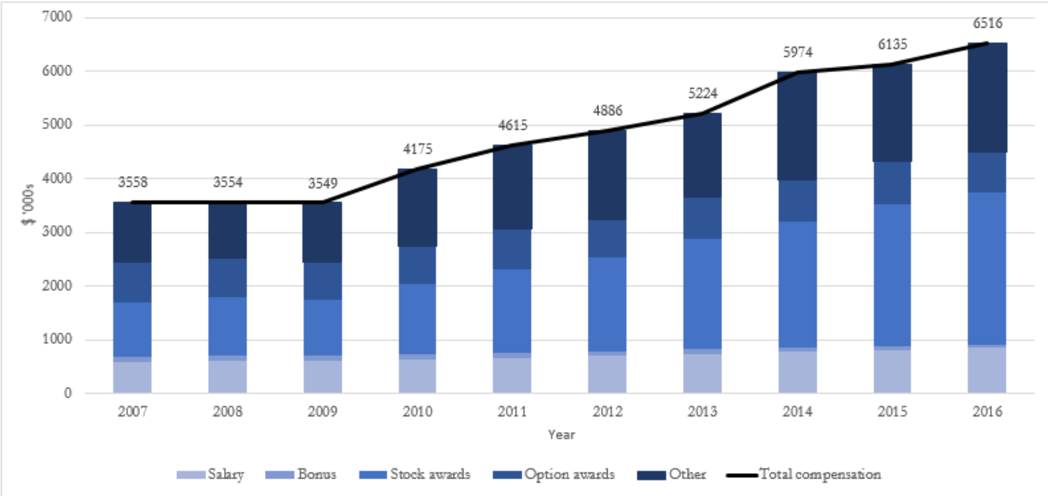


Figure 5 shows the development in the level of the compensation components salary, bonus, stock awards, option awards and other compensation (long-term incentive plans, severance pay, pension plans, etc.) as well as the level of total compensation in 2007-2016 sample of the 1,205 financial firm-year observations. Source: Compustat, ExecuComp; 2018.

Figure 5: Yearly comparison: Compensation level - financial firms

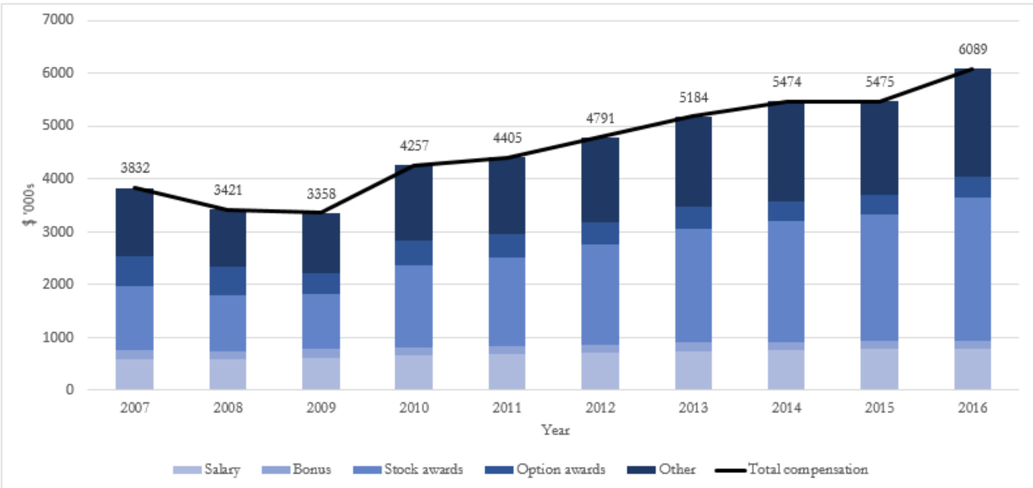


Figure 6 shows the development in the level of the compensation components salary, bonus, stock awards and option awards, other compensation (long-term incentive plans, severance pay, pension plans, etc.) as well as level of total compensation in 2007-2016 sample of 4,536 non-financial firm-year observations. Source: Compustat, ExecuComp; 2018.

Figure 6: Yearly comparison: Compensation level - non-financial firms

Statistic	Mean	Median	St. Dev.	Min	Max
Total compensation	4,846.6	3,380.0	4,280.7	538.0	16,093.1
Salary	702.9	665.3	306.8	226.0	1,350.1
Bonus	103.3	0.0	259.7	0.0	1,000.0
Stock awards	1,806.6	957.8	2,168.8	0.0	7,637.5
Option awards	684.4	95.4	1,064.0	0.0	3,750.0
ln(total compensation)	8.1	8.1	0.9	6.3	9.7
ln(salary)	6.5	6.5	0.5	5.4	7.2
ln(bonus)	5.5	5.8	1.6	−3.0	6.9
ln(stock awards)	7.2	7.3	1.2	−3.6	8.9
ln(option awards)	6.7	6.8	1.2	−2.3	8.2

Table 1 provides summary statistics for measures of CEO compensation level in our 2007-2016 sample of 4,571 firm-year observations. However, for the bonus variable only 1,036 firm-year observations are included. All dollar values are in thousands. Note that the following variables are denoted with and without the natural logarithm in the above for clarity: "Total compensation", "salary", "bonus", "stock awards", "option awards", "delta", "vega", "size" and "performance".

Table 1: Descriptive statistics - compensation level

Statistic	Mean	Median	St. Dev.	Min	Max
Salary (%)	23.9	19.3	15.0	6.9	60.2
Bonus (%)	2.7	0.0	6.2	0.0	22.8
Stock awards (%)	30.0	30.4	22.2	0.0	69.7
Option awards (%)	12.6	5.8	15.2	0.0	48.0

Table 2 provides summary statistics for measures of CEO compensation structure in our sample of 4,571 firm-year observations. However, for the bonus variable only 1,036 firm-year observations are included.

Table 2: Descriptive statistics - compensation structure

For close to all our variables, the average observation has a mean value higher or similar to its median value. A positive difference is likely due to a few high-paid CEOs pulling up the average. Additionally, the lower bound of zero on the variables is likely to skew the averages of the compensation levels in our sample. However, we apply the logarithmic transformation of the variables to normalize the initial values. In this way, we reduce the impact of large observations.

Total compensation In our sample, the average CEO has a total annual compensation of \$4.85 M. However, the variability of total annual compensation is quite large, indicating that differences from one firm to another are quite large. This can be seen in the standard deviation (\$4.28 M), which equals almost 86.6% of the mean value. These values for the mean and standard deviation yield logarithmic values of respectively 8.1 and 0.9. In financial firms, mean (median) total compensation of the CEO is \$4.68 M (\$3.38 M), that is, \$209,600 lower than in non-financial firms (appendix 14.7). The lower level also applies to the median and standard deviation, indicating a larger spread of CEO compensation levels in the non-financial sector. Further, the difference in means seems to be significantly different at a 1% level. These indications are in line with the findings of Conyon and He (2016).

Salary The mean (median) CEO salary in our sample is \$702,900 (665,300) with a standard deviation of \$306,800. Log-transformed, the values are 6.5 (6.5) and 0.5 respectively. For financial firms, the mean (median) and standard deviation are \$697,800 (676,000) and \$295,800, which is respectively \$6,500 (7,000) and \$13,900 lower than for non-financial firms.

Regarding compensation structure, we find that salary makes up 23.9% of total CEO compensation, with a standard deviation of 15.0%. For financial (non-financial) firms, average CEO pay consists of 25.4% (23.5%) salary (see appendix 14.7). The positive difference is only 1.9 percentage points but is nonetheless significant at a 1% level. In terms of standard deviation, we find that CEOs of financial firms have a slightly higher spread (16.0%) than CEOs of non-financial firms (14.7%), indicating that there is a marginally higher variation in salary in the financial industry than in the non-financial industry.

All summary statistics for salary are in line with the findings of Conyon and He (2016).

Bonus Next, we look at bonus. The average CEO earns \$103,300. With a median of zero, we can infer that there are quite a lot of zero values shifting the mean value downwards. Additionally, the standard deviation of \$259,700 is very large and much higher than the mean. Thus, the low mean does not seem to be very robust. This can be further apprehended by looking at the min and max values of bonus in the sample, which range from zero to $1 M. The logarithmic transformation of the variable yields a mean (median) of 5.5 (5.8) and a standard deviation of 1.6. Looking at the differences across CEOs in financial and non-financial industries, we find similar results with low mean values (financial: $155,900, non-financial: $89,200) and large standard deviations (financial: $316,200, non-financial: $240,400) (see appendix 14.7). Bonus is $66,700 higher in financial firms which is significant at the 1% level. This is in contrast with findings of Conyon and He (2016) who find "little differences" in bonus for financial firm CEOs relative to non-financial firm CEOs.

The mean (median) percentage of bonus to total pay is also very low, that is, 2.7% (0%). Also, the spread in bonus is quite low as the standard deviation is a mere 6.2%. Thus, bonus is the only structure variable with a standard deviation lower than 15%. Financial firm CEOs have a somewhat higher percentage of their pay in bonus (4.1%), 1.8 percentage points higher than that of non-financial firms (2.3%) (see appendix 14.7). The variation in the financial sector is also somewhat higher at 7.5% relative to that of 5.8% in the non-financial sector. This difference is significant at the 1% level. The finding that financial firm CEOs earn a higher share of their pay in bonus compared to non-financial firm CEOs is consistent with the findings of Conyon and He (2016).

Following the observations of bonus, it should be noted that the descriptive statistics for bonus is very low, both in terms of level and percentage of total compensation. This is because almost 80% of the observations on bonuses are zero. Comparing our results those of Conyon and He (2016), this seems odd, as the remaining descriptive statistics on compensation structure are broadly in line with theirs. For bonus, however, they find that bonus makes up 23.5% of total pay in contrast to our 3%. Therefore, we acknowledge that the observations on bonus might be biased or incorrect, despite being drawn from an acknowledged and widely used database.

Stock awards The average CEO earns $1.81 M in stock awards compared to a median value of $957,800, indicating that the distribution is positively skewed. Additionally, the standard deviation is $2.17 M, approximately $400,000 higher than the mean. Therefore, stock awards seem to be highly volatile. The large standard deviation is also evident in the min and max values of the sample, which range from zero to $7.64 M. However, in our analysis, the high standard deviation and skewed sample are mitigated by log-transforming the values. In logs, the mean and standard deviation are 7.2 and 1.2 respectively. When contrasting the means and standard deviation of the financial sample ($1.83 M, $2.18 M) and the non-financial sample ($1.80 M, $2.17 M), we find that CEOs of financial firms in our sample earn $33,500 more in stock awards than CEOs of non-financial firms. However, the difference is not statistically significant.

In terms of the structure of compensation, stock awards appear to on average make up about 30.0% of the average CEO's compensation. The standard deviation is 22.2% and the sample seems to be approximately normally distributed with a mean almost equal to the median value. Financial firm CEOs appear to on average have a slightly higher percentage of their pay in stock awards (31.1%) than non-financial firm CEOs (29.7%). However, the variation in stock award pay percentages is slightly lower in the financial sector at 21.9% relative to 22.3% in the non-financial sector. The difference is significant at the 1% level. This is in line with Conyon He (2016).

Option awards The variable shows many of the same characteristics as stock awards; it is very positively skewed with a large standard deviation and therefore a wide range. An average CEO receive option awards with a value of $684,400 with a very large volatility of $1.06 M. This translates into a logarithmic mean value of 6.7 and standard deviation of 1.2. Financial firm CEOs appear to earn significantly lower values of option awards ($436,600) than non-financial firm CEOs ($751,000). The standard deviations are similarly high in the split sample with values of $897,200 for financial firms and $1.10 M for non-financial firms.

Option awards take up 12.6% of the total compensation for the average CEO in our sample with a median of 5.8% and a standard deviation of 15.2%. The fact that the mean is higher than the median indicates that some CEOs earn a considerably larger percentage of their pay in options and thus pull up the average. Financial firm CEOs on average earn 7.6% of their pay in options as opposed to CEOs of non-financial firms who earn on average 14.0% of their pay in options. This difference (6.4 percentage points) is significant at the 1% level.

Delta and vega variables Similar to above, this section will provide a general overview of the development of delta and vega in the past decade and continue with the specifics on the summary statistics and differences in CEO pay between the financial and non-financial industries.

Yearly comparisons For financial firms, there is a general positive trend in the level of delta (Figure 7). Since 2009 it has increased steadily from $253,000 to $369,000 in 2016, where it also reaches its highest level. For vega, the level differs more throughout the sample period but is generally higher in the last four years of our sample where it varies between $69,000 and $103,000.

Also, for non-financial firms, the overall level of delta has increased since 2008 from a value of $183,000 to $304,000 in 2016 (Figure 8). The same trend is evident for vega, which has increased from $41,000 in 2008 to $99,000 in 2016.

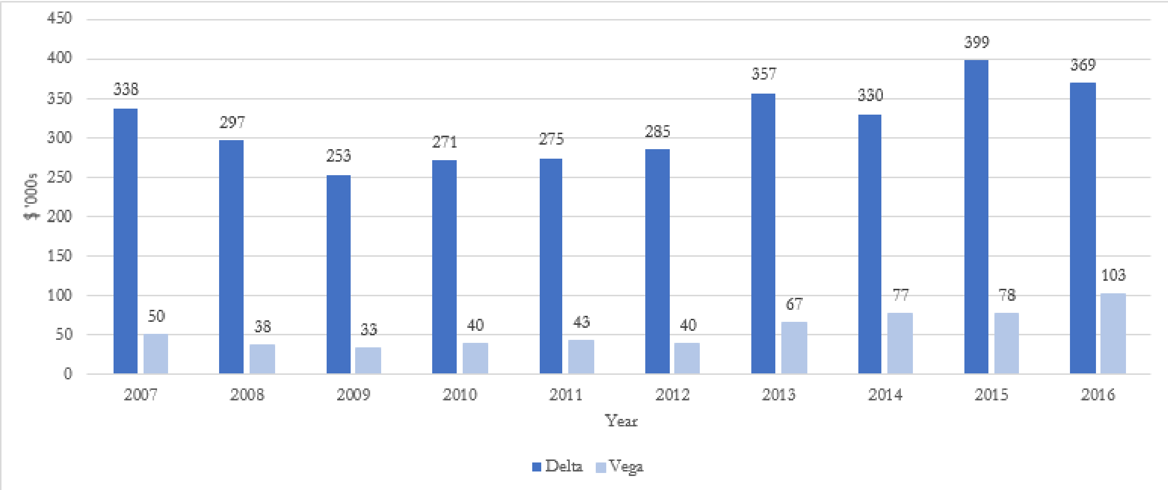


Figure 7 provides a yearly comparison of the development in the level of delta and vega in our sample of financial firms. Source: Compustat, ExecuComp; 2018.

Figure 7: Yearly comparison: Delta and vega - financial firms

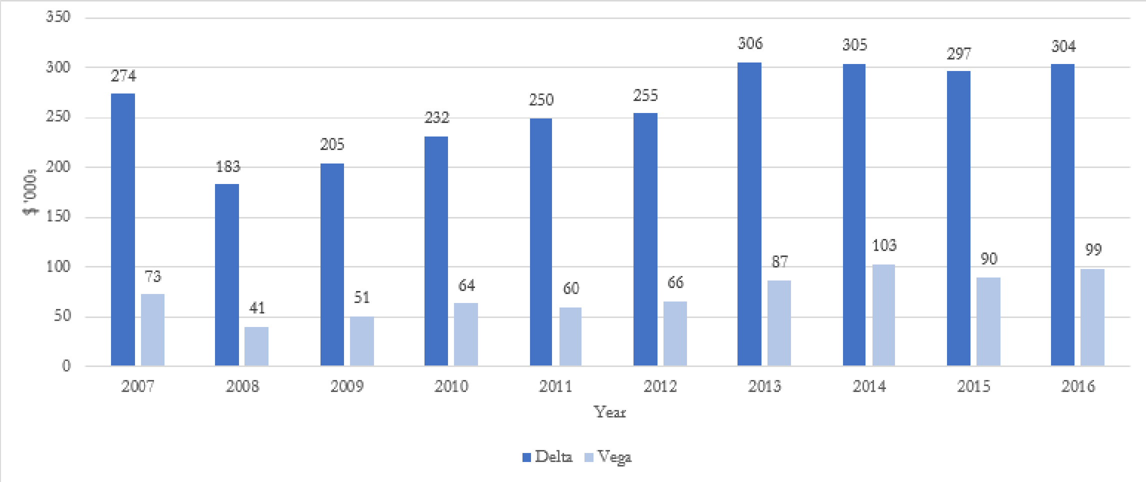


Figure 8 provides a yearly comparison of the development in the level of delta and vega in our sample of non-financial firms. Source: Compustat, ExecuComp; 2018.

Figure 8: Yearly comparison: Delta and vega - non-financial firms

Statistic	Mean	Median	St. Dev.	Min	Max
Delta	277.4	112.3	403.5	9.1	1,602.9
Vega	72.7	26.6	105.7	0.1	391.6
ln(delta)	4.7	4.7	1.4	2.2	7.4
ln(vega)	2.8	3.3	2.2	−2.6	6.0

Table 3 provides summary statistics for measures of delta and vega in our sample of 4,309 firm-year observations. All dollar values are in thousands.

Table 3: Descriptive statistics - delta and vega

Delta Delta has a mean (median) value of $277,400 ($112,300) equivalent to a value in logs of 4.7 (4.7). This indicates that the average change in the option portfolio value for a 1% change in stock price is $277,400. The variable in logs appears to be normally distributed as the median is similar to the mean. The difference in mean values of the logarithm of CEO delta in financial and non-financial firms of 4.9 and 4.7 respectively is significant at a 1% level (see appendix 14.7). This indicates that CEOs of financial firms have a slightly stronger pay for performance sensitivity than CEOs of non-financial firms.

Vega Vega has a mean (median) value of $72,700 (26,600) equivalent to a value in logs of 2.8 (3.3). This indicates that the average CEO enjoys an increase of $72,700 in his option portfolio for a 0.01 unit increase in stock return volatility. The variable in logs is negatively skewed as the median is larger than the mean. The large span in values is further underlined by the large standard deviation of $105,700 or 2.2 in logs. The difference in mean values for the logarithm of CEO vega in financial and non-financial firms of 2.3 and 3.0 respectively is significant at a 1% level (see appendix 14.7). This indicates that the pay of financial firm CEOs has a slightly weaker pay-sensitivity to risk than non-financial firm CEOs.

Control variables for compensation In the analysis, we use a number of control variables which are described in Table 4.

Statistic	Mean	Median	St. Dev.	Min	Max
Financial	0.212	0.000	0.409	0.000	1.000
Commercial	0.056	0.000	0.230	0.000	1.000
Regulation	0.600	1.000	0.500	0.000	1.000
Size	4,214,912.0	1,377,873.0	6,569,455.0	101,979.0	25,683,470.0
ln(size)	14.2	14.1	1.5	11.5	17.1
Performance	1.174	0.032	2.869	−0.914	10.383
Leverage (%)	46.1	40.7	33.0	2.1	100.0
Firm growth opportunities	6.9	1.8	11.4	0.1	43.8
Age	53.8	53.0	7.4	27.0	92.0
Risk (%)	36.1	35.4	11.7	12.0	75.3

Table 4 provides summary statistics for the independent variables in our 2007-2016 sample of 4,571 firm-year observations. All dollar values are in thousands.

Table 4: Descriptive statistics - independent variables

Firm size The mean indicates that the average firm in the sample has revenues equal to $4.2 billion translating into a value in logs of 14.2. The value compares to that found by Coles et al. (2006) of $3.8 billion indicating that the average firm size has increased since their sample period. The mean is slightly higher than the median of 14.1 indicating that the sample holds some considerably larger firms that increase the mean value. Further, the standard deviation and span of firm size of 1.5 is relatively low. This could be due to the fact that the smallest value is $102 M, which is relatively high, is making the potential differences smaller. In line with Gregg et al. (2012), our summary statistics indicate that the mean differences between CEOs of financial and non-financial firms are significant at a 1% level with values of 14.3 and 14.2 respectively (see appendix 14.7).

Performance The sample return for the average firm over the entire sample period is 117.4%. At first sight, this value seems extremely high. However, the median is much lower with a value of 3.2% indicating that the variable is heavily positively skewed. This indicates that, despite being winsorized at the 1st and 99th percentiles, the sample seems to contain some observations with extreme returns shooting the mean return to the roof. The huge standard deviation of 286.9% further confirms this remark, and not surprisingly, the minimum and maximum values are –91.4% and an excessive 1038.3% respectively. Further, the difference in returns is statistically significant at a 5% level in financial firms relative to non-financial firms with means of 106.4% and 119.7% respectively (see appendix 14.7). These returns are still high compared to those found by Gregg et al. (2012) finding mean values of 15.6% and 17.2% respectively. We also see that the returns of non-financial firms appear to be much more volatile than those of financial firms as it has a standard deviation that is 27.5 percentage points higher.

Leverage Leverage has an overall mean (median) value of 46.1% (40.7%). The value is higher than the average market leverage found by Conyon and He (2016) and Coles et al. (2006) of 20.0% and 15.0% respectively. However, in our sample, the span in terms of average leverage values is twice as high as other studies with a standard deviation of 33.0%. Also, the variable is positively skewed as the median is lower than the mean. In terms of the difference across the financial and non-financial industries, the average leverage for financial firms is significantly higher than that of non-financial firms with means of 68.8% and 40.0% respectively (see appendix 14.7). The span of leverage levels is slightly larger in non-financial firms as the standard deviation is 2.6 percentage points higher.

Firm growth opportunities Firm growth opportunities measured by Tobin's Q has a mean equal to 6.9, which is much larger than the median of 1.8. The mean of the measure can be interpreted as the market in general expects the firms in the sample to be able to create more value in their assets than if other companies were holding the same assets. Compared to Conyon and He (2016) who find a mean (median) of 1.7 (1.4), the mean is much higher while the median is more in line with our results. This can partly be explained by our standard deviation of 11.4 and is also reflected in the huge differences in values between the min (0.1) and max (43.8). Similar to the majority of the other control variables, there are significant differences between the Tobin's Q for financial and non-financial firms with means of 9.6 and 6.2 respectively (see appendix 14.7). In line with literature emphasizing the constraints of regulations on growth opportunities, this suggests that the market believes that, on average, financial firms have fewer growth opportunities relative to non-financial firms. Still, the mean values seem excessive, and the median values of 3.1 and 1.6 respectively for financial and non-financial firms suggest that the distributions in both groups are positively skewed.

Age The average age of a CEO in our sample is 53.8 years with a median of 53.0 suggesting a relatively normal distribution of ages across the sample. Together with the standard deviation of 7.4 years, this suggests that the firms in our sample tend to have CEOs with many years of experience (assuming that CEOs of a higher age have more experience). This is in line with values found in literature (Coles et al., 2006; Conyon and He, 2016). However, there is a wide range in CEO age (from 27 to 92) indicating that CEO age varies a lot between firms. According to the two-sample t-test, the difference in mean CEO age in financial and non-financial firms is significant with mean values of 54.6 and 53.6 respectively (see appendix 14.7). However, in both cases, it indicates that experience is attractive for CEOs across industries.

Risk The level of risk in terms of the annualized standard deviation of stock returns is 36.1% on average for firms in our sample. The data is slightly positively skewed as the median is equal to 35.4% indicating there are a few more volatile firms pulling up the average. The means of financial and non-financial firms of 31.8% and 36.6% appear to be significantly different (see appendix 14.7).

Summary of control variables Consequently, the majority of control variables tell a similar story concerning a broad span in values and thereby a high standard deviation. Also, most of the variables seem to be significantly different between financial and non-financial firms, which together with the empirical literature review further justifies the need for the above-mentioned control variables in the subsequent regressions.

10.2.2 Extension: Differences within the financial industry

To examine the differences within the financial industry, this section highlights the significant differences between commercial and non-bank financial firms in our sample. Insignificant differences will not be considered. The descriptive statistics and mean difference tests for all variables can be found in appendix 14.8.

Compensation variables Of the compensation variables, the level of salary appears to be the only one that is not significantly different between commercial banks and non-bank financial firms.

Total compensation appears to be significantly lower in commercial banks relative to the remaining firms in the financial industry. On average, the CEO of a commercial bank receives $3.5 M (7.7 in log levels) in total pay, which is $1.6 M (0.4 in log levels) lower than for CEOs of financial firms that are not commercial banks. This is constituted of a lower level of bonuses (-$164,300), stock awards (-$859,300) and option awards (-$179,500). All differences are significant at the 1% level.

The structure of pay within the financial industry also seems to differ. For commercial banks, salary and stock awards are the most important compensation components. Relative to the remaining firms in the financial industry, salary is a bigger part of total CEO pay, whereas bonus, stock awards and option awards constitute a smaller part of total pay. Specifically, salary constitutes 33.2% of total pay, which is 10.6 percentage points higher than the salary of CEOs of non-bank financial institutions. Bonus constitutes 4.3% of total pay, 1.5 percentage points less than CEOs of non-bank financial institutions. Stock and option awards take up 25.0% and 6.2% of total pay, which is respectively 8.6 and 0.9 percentage points lower than for the remaining financial institutions. For all structure variables, these differences are statistically significant at the 1% level, except for the percentage of stock options, which is significant at the 5% level.

Control variables For all control variables, aside from firm size and performance, there seem to be significant differences between the mean values of commercial banks and non-bank financial firms. In terms of leverage, commercial banks have a mean (median) of 85.4% (69.3%), whereas non-bank financial firms have a lower mean (median) of 63.0% (69.3%). The standard deviations are 19.0% and 34.5% for commercial and non-bank financial institutions respectively. The level of growth opportunities differs significantly with means (medians) of 8.0 (2.4) and 5.6 (0.9) respectively for commercial and non-bank financial firms. The variable is highly volatile as the standard deviations of 12.5 and 11.5 are much larger than the means. Also, in terms of average CEO age there seem to be significant differences. Commercial banks have a mean (median) CEO age of 55.7 (55.0), while non-bank financial firms have a mean (median) CEO age of 54.2 (54.0). The standard deviations are in line with the total sample with values of 6.9 and 7.8 respectively for commercial and non-bank financial firms in the subsample. Finally, commercial banks have a significantly lower mean (median) in terms of risk than that of non-bank financial institutions with levels of 29.9% (28.1%) and 33.0% (30.2%) respectively.

Delta and vega Both delta and vega are significantly different within the financial industry. The mean (median) value of CEO delta in commercial banks is $293,500 ($81,800) equivalent to a value in logs of 4.6 (4.4), while the mean (median) value in non-bank financial institutions is $444,300 (155,500) equivalent to a value in logs of 5.1 (5.0). This indicates that CEOs of commercial banks on average have a lower pay-performance sensitivity relative to the CEOs of the rest of the financial industry. The mean (median) value of CEO vega in commercial banks is $33,400 (5,300), equivalent to a value in logs of 1.4 (1.7), while the mean (median) value in non-bank financial institutions is $74,400 (29,000) equivalent to a value in logs of 2.7 (3.4). Looking at the un-transformed values, this implies that CEOs of commercial banks on average have a lower pay-sensitivity to risk relative to CEOs of the rest of the financial industry.

10.2.3 Multicollinearity check

The tests for multicollinearity include a correlation matrix of the independent variables included in our regression as well as a table of the VIF for the included control variables, as mentioned in our statistical considerations section.

Correlation matrix High correlations between the variables included in a regression typically lead to wider confidence intervals, insignificant t-ratios and high sensitivity of the OLS estimators and standard errors to small changes in the data. Accordingly, multicollinearity significantly complicates precise estimation. Therefore, the correlation matrix is applied to check for potential correlations between our control variables in the models for compensation structure and level as well as for vega and delta respectively.

	Size	Performance	Leverage	Firm growth opportunities	Age	Risk
Size	1.00					
Performance	0.19	1.00				
Leverage	0.00	0.24	1.00			
Firm growth opportunities	-0.29	-0.16	0.09	1.00		
Age	0.03	-0.05	0.01	0.01	1.00	
Risk	0.00	0.42	0.22	-0.15	-0.04	1.00

Table 5 provides Pearson correlation matrix of the control variables for the compensation structure and level regressions.

Table 5: Correlation matrix

	Size	Performance	Leverage	Firm growth opportunities	Age	Risk	Delta	Vega
Size	1.00							
Performance	0.19	1.00						
Leverage	0.00	0.09	1.00					
Firm growth opportunities	-0.43	-0.21	0.25	1.00				
Age	0.03	-0.05	0.04	0.03	1.00			
Risk	0.00	0.38	-0.11	-0.23	-0.01	1.00		
Delta	-0.01	-0.28	-0.04	0.18	0.24	-0.27	1.00	
Vega	0.00	-0.25	-0.13	0.11	0.02	-0.22	0.52	1.00

Table 6 provides Pearson correlation matrix of the control variables for the delta and vega regressions.

Table 6: Correlation matrix

Pearson correlations range from –1 to 1, where a correlation of 1 means that the variables are perfectly collinear. In terms of detecting multicollinearity, there is however no absolute number that we can cite to conclude that multicollinearity is a problem (Wooldridge, 2012). When examining our correlation matrices (Tables 5 and 6), none of the variables have correlations that are close to 1 and all values are below 0.52. The highest intercorrelation between two variables is that between delta and vega. This makes sense as we assume that CEO vega and CEO delta are jointly determined in line with DeYoung et al. (2013). Due to the relatively small sizes of the intercorrelations between our included dependent variables, we do not believe that any of the control variables will cause any problems for the regressions in terms of multicollinearity.

VIF table VIF values are examined to confirm the lack of multicollinearity in our model specifications as indicated above. The VIF measures how much a variable is contributing to the total standard error in the regression. If the VIF is close to 10, it indicates a high degree of multicollinearity in the model (Wooldridge, 2012). The VIFs for the control variables in the models for compensation structure and level as well as for vega and delta respectively are displayed in Tables 7 and 8.

Variable	**VIF**	**1/VIF**
Size	1.71	0.58
Performance	1.32	0.76
Leverage	1.86	0.54
Firm growth opportunities	1.64	0.61
Age	94.59	0.01
Age^2	94.23	0.01
Risk	1.46	0.69

Table 7 provides the VIFs and 1/VIF for the control variables for the compensation structure and level regressions.

Table 7: VIF

Variable	**VIF**	**1/VIF**
Size	1.33	0.75
Performance	1.29	0.77
Leverage	1.38	0.72
Growth opportunities	1.52	0.66
Age	127.42	0.01
Age^2	127.23	0.01
Risk	1.38	0.72
Delta	1.24	0.81
Vega	1.21	0.83

Table 8 provides the VIFs and 1/VIF for the control variables for the delta and vega regressions.

Table 8: VIF

As all the VIFs are close to 1, there does not appear to be any multicollinearity present in our models. The only variables with a VIF above 10 are the age variables as both the age term as well as the age squared are included. However, when excluding the squared term, we obtain a VIF below 2 and the conclusion of no multicollinearity holds. A multicollinearity check on the regression models for the analysis of commercial and non-bank financial firms yielded similar results.

10.2.4 Summary of descriptive statistics

In sum, we find that there has been an overall increase in the level of total compensation, salary, level of shares granted as well as in the level of delta and vega. Over the same period, there has been a decrease in the level of option awards. Additionally, the summary statistics suggest significant differences in executive compensation between financial and non-financial firms in terms of total compensation, bonus, option awards as well as the fraction of salary, bonus, stock awards and option awards. Also, the levels of delta and vega seem to be significantly different. The differences will be further tested in the regression analysis below. Finally, we have confirmed that our regressions will not be biased from multicollinearity by setting up a correlation matrix and studying the VIF values.

10.3 Results

The following section will examine if the indicated differences in CEO compensation packages between financial and non-financial firms hold when including our control variables and controlling for robust standard errors. Initially, the model specifications of our regressions will be described followed by a thorough examination of the regression results for each of our four main hypotheses.

10.3.1 Empirical specification

We estimate the following regressions for the analysis of compensation level (salary, bonus, option awards, stock awards):

$$\begin{aligned}\text{Dependent level variable} = \text{Financial} + \text{Year} + \text{Size}_{t-1} + \text{Performance}_{t-1} + \text{Leverage} \\ + \text{Firm growth opportunities}_{t-1} + \text{Age} + \text{Age}^2 + \text{Risk}_{t-1} \quad (1)\end{aligned}$$

We estimate the following regressions for the analysis of compensation structure (individual compensation variables salary, bonus, option awards and stock awards divided by total compensation):

$$\begin{aligned}\text{Dependent structure variable} = \text{Financial} + \text{Year} + \text{Size}_{t-1} + \text{Performance}_{t-1} + \text{Leverage} \\ + \text{Firm growth opportunities}_{t-1} + \text{Age} + \text{Age}^2 + \text{Risk}_{t-1} \quad (2)\end{aligned}$$

We estimate the following regressions for the analysis of delta and vega:

$$\begin{aligned}\text{Delta} = \text{Financial} + \text{Year} + \text{Vega} + \text{Size}_{t-1} + \text{Performance}_{t-1} + \text{Leverage} \\ + \text{Firm growth opportunities}_{t-1} + \text{Age} + \text{Age}^2 + \text{Risk}_{t-1} \quad (3)\end{aligned}$$

$$\begin{aligned}\text{Vega} = \text{Financial} + \text{Year} + \text{Delta} + \text{Size}_{t-1} + \text{Performance}_{t-1} + \text{Leverage} \\ + \text{Firm growth opportunities}_{t-1} + \text{Age} + \text{Age}^2 + \text{Risk}_{t-1} \quad (4)\end{aligned}$$

We estimate the following regressions for the analysis of pay sensitivities after 2010:

$$\text{Delta} = \text{Financial} + \text{Regulation} + \text{Vega} + \text{Size}_{t-1} + \text{Performance}_{t-1} + \text{Leverage} + \text{Firm growth opportunities}_{t-1} + \text{Age} + \text{Age}^2 + \text{Risk}_{t-1} \quad (5)$$

$$\text{Vega} = \text{Financial} + \text{Regulation} + \text{Delta} + \text{Size}_{t-1} + \text{Performance}_{t-1} + \text{Leverage} + \text{Firm growth opportunities}_{t-1} + \text{Age} + \text{Age}^2 + \text{Risk}_{t-1} \quad (6)$$

To investigate executive compensation level, we use the natural logarithm of total compensation, salary, bonus, stock awards and option awards as dependent variables. To examine pay structure, we use the level of salary, bonus, stock awards and option awards, each divided by total compensation, as the response variable. To examine delta and vega we use the natural logarithm of vega and delta respectively as dependent variables. Lastly, to examine the effect of regulations we use the natural logarithm of vega and delta respectively.

The main independent variable of interest is the financial dummy indicating whether or not the firm is a financial institution. Therefore, the implicit control group in each of these models is all other firms who are constituents of the S&P 1500 index. Consistent with existing studies on executive compensation in financial and non-financial institutions, our specifications control for firm size (revenue$_{\text{t-1}}$), performance (return$_{\text{t-1}}$), leverage, firm growth opportunities (Tobin's Q$_{\text{t-1}}$), the executive's age and risk$_{\text{t-1}}$. Also, we control for time-specific effects by using a dummy for years 2007-2016. Finally, in the equations investigating the effect of regulation, we insert a regulation dummy for years after 2010 as well as an interaction term between the financial firm dummy and the regulation dummy for years after 2010. Also, for equations with delta and vega as dependent variables, we include the natural logarithm of delta (in vega regression) and vega (in delta regression), in line with DeYoung et al. (2013). For ease of exposition, we use the same notation to represent the original as well as the transformed variables in the following sections describing our results. For instance, we let "total compensation" represent the natural logarithm of total compensation. In all specifications, the standard errors are adjusted for potential heteroskedasticity, cross-sectional dependence and autocorrelation by using clustered standard errors.

10.3.2 Regression results

The regressions based on the empirical specifications in section 10.3.1 are shown below. Tables 9-10 reports estimates from regressing total compensation, salary, bonus, option awards and stock awards (model equation 1 displayed above) on the financial firm dummy and contemporaneous control variables. Here and throughout, reported t-statistics and p-values are based on robust standard errors. Table 11 reports estimates from model equation 2. Table 12 reports estimates from model equations 3 and 4. Table 13 reports estimates from model equations 5 and 6.

	Dependent variable:		
	Total compensation	Salary	Bonus
	(1)	(2)	(3)
Financial	−0.532***	−0.219***	0.061
	(0.116)	(0.058)	(1.120)
Size	0.073**	0.023*	0.030
	(0.028)	(0.013)	(0.209)
Performance	−0.059***	−0.016**	−0.033
	(0.013)	(0.006)	(0.109)
Leverage	0.814***	0.405***	0.248
	(0.140)	(0.070)	(1.199)
Firm growth opportunities	0.014***	0.005***	0.020
	(0.003)	(0.002)	(0.033)
Age	0.120*	0.053	−0.016
	(0.071)	(0.042)	(0.293)
Age^2	−0.001*	−0.0004	0.0004
	(0.001)	(0.0004)	(0.002)
Risk	−1.301***	−0.670***	0.780
	(0.364)	(0.180)	(3.958)
Constant	3.594*	4.533***	4.357
	(1.973)	(1.159)	(9.041)
Year fixed effects	Yes	Yes	Yes
Observations	5,741	5,741	1,036
R^2	0.288	0.261	0.049
Adjusted R^2	0.286	0.259	0.034
F Statistic	136.172*** (df = 17; 5723)	118.897*** (df = 17; 5723)	3.085*** (df = 17; 1018)

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

Table 9: Regression output - compensation level (models 1-3)

	Dependent variable:	
	Option awards	Stock awards
	(4)	(5)
Financial	-0.792^{***}	-0.533^{***}
	(0.283)	(0.168)
Size	0.052	0.066
	(0.056)	(0.041)
Performance	-0.057^{**}	-0.079^{***}
	(0.028)	(0.022)
Leverage	0.619^{**}	0.914^{***}
	(0.260)	(0.203)
Firm growth opportunities	0.011	0.013^{***}
	(0.007)	(0.005)
Age	0.083	0.101
	(0.142)	(0.096)
Age^2	−0.001	−0.001
	(0.001)	(0.001)
Risk	-1.401^{*}	-1.025^{*}
	(0.769)	(0.527)
Constant	3.352	2.744
	(4.066)	(2.737)
Year fixed effects	Yes	Yes
Observations	5,741	5,741
R^2	0.193	0.225
Adjusted R^2	0.190	0.223
F Statistic	80.512^{***} (df = 17; 5723)	97.736^{***} (df = 17; 5723)
Note:		$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 10: Regression output - compensation level (models 4-5)

Hypothesis 1 In this section, we examine how the level of CEO compensation in financial firms relates to that of non-financial firms. As stated in our hypothesis, we expect that:

> *H1: CEOs of financial firms have a lower level of total compensation relative to CEOs of non-financial firms*

Our descriptive statistics and t-tests indicate that, on average, our hypothesis should be accepted. Financial firm CEOs earn in total $209,600 less than financial firm CEOs. However, the mean-difference tests performed do not control for firm-specific factors and robust standard errors. We do this in our regression results, that can be found in column 1 in table 9. Our results suggest that, as expected, financial firm CEOs are paid relatively less. Specifically, we find that financial firm CEOs have a 53.2% lower total compensation than non-financial firm CEOs. These results are significant at the 1% level and are consistent with the findings of Conyon and He (2016).

Additionally, to examine what drives the differences in total compensation, we have run four additional regressions on the main components of compensation, salary, bonus, stock awards and option awards. The summary statistics in appendix 14.7 show that financial firms on average have a significantly lower mean level of option awards and higher mean levels of bonus.

We find strong evidence consistent with the expected differences between CEO pay in financial and non-financial firms laid out in the hypotheses development in terms of salary, option awards and stock awards, and no differences in bonus levels. The results suggest that financial firm CEOs have a salary level which is 21.9% lower than for CEOs of non-financial firms. Further, CEOs of financial firms have a 79.2% lower mean value of option awards relative to CEOs of non-financial firms. Also for stock awards, financial firm CEOs have a 53.3% lower level relative to non-financial firm CEOs. In all three cases, the financial dummy is significant at a 1% level and thus has explanatory power. This is consistent with the findings in literature on CEO pay in financial firms relative to non-financial firms (Conyon and He, 2016) and on banks relative to non-banks (Houston and James, 1995). In the case of CEO bonuses, despite the slight positive value in the dummy coefficient, there are no discernible statistical differences between the two industry groups. The finding that financial and non-financial firm CEOs receive similar levels of bonus is equivalent to that of Conyon and He (2016).

	Dependent variable:			
	Salary %	Bonus %	Option awards %	Stock awards %
	(6)	(7)	(8)	(9)
Financial	0.071***	0.020***	−0.072***	−0.021
	(0.018)	(0.008)	(0.015)	(0.024)
Size	−0.011**	−0.001	0.002	0.003
	(0.005)	(0.002)	(0.004)	(0.006)
Performance	0.010***	0.0003	0.001	−0.008***
	(0.002)	(0.001)	(0.002)	(0.003)
Leverage	−0.077***	−0.020**	−0.033	0.082***
	(0.023)	(0.009)	(0.021)	(0.031)
Firm growth opportunities	−0.002***	−0.00000	0.001	0.001
	(0.001)	(0.0002)	(0.001)	(0.001)
Age	−0.013	−0.006	0.004	0.022*
	(0.009)	(0.005)	(0.009)	(0.013)
Age^2	0.0001	0.0001	−0.00004	−0.0002*
	(0.0001)	(0.00004)	(0.0001)	(0.0001)
Risk	0.128**	0.064**	−0.104*	0.006
	(0.061)	(0.025)	(0.057)	(0.081)
Constant	0.756***	0.159	0.077	−0.388
	(0.264)	(0.128)	(0.260)	(0.371)
Year fixed effects	Yes	Yes	Yes	Yes
Observations	5,741	1,036	5,741	5,741
R^2	0.183	0.067	0.074	0.115
Adjusted R^2	0.181	0.064	0.072	0.112
F Statistic	75.406*** (df = 17; 5723)	4.300*** (df = 17; 1018)	26.903*** (df = 17; 5723)	43.745*** (df = 17; 5723)

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

Table 11: Regression output - compensation structure (models 6-9)

Hypothesis 2 Next, we will cover the extent to which the CEO pay structure differs for financial firm CEOs relative to that of non-financial CEOs. As stated earlier, we hypothesize that:

> *H2: Cash compensation (salary and bonus) takes up a larger part of total pay and equity incentives take up a smaller part of total pay in the CEO compensation of financial firms relative to that of non-financial firms*

From the summary statistics, we found that, on average, the percentage of salary, bonus and stock awards to total pay are higher and that stock options as a percentage of total pay is lower for CEOs of financial firms than for CEOs of non-financial firms. Controlling for firm-specific effects and robust standard errors, the results from the regressions confirm these findings at the 1% level for salary, bonus and option awards. Specifically, we find that the fractions of salary and bonus are 7.1% and 2.0% higher and the fraction of option awards is 7.2% lower. This is consistent with the findings of Conyon and He (2016). The fraction of stock awards of financial firm CEOs appears to be lower than for non-financial CEOs, as expected. However, this difference is not significant. This conflicts with the results of Conyon and He (2016), who found that stock awards comprise a lower part of total pay for CEOs of financial firms.

	Dependent variable:	
	Delta	Vega
	(10)	(11)
Financial	0.167	−0.760**
	(0.198)	(0.320)
Size	0.036	0.052
	(0.044)	(0.072)
Performance	−0.054**	−0.059
	(0.022)	(0.045)
Leverage	−0.050	−0.401
	(0.253)	(0.392)
Firm growth opportunities	0.009	0.007
	(0.006)	(0.011)
Vega	0.298***	
	(0.034)	
Delta		0.808***
		(0.088)
Age	−0.087	0.217
	(0.117)	(0.201)
Age^2	0.001	−0.002
	(0.001)	(0.002)
Risk	−1.154*	−2.367**
	(0.654)	(1.063)
Constant	5.063	−6.414
	(3.440)	(5.883)
Year fixed effects	Yes	Yes
Observations	4,309	4,309
R^2	0.391	0.381
Adjusted R^2	0.389	0.379
F Statistic (df = 18; 4290)	153.019***	146.696***
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 12: Regression output - delta and vega (models 10-11)

Hypothesis 3a In the following, we will examine if the CEO pay for performance sensitivity is different across the financial and non-financial industries. Based on the literature review, we have hypothesized that:

> *H3a: CEO compensation delta is lower in financial firms relative to non-financial firms*

From the descriptive statistics, we find that financial firm CEOs in our sample have a significantly higher change in their portfolio value with a value of $320,200 for a 1% change in stock price than non-financial CEOs. The results from the pooled OLS are inconsistent with the hypothesized difference in delta levels, which can be seen in Table 12 (column 10). Controlling for firm-specific effects and robust standard errors, the coefficient on the financial dummy variable unexpectedly carries a positive sign (i.e. financial firm CEOs have lower levels of pay-performance sensitivity). However, this result falls short of statistical significance. As such, the sensitivity of CEO compensation to the performance of the firm appears to be similar for financial and non-financial firms.

Hypothesis 3b As a natural progression from delta, we examine the difference in vega values between financial and non-financial firms. Our hypothesis is that:

> *H3b: CEO compensation vega is lower in financial firms relative to non-financial firms*

The analysis of the summary statistics shows that financial firm CEOs have significantly lower levels of vega with an increase in the option portfolio value of $58,800 for a 0.01 unit increase in stock return volatility. When controlling for robust standard errors and our selected control variables we find that, as expected, the vega of financial firm CEOs on average is 76.0% lower than for CEOs of non-financial firms. Accordingly, the sensitivity of CEO pay to risk is 76.0% lower for CEOs of financial firms than their non-financial peers.

	Dependent variable:	
	Delta	Vega
	(12)	(13)
Regulation	0.067	0.481**
	(0.111)	(0.196)
Financial	0.065	−0.992**
	(0.277)	(0.477)
Size	0.037	0.053
	(0.044)	(0.072)
Performance	−0.053**	−0.056
	(0.021)	(0.045)
Leverage	−0.057	−0.415
	(0.254)	(0.394)
Firm growth opportunities	0.009	0.008
	(0.006)	(0.011)
Vega	0.299***	
	(0.034)	
Delta		0.817***
		(0.087)
Age	−0.088	0.230
	(0.116)	(0.198)
Age^2	0.001	−0.002
	(0.001)	(0.002)
Risk	−0.976	−2.455**
	(0.617)	(0.998)
Regulation*Financial	0.152	0.288
	(0.216)	(0.431)
Constant	5.072	−6.580
	(3.417)	(5.785)
Year fixed effects	Yes	Yes
Observations	4,309	4,309
R^2	0.388	0.373
Adjusted R^2	0.386	0.372
F Statistic (df = 11; 4297)	247.658***	232.388***
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 13: Regression output - delta and vega (models 12-13)

Hypothesis 4a Further, we consider if there has been a change to the level of delta in financial firms following the Dodd-Frank Act of 2010. Specifically, we hypothesize that:

H4a: Following the Dodd-Frank Act in 2010, CEO delta is higher. This effect is weaker in financial firms relative to non-financial firms

In the summary statistics, we saw increasing values of delta in financial and non-financial firms. The regression shows a positive sign for the regulation dummy. However, the finding is insignificant suggesting that delta has not changed after 2010. Also, the financial firm dummy is positive implying that CEOs of financial firms have a higher level of delta relative to CEOs of non-financial firms before 2011. But similarly to the regulation dummy, this association is insignificant indicating that there is no difference in the level of delta between CEOs of financial and non-financial firms. Finally, the interaction term is positive indicating that the difference in delta is larger after the regulation for financial firms relative to non-financial firms. However, this difference is insignificant.

Hypothesis 4b Finally, we look at the differences in the sensitivity of CEO wealth to stock price volatility following the Dodd-Frank Act of 2010. As stated earlier, we hypothesize that:

H4b: Following the Dodd-Frank Act in 2010, CEO vega is lower. This effect is stronger in financial firms relative to non-financial firms

When looking at the descriptive statistics, we found that there has been a general increase in the level of vega across industries up until today. The data provides evidence that this increase in vega also is significant when controlling for other factors. The general level of vega seems to be 48.1% higher after 2010 relative to before. Also, the regression output suggests that CEOs of financial firms had a 99.2% lower level of vega relative to CEOs of non-financial firms before 2011. Finally, the interaction term is positive indicating that the difference in vega is larger after the regulation for financial firms relative to non-financial firms. However, this difference is not significant.

Control variables and model specification A poorly specified model can result in inaccurate point estimates and thus incorrect statistical inference (DeYoung et al., 2013). Generally, it should be noted that for all our regressions, the adjusted R-squared is no higher than 0.389. Thus, 38.9% is the maximum level of variability in the response variable that the selected predictors in the model together can explain (taken the number of predictors used in the model into account). The models for compensation structure exhibit the lowest adjusted R-squared values indicating that we are missing some relevant determinants of the dependent variable for these models especially.

Also, it is worth noting that the control variables used in our regressions tend to carry strong coefficients with reasonable signs for most of the models. First, firm size is significant and positively associated with compensation in terms of total compensation and the level of salary. This is in line with literature (Bebchuk and Grinstein, 2005; Conyon, 2013; Conyon and He, 2016; Gabaix et al., 2013; Gregg et al., 2012; Harjoto and Mullineaux, 2003; Murphy, 1999; Sierra et al., 2006). However, for the fraction of salary, size seems to have a negative effect. Surprisingly, firm size remains insignificant for the remaining variables indicating that it is not a significant determinant of those variables.

Second, performance is positively associated with the fraction of salary in line with several studies (Barro and Barro, 1990; Conyon, 2013; Conyon and He, 2016). However, for the majority of the remaining regressions, we surprisingly find a negative relationship indicating that negative returns improve compensation.

Third, we generally find that there is a positive correlation between leverage and compensation indicating that highly leveraged firms pay their CEOs more. However, leverage seems to correlate negatively with the use of salary and bonus in the design of compensation structures. Finally, leverage does not seem to be associated with changes in delta and vega, in contrast with literature (John and John, 1993).

Fourth, the relationship between growth opportunities and compensation tend to be either positive or insignificant, while the relationship between growth opportunities and pay-performance is insignificant. The positive relation is in line with literature (Conyon and He, 2016; Harjoto and Mullineaux, 2003; Sierra et al., 2006). However, the insignificant relation for vega is in contrast with Belkhir and Chazi (2010) who find that BCHs with more growth opportunities have higher vega.

Fifth, for age we either see a positive, inverse U-shaped quadratic relation or an insignificant relationship. The quadratic relation is in line with Cole and Mehran (2010) and Conyon and He (2016).

Finally, risk tends to be negatively associated with compensation as well as the pay-sensitivity variables and is only insignificant in two cases. The negative association is in line with literature on pay-performance measures (Harjoto and Mullineaux, 2003) as well as literature on compensation level and structure (Sierra et al., 2006).

As none of the control variables in Table 9 (column 3) for bonus are significant, it is possible that there are other determinants of bonus that we have not controlled for.

10.3.3 Extension: Commercial banks vs non-banks financial institutions

In this section, we will elaborate on the findings above in terms of potential differences within the financial industry.

Compensation level and structure The summary statistics indicate that the two parts of the financial industry differ in terms of all compensation variables, aside from salary. In the pooled regressions we only find that there are significant differences in terms of total compensation, the level of stock awards and the fraction of salary as a percentage of total pay. Specifically, the data suggest that commercial bank CEOs receive a 52.2% lower level of total compensation than their peers in non-bank financial institutions. Also, we see that CEOs of commercial banks receive an 80.6% lower value of stock awards. Finally, the significant and positive coefficient for salary as a percentage of total pay indicates that commercial bank CEOs receive a 10.1% higher fraction of salary compared to CEOs of non-bank financial institutions in line with Tian and Yang (2014). For the remaining regressions, the commercial dummy remains insignificant indicating no significant differences within the financial industry on these parameters.

Delta and vega The descriptive statistics indicated that commercial bank CEOs had significantly lower levels of delta and vega than CEOs of non-bank financial institutions. However, there appears to be little evidence that this is true when controlling other factors. In the OLS regressions 23 and 24 (appendix 14.11) neither of the coefficients for commercial banks are significant implying there are no differences in terms of delta and vega within the financial industry.

Impact of regulation The insignificant coefficients on the regulation dummy and commercial dummy in the delta and vega regressions indicate that there are no differences in delta or vega following the regulation. Neither does there seem to be any differences within the financial industry before the regulation.

Generally, it should be noted that for all our regressions, the adjusted R-squared is no higher than 0.417. Thus, 41.7% is the maximum level of variability in the response variable that the selected predictors in the model together can explain (taken the number of predictors used in the model into account). Similar to the regressions on the differences between the financial and non-financial industries, the models for compensation structure exhibit the lowest adjusted R-squared values indicating that we are missing some relevant determinants.

10.3.4 Robustness check

To confirm the experimental validity and reliability of our results, several robustness checks are performed. First, we run the regression with standard errors clustered by fiscal year instead of by firm to allow model errors within a year to be correlated, as elaborated in section 9.2.4. Second, we run the regressions with different measures for the control variables – e.g. use assets as a measure of firm size and CEO tenure as a measure of human capital. Third, we include additional explanatory variables such as CEO ownership, CEO duality and control for industry using the 12 SIC code groups. In all cases, the results are qualitatively similar.

Additionally, we include an interaction effect for fiscal year and the financial firm dummy in all regressions. This was done to control for a difference in the dependent variable in either of the two industries in a specific year. Also, we wanted to see if the effect of the DFA was different in any year for financial firms relative to non-financial firms. A similar check was done for the commercial/non-bank financial firm sample. Similarly, the results are qualitatively similar and there does not appear to be any significant differences in any specific years either. Finally, we examine the results when all firms are present in all years (balanced panel dataset). This reduces the sample size from 1,024 firms to 326 firms. Though the sizes of the coefficients differ, the results are also qualitatively the same in this case. Full results are available from the authors upon request.

10.3.5 Summary of results

In summary, from the empirical analysis a number of the proposed hypotheses are confirmed. The hypotheses on a lower level of total compensation (H1) and a lower vega (H3b) of CEOs of financial firms relative to CEOs of non-financial firms are accepted, while the remaining hypotheses are either partly accepted (H2) or rejected (H3a, H4a, H4b). As expected, we see some structural differences in CEO compensation within the financial industry. Finally, our results are qualitatively robust when running a number of robustness checks. The results will be further discussed in the following section.

11 Discussion

The discussion will evaluate the findings of our empirical analysis and is structured according to our three sub-research questions introduced in section 3.2. The first part attempts to explain the level and structure of CEO compensation in the financial industry relative to the non-financial industry, drawing on findings from H1 and H2. The second part discusses the differences in delta and vega in the financial and non-financial industries thereby incorporating H3a and H3b. The final part focuses on the overall effect of the DFA of 2010 and industry differences based on H4a and H4b. To elaborate on the dynamics of executive pay within the financial industry, we also extend our analysis to highlight potential differences between commercial banks and the remaining financial firms in the financial sector.

In each of the three parts of the discussion, we will start by highlighting key results from our study, then propose plausible explanations for the findings followed by a discussion of limitations associated with the study design. Finally, a number of implications will be listed.

11.1 Part 1: Differences in CEO compensation level and structure of CEOs between financial and non-financial firms

As hypothesized in H1, our results show that, controlling for a number of firm and CEO specific characteristics, the total pay level is lower for CEOs of financial firms relative to CEOs of non-financial firms. The lower level of pay is driven by a lower level of salary, stock and options. Similarly, we find that, as hypothesized in H2, there are structural differences in the compensation in terms of higher fractions of cash compensation and a lower fraction of options for CEOs of financial firms. However, contradictory to our expectations, there appear to be no differences in the fraction of shares awarded to the CEOs of financial and non-financial firms in our sample during the year. Within the financial industry, the CEOs of commercial banks appear to receive lower absolute levels of total pay and stock awards as well as a lower fraction of salary relative to the CEOs of non-bank financial firms.

There are several possible reasons for the outlined findings. Regarding the level of compensation, the lower level of equity incentives (stock and options) can help to explain why CEOs of financial firms have lower levels of fixed compensation in terms of salary. The Economist (2016) reports that executives can demand higher premiums in their fixed compensation to compensate for the higher pay-risk associated with holding larger amounts of equity incentives as this increases the variability of their final pay. As the overall level of equity incentives is lower in financial firms, this could imply that CEOs of financial firms require a lower premium in terms of salary, as their final pay is more certain. Also, financial firms in our sample appear to be less risky (31.8%) relative to non-financial firms (36.6%), strengthening the assertion that financial firm CEOs require lower premiums.

As hypothesized, it is probably more likely that the lower level of pay observed in financial firms is due to regulatory monitoring and limited growth opportunities rather than a reflection of optimal pay-setting. The Economist (2016) proposes a number of suggestions for why the arguments of optimal contracting in reality are weak. More specifically, the argument that pay is determined by market forces may not hold due to the violation of two key characteristics of a well-functioning market in real life. First, the liquidity condition is flawed as the market for CEOs appears to be quite illiquid with an average CEO tenure in S&P 500 firms of 9 years between 2001 and 2014. Second, the requirement of transparency and knowledge of the product being traded is challenged. As boards are unable to estimate a fair “market price” before setting CEO compensation, they cannot measure exactly how much value a certain CEO will add. Also, Bebchuk and Fried (2004) support this critique and provide empirical evidence against optimal contracting as elaborated in section 5.2.4. Regulatory monitoring and the lower level of growth opportunities could also be affecting commercial banks in particular which is indicated by their lower levels of stock relative to the remaining financial firms. The lower level of stocks could explain the lower levels of total pay.

Our results of higher fractions of fixed salary for CEOs in the financial industry could potentially reflect the implementation of TARP in 2008. Specifically, a number of banks that received TARP assistance increased their base salaries. This was likely to offset the lack of variable and incentive pay in terms of bonuses and options as the regulatory

requirements hampered the ability of CEOs to earn the same returns as in prior years. These changes positively impacted the relative salary level (Deloitte US, 2018). Combined with pressure from stakeholders of financial institutions to dial back risk-taking, one might also expect an overall higher fraction of salary for CEOs in the rest of the financial industry relative to CEOs in the non-financial industry. The arguments above are also applicable to the higher fraction of salary for banks relative to the remaining financial industry, as a large part of TARP recipients were commercial banks. However, some institutions - like Goldman Sachs, JPMorgan, Bank of America and Morgan Stanley - completed their repayments already in 2009 (The New York Times, 2009b), so the implementation of TARP is most likely not the only explanation for the higher fractions of salary for financial firm CEOs.
In terms of equity compensation, the relatively lower levels of options and shares seem to be in line with the Financial Stability Board's guidelines that focus on prudent risk-taking in compensation packages (Financial Stability Forum, 2009).
Consequently, the results for compensation structure are overall in line with the governance effect of regulation, fewer growth opportunities in financial firms compared to non-financial firms and the characteristics of cash compensation as described in section 8.2.

Our results did not provide support to our hypotheses on stock compensation as we observe a similar fraction of stock paid to CEOs across the financial and non-financial industry. Possible explanations for these findings might relate to our model specification or possible spillover effects. In terms of our model specification, Jaggia and Thosar (2017) argue that there are some concerns related to comparing financial and non-financial firms in empirical studies. Financial firms are usually excluded from empirical studies due to their distinctive characteristics. However, it is imperative for our study to be able to compare actual, numeric differences between the industries. Thus, we have attempted to mitigate this difficulty by basing our control variables on research also contrasting the pay in financial and non-financial firms (Conyon and He, 2016; DeYoung et al., 2013). An alternative way to account for the structural differences would have been to standardize the variables by time period and sector (Jaggia and Thosar, 2017).

The surprising results on the compensation of financial firms might be driven by unobserved heterogeneity in our model specification. Although we control for a number of CEO and firm characteristics, we cannot entirely rule out the assumption of strict exogeneity, meaning that the coefficients of our key variables might be biased. This is also reflected in the relatively low value of the adjusted R-squared in our regression models 1-9. Particularly, the adjusted R-squared for the models concerning compensation structure indicates that we are missing some relevant determinants for the dependent variables. These two issues with model specification apply to all our results.

Finally, the unexpected results can potentially be explained by a spillover effect. Our study deals with very large firms (>$100 M in revenue), and such firms likely have highly skilled and experienced individuals on boards who are able to manage the complexities of such operations. Candidates with this set of skills may be hard to find. Thus, board members, and compensation committee members specifically, could serve on several boards or compensation committees across the financial and non-financial industries. Accordingly, cross-industrial board members may advocate for similar compensation structures with respect to certain components, such as stock fractions. This is especially relevant for the comparison between the CEOs of commercial banks to CEOs of other financial firms, where our data suggests that there are few differences. To detect such effects, we could e.g. have included a variable capturing the number of compensation committee memberships and board seats held by a specific director across financial and non-financial industries.

Our study carries several implications for CEO compensation in financial firms. First, it seems that CEOs of financial firms cannot be criticized for excessive pay levels in the same way as before the GFC. Conyon and He (2016) show that, before the crisis, financial firm CEOs receive higher levels of total compensation relative to non-financial firm CEOs. Therefore, it is not surprising that the CEOs of financial institutions received massive levels of criticism in media for contributing to the downfall of the economy and getting rich while doing so. However, according to our findings, it seems that following the crisis, CEOs of financial firms are paid less - both in terms of relative total compensation as well as each individual component (aside from bonus level which appear to be similar). This is emphasized by The Economist (2012) and McRitchie (2016) reporting that the most "overpaid" CEOs (measured by profit growth and shareholder return compared to peers) in 2008-2010 and 2015 respectively are employed outside the financial sector. As a matter of fact, one of the 10 most underpaid CEOs in 2008-2010 is the CEO of Citigroup Vikram Pandit mentioned in the introducing remarks of the thesis. Second, our finding that CEO compensation in financial firms consists of a relatively higher fraction of cash compensation and a lower fraction of options suggests that CEOs of financial firms might pursue strategies that are relatively less long-term oriented, compared to the CEOs of non-financial firms. Also, as it seems like CEOs of financial firms are less incentivized for taking on risky projects, it could mean that the strategies they pursue are correspondingly less risky. In commercial banks, the effect seems to be even stronger than in the remaining financial industry. These findings suggest that, overall, some other elements of pay should be put in place in order to incentivize them to pursue long-term oriented policies. Also, the focus on short-term incentives in commercial banks may be explained by the nature of their business model. Commercial banks without an investment banking arm do not have a ton of bells and whistles they can add to a retail bank operation. They can take deposits and make loans and, with some exceptions, that is about it.

11.2 Part 2: Differences in delta and vega between CEOs of financial and non-financial firms

Regarding delta, our results are somewhat surprising. Contrary to general findings of literature and our hypothesis, we find that delta of financial firm CEOs is not significantly lower than that of non-financial CEOs in our sample. Relative to other financial firms, bank CEOs seem to have a lower delta, although the result is not statistically significant either. Thus, delta appears to be similar for CEOs across the financial and non-financial industries as well as within the financial industry. In terms of vega, our results confirm that the pay-risk sensitivity of financial firm CEOs is 76.0% lower than that of non-financial firm CEOs. There are however no significant differences between CEO compensation in banks and non-banks within the financial industry.

It seems like CEOs of financial firms may have deltas that are equally high to those of non-financial firm CEOs. There are several potential explanations for this. First, higher levels of delta can encourage CEOs to reduce risk-taking (DeYoung et al., 2013). A higher delta lets managers share gains and losses with shareholders (Coles et al., 2006), exposing them to the downside risk of the firm. Assuming that boards of financial firms wish to minimize risk-taking, they might implement a higher level of delta for CEOs. This effect is likely stronger in banks relative to non-bank financial firms because of their role as one of the most important liquidity providers and stabilizers in the economy.

Moreover, a factor that possibly increases the level of delta in financial firms is a provision in the US tax code that favors performance-linked compensation. Section 162(m) of the IRS Code, which was put in place in 1993 and lasted through December 2017, encouraged firms to link executive compensation to performance metrics by limiting the amount of tax-deductible pay at $1 M. An exclusion was made for pay that was sufficiently contingent on some form of performance metric. The change resulted in companies increasing the share of options, restricted shares and incentive bonuses to capture the tax deductions. Salary and other guaranteed payments in excess of $1 M were not eligible for deduction (Center on Executive Compensation, 2018). Thus, because of the tax code, even financial firms may have been inclined to rely more on equity awards to reward their CEOs in the extent similar to non-financial firms, even when this might be less optimal for financial firms.

An explanation for the fact that financial firm CEOs receive (ceteris paribus) similar levels of delta compared to non-financial firm CEOs might be that the substitution effect of regulations is not as strong as expected. In the setting of agency theory, the goal of ownership stakes is to align objectives of managers and owners. However, the main objective of regulations in the financial and banking industry is to ensure an efficient and competitive financial system and monetary and financial stability, as well as to protect depositors and consumers (Spong, 2000). Thus, the primary goal is not to align the incentives of shareholders and managers. Therefore, regulation might not be efficient enough to reduce the need for equity incentives significantly. If this is the case, the expected substitution effect might not be observed and the pay-performance sensitivity will be similar across industries as in our results.

Regarding vega, the lower level of vega in financial firms relative to non-financial firms is substantial and signals that there are some underlying characteristics of financial firms that induce their boards to encourage less risk-taking. First, as explained in section 6.2.2, the lower vega is in line with literature emphasizing the overall systemic importance of financial firms to the overall economy. Second, the lower vega is also in line with priorities of a number of other stakeholders, such as regulators and the public. These stakeholders are directly (negatively) affected if systemically important financial institutions - and especially banks - go bankrupt. They will therefore prefer low-risk policies. Moreover, the high relevance of creditors as claimants on the firm's assets limits the downside risk born by equity holders in financial firms. If managers are rewarded with more options and their vega increases, this will increase their risk-taking appetites, thus further accentuating the agency costs of debt.

The surprising results in terms of delta can also come from biases in the chosen variable measures as well as limitations to data availability. There appears to be some odd dynamics in relation to delta in our sample, despite the fact that its calculation is based on acknowledged literature (Coles et al., 2006; DeYoung et al., 2013; Guay, 1999). The delta in our analysis is defined as the sum of the delta of the stock and option portfolio of the CEO. However, even though we see significantly lower stock and option values for CEOs of financial firms relative to CEOs of non-financial firms, this is not reflected in a lower overall delta, which seems strange.

The results could be explained by limitations in our measures of delta and vega. Though based on well-respected literature, these measures are somewhat incomplete as they exclude unexercisable shares (in the calculation of delta) and unearned option awards (in the calculation of delta and vega). Instead, such shares and options show up when they are exercised or earned respectively (typically several years later). The reason that they are excluded is due to the difficulty in estimating their actual value as it depends (positively) on the success in realizing certain performance targets. The consequence is a potential bias in our measure. For instance, if the pay-performance sensitivity of CEOs in financial firms is actually lower, this difference could have been captured by the unexercisable shares that are not included in our regressions. Similarly, if the pay-risk sensitivity of financial firm CEOs is lower for the excluded options, it would have further accentuated the significantly lower vega.

Also, our measures of delta and vega can be subject to bias due to a lack of data of inputs to the calculations. If the occurrence of missing data in our sample is not random, but due to some systematic error, our results might be subject to the measurement error related to delta and vega of CEOs in the financial and non-financial industry. Compared to the initial sample, when we eliminate the missing observations, the remaining sample of delta and vega is found to consist of larger firms with a higher mean of revenues ($5.5 billion) relative to our total sample ($4.2 billion). We also find that the remaining firms contain a slightly lower fraction of financial firms (19.9%) and a slightly higher fraction of commercial banks (8.3%) relative to our total sample (21.2% and 5.6% respectively). Thus, our results might be affected by sample selection bias.

Our findings on delta and vega have several implications. First, it appears that the delta of CEO pay does not vary between the two industry groups. It might be that the compensation committees in financial institutions are balancing two opposing preferences in regard to incentive structures. On one side, debtholders push for a lower delta as they do not have any upside potential to gain when the CEO pursues risky projects. On the other side, when debtholders are present, shareholders benefit from a higher delta as they are less exposed to downside risk. As delta is the same, and not lower, for CEOs in financial firms relative to those in non-financial firms, it seems that the importance of debtholders is lower in the eyes of compensation committee members relative to what we expected. The relevance of debtholders relative to shareholders may also have decreased following the financial crisis due to the increased focus on shareholder voice (The Financial Times, 2018).

Moreover, the comparable levels of delta across industries might reflect that managers generally prefer similar levels of pay for performance. For instance, if managers in general are more risk-averse, they will prefer lower deltas and higher fractions of fixed compensation. If indeed, firms search for leaders with general rather than firm-specific managerial skills and therefore search for managers in the same talent pool, they might adjust the compensation accordingly to attract the best talent.

Finally, the denunciation of excessive risk levels in executive compensation for CEOs of financial industries might be unjust. While the accusations may have been justified prior to the financial crisis, it seems as if CEO compensation in financial firms over the past decade promotes a lower level of risk (reflected in a lower vega) relative to that in non-financial firms. A recent example of a non-financial firm with a noteworthy executive compensation package after the crisis is the case of Valeant Pharmaceuticals. The pay program of the CEO at the time, Michael Pearson, had far higher risk levels than that of any financial firm CEO and the compensation package appeared to reward risky acquisitions without regard to the negative, long-term implications (Forbes, 2016). The result was that Valeant's stock price plummeted from its peak by more than 90% while the company debt levels exceeded $30 billion (ibid.).

11.3 Part 3: The effect of the Dodd-Frank Act on the nature of CEO compensation in financial and non-financial firms

We find conflicting results with regard to the impact of the DFA. Delta is not significantly higher after 2010 controlling for firm- and CEO-specific effects as expected in H4a - it actually appears to be unchanged. Also, opposite to our expectations in H4b, we find that vega increases overall after 2010. There does not seem to be any difference in the effect of regulation between financial and non-financial firms nor any significant differences within the financial industry for any of the hypotheses 4a or 4b. Within the financial sector, we find that vega is higher for commercial banks after 2010.

There are a number of possible reasons for our findings. Compared to literature, our results of a higher vega following the DFA contradict with our inferences from the findings of Chen et al. (2006), i.e. that vega should decrease following a regulation. The findings also contradict with literature proposing formal regulations as a substitute to strong internal incentive systems (Adams and Mehran, 2003; Qian and John, 2003; Sierra et al., 2006; Webb, 2008).

In particular, the unchanged delta is unexpected. One of the goals of the DFA was to close the gap between executive remuneration and actual performance (Dunning, 2010) as mentioned in section 6.1. Therefore, it seems strange that the pay-performance sensitivity has remained the same after the introduction of the Act. Also, building stock ownership and implementing stock retention guidelines can help a firm to ensure long-term viability and reduce risk-taking as the CEO acquires a meaningful stake in the firm (Deloitte US, 2018). As more stock ownership implies a higher level of stock awards, this should positively impact the value of delta. Therefore, it is surprising that a regulation that focuses on increasing shareholder power which, among other things, would imply more stock ownership, does not appear to have a significant effect on delta. Further, the finding on delta is against evidence from Correa and Lel (2016) who find that "Say on Pay" legislations have increased pay-performance sensitivity in a number of countries. Even though the DFA includes such a legislation, the pay-performance sensitivity is unchanged in our sample.

A potential explanation for the unchanged delta can be that while the overall level of stock may be the same, the underlying composition can have changed. Originally, most stock used in executive compensation had service-based vesting conditions meaning that the executive is granted a given amount of shares each year for a certain number of years that the executive offers his services to the company. However, shares with a performance-based vesting condition entail that the manager is rewarded with a number of shares depending on how well he meets performance targets. Accordingly, this type of shares offers a closer pay for performance relationship than stock with a service-based vesting condition. Thus, if there has been a shift from service-based to performance-based vesting conditions, pay could have become closer linked to performance without it showing in our measure of delta.

Additionally, the implementation of the "Say on Pay" votes can have led to more homogeneous pay structures across firms. As discussed in section 6.1.1, the influence of proxy advisory firms on the size and shape of executive compensation plans has increased following the implementation of "Say on Pay" votes. To avoid negative recommendations from proxy advisory firms, one could expect that pay packages have become increasingly tailored to meet advisory firm standards (Dunning, 2010). If this is the case, the differences in pay packages across industries would decrease and the effect could be a high similarity in the level of delta across firms.

In relation to our findings on vega, the results contradict with literature which indicates that regulations result in fewer firm growth opportunities and lower levels of vega (Bai and Elyasiani, 2012; Crawford et al., 1995; DeYoung et al., 2013; Hubbard and Palia, 1995). As a matter of fact, our findings suggest the exact opposite implying that regulations actually accentuate risk volatility, and potentially also impact firm growth opportunities positively.

The insignificant differences of the regulatory effect on the pay sensitivities of financial firm CEOs to performance and risk relative to those of non-financial firm CEOs were also surprising. Despite the DFA attempting to tighten regulations on the financial services sector, the most important provisions were not imposed on financial firms specifically, but rather for all firms. As such, this could explain the similar response for the two industry groups to the regulation.

Finally, the insignificant differences in the regulatory effect between industries for delta are against the findings of DeYoung et al. (2013) who explain that a higher delta can lead to risk-shifting incentives in industries with a high relevance of debtholders.

Consequently, it seems like regulation and deregulation may not exhibit the exact opposite effects as we expect them to do. In our hypotheses development, we have inferred that the effects found on compensation following deregulation, exemplified by the GLBA, could be the exact opposite of the response to a regulation like the DFA. A potential reason for why we cannot observe the relationships identified in our literature review is that vega and delta in practice may be "sticky down" (ibid., p. 171). This means that delta and vega can easily be adjusted upwards by granting more stock and options. However, due to old option grants that have not yet been exercised and shares that have accumulated from past compensation contracts, the board's ability to adjust vega or delta downwards is much more limited.

In relation to our study design, there may be several reasons for the unexpected results on the effects of the DFA. These are related to our model specification, spillover effects and the impact of proxy advisory firms. First, a reason could be found in our choice of sample period. We look at the changes between the periods 2007-2010 and 2011-2016. However, in the aftermath of the financial crisis, the government introduced several regulations before the DFA. Thus, the firms that did not receive government bailout money from TARP can have anticipated a change in the regulatory landscape for all firms at a later point. Accordingly, the effects in executive compensation we expected to see following the DFA may already have taken place before its introduction. To capture this potential effect, we could have expanded the time horizon backward.

Also, following the reasoning of H1 and H2 in section 11.1, there may be spillover effects in boards across industries which result in similar compensation structures, even following a regulation, which we have not controlled for.

The findings may have several implications. First, the unchanged delta can imply that the firms have not shifted to a larger focus on funding from shareholders over borrowing through granting larger CEO ownership stakes. This contradicts the new capital recommendations encouraging equity rather than debt funding (The Financial Times, 2018). Second, the higher level of vega can result in a more risk-taking environment as CEOs are compensated for stock return volatility. Especially the findings of a significantly higher vega in commercial banks seem a bit worrying as institutions which function as the foundation of the economy appear to encourage their top executives to pursue more risky projects. However, the findings may rather be a result of TARP than of the DFA as one could argue that TARP in some ways incentivizes firms to become bigger and more risk-taking to obtain or maintain a status of TBTF. This allows firms to plausibly rely on government bailing the firm out if things go south. Additionally, as the effect on vega is especially strong in commercial banks, it suggests that the FDIC insurance mechanism may not be working as expected. Instead of protecting the overall economy from instability, it could function as an encouragement for CEOs to take on more risky investments as the firm to some degree is protected from downside risk.

Further, the higher vega following the 2010 regulations could imply larger premiums on deposits and insurance premiums if depositors and deposit insurers take the increased risk of executive compensation into account (Bai and Elyasiani, 2012). Finally, it seems like the DFA has successfully given shareholders a bigger say in line with one of the overall regulation goals. From the increased pay-risk sensitivity of CEO pay, it seems like the power has shifted more to shareholders following the regulation. As an example, in 2007 the CEO of JP Morgan, James Dimon, received a total compensation of $27.8M of which 55.8% was in the form of cash compensation (SEC, 2008). In 2016, Mr. Dimon received a total pay of $27.2M of which 24.1% was cash-based (SEC, 2017).

11.4 Summary of discussion

In the discussion, we find several possible explanations for our results. We also find that the results could be biased due to unobserved heterogeneity, the general difficulty in comparing financial and non-financial firms in empirical studies and limitations in our measures of delta and vega. Finally, we propose a number of implications. These include that CEOs of financial firms may pursue strategies that are less long-term oriented and less risky relative to CEOs of non-financial firms. Also, the substitution effect of regulations may be lower than we expected. Moreover, it seems like the DFA has successfully given shareholders a bigger say in line with one of the overall regulation goals.

12 Conclusion

This thesis finds that there are significant differences in executive compensation of financial firms relative to non-financial firms. Also, although the pay-risk sensitivity (vega) has increased following the DFA, the differences in CEO compensation of financial and non-financial institutions do not appear to have changed significantly. Also, there appears to be differences between CEO compensation in commercial banks and non-bank financial firms.

The study finds its grounds in the aftermath of the financial crisis where executive compensation received extensive amounts of negative attention from the media, the public and regulators. Financial institutions have been harshly criticized for excessive risk-taking, weak governance structures and absurd pay levels. However, some aspects of executive compensation are not represented in the critique. For instance, little attention is paid to the fact that components of CEO compensation which are sensitive to risk and performance, such as options and restricted stock, suffered substantial value losses during the GFC (Deloitte US, 2018). For executives who received large amounts of compensation in the form of equity, the substantial drop in stock prices following the crisis implied major losses of their wealth as the initial example from the introduction shows.

The study examines executive compensation in the financial and non-financial industries in the US using 2007-2016 data in firms listed in the S&P 1,500 index. Specifically, we seek to find whether there are differences in the executive compensation of financial firms relative to non-financial firms and whether these differences have changed following the DFA. This is interesting to examine due to the role of financial firms, and banks, to the society as a whole. As providers of capital, financial liquidity and economic confidence, their actions reach far beyond the intentions of their business models. It is important to note that our findings do not promote any causal relationships but rather describe industry differences. To conclude causality, a more thorough analysis with more detailed data is necessary.

Our empirical analysis shows that the level of total pay is 53.2% lower for CEOs of financial firms relative to CEOs of non-financial firms, as expected. The difference is driven by a lower salary level (-21.9%) as well as a lower value of options (-79.2%) and stock awards (-53.3%). In terms of compensation structure, we find that, as expected, CEOs of financial firms receive a 7.1% and 2% higher fraction of their total pay in salary and bonus respectively and a 2.2% lower fraction of their pay in options relative to CEOs of non-financial firms.

We argue that these dynamics are due to the high levels of regulatory monitoring of financial institutions as a consequence of their importance to the overall economy. This yields a substitution effect of regulation on the incentives of managers by reducing the level of equity. Further, we argue that regulations limit the investment opportunity set of the manager which reduces the need for equity-based incentives. Combined with the fact that financial firms – and commercial banks in particular – are less risky, this may cause the manager to require a lower premium on his pay.

Opposite to expected, the pay structure in terms of stock incentives appears to be similar for executives across the financial and non-financial industry. We explain this similarity by spillover effects, unobserved heterogeneity and bias from the difficulties in comparing financial and non-financial sectors.

Our results may have a number of implications. It seems that CEOs of financial firms may pursue strategies that are less risky compared to CEOs of non-financial firms. Also, it appears that the criticism directed towards executive pay in financial firms after the crisis is somewhat unjust as overall pay levels seem to be lower relative to that of CEOs in non-financial firms in our sample.

Regarding delta, we show that, unlike other findings in the literature (e.g. Core and Guay, 2010; Qian and John, 2003), CEOs of financial firms may have deltas that are equally high as those of non-financial firm CEOs. This could be explained by boards in financial firms wanting to minimize risk-taking combined wit tax deductions favoring performance-based compensation. Also, the results can be explained by a weaker substitution effect of regulations on financial firm compensation relative to what we expected. Finally, the surprising results can derive from a bias in our sample selection or an incomplete measure of delta and vega (despite applying measures defined in acknowledged literature). The findings on delta can imply that managers generally prefer similar levels of pay for performance. Also, it could mean that compensation committees in financial institutions are balancing the two opposing preferences of debtholders and shareholders in regard to incentive structures.

Furthermore, when looking to vega, we provide empirical evidence that CEOs of financial firms receive a vega that is 76.0% lower than that of non-financial firm CEOs. The findings can be explained by the relative importance of debtholders in financial institutions as well as the importance of financial institutions to the overall economy. Finally, the findings are in line with priorities of other stakeholders, such as regulators and the public. However, for commercial banks and non-bank financial firms, the expected effect of the relative differences in the importance of debtholders does not appear to be strong enough to cause differing levels of vega. These results could imply that accusations of excessive risk levels for financial firm CEOs after the crisis may be unjust as it appears that they are less rewarded for risk relative to non-financial firm CEOs.

Looking into the dynamics of compensation after the DFA, we find that vega increases. The findings can imply a more risk-taking environment as CEOs are compensated for stock return volatility. Taking this into account one could expect larger deposit and insurance premiums. More importantly, it seems like the DFA has succeeded in giving more power to shareholders in line with one of the overall regulation goals.

Also, in contrast to our expectations, we find no change in delta following the implementation of the DFA. The results can be due to the fact that delta is "sticky down" or due to spillover effects across boards and compensation committees. The findings could also be explained by a potential shift in the use of service-based stock to performance-based stock, or increasingly homogeneous pay structures following the implementation of "Say on Pay"-votes. Moreover, the results imply that generally firms have not shifted to a larger focus on funding from shareholders over borrowing as proposed by new capital requirements.

Our findings further suggest that the differences in the degree of sensitivity to performance and risk between financial and non-financial firms have not significantly changed following the DFA. Even though the DFA attempted to tighten regulation in the financial services sector, the most important provisions were not imposed on financial firms specifically, but rather on all firms. This could explain our surprising findings.

The study contributes to existing literature in several ways. First, the focus area of our study is a topic that has not yet received much attention in the corporate governance literature. Financial institutions are often excluded from analyses due to their distinct characteristics, and if investigated, they tend to be examined alone. Thus, this thesis adds to the knowledge on the distinctive features of executive compensation in financial firms and why it might differ from CEO remuneration in non-financial firms. Second, the majority of literature investigates the effect of regulation in periods of deregulation rather than in those of stricter regulation. Also, the studies that analyze the impact of regulation only cover a few years after the implementation. Thus, this study sheds further light on the impact of regulation on executive compensation with an expanded time horizon.

Finally, to answer new questions raised by this study, further research is needed. Elaborations on potential future research are provided in the final section below.

12.1 Future research

In the process of writing this thesis, we disregard a number of interesting sub-topics, even though they would have made the research more complete. The following section is dedicated to discussing the most relevant of such topics for future research.

The first factor that would have been interesting to examine is whether our findings would apply in another setting. One setting of interest is smaller and unlisted firms. For instance, one could expect that pay-performance sensitivity would be less necessary as the manager may be the largest owner or as managers may feel more responsible for the firm's success in smaller firms. Another interesting change of setting would be to conduct the same study in a different geographic region. In particular, it would be interesting to examine if the findings also apply in e.g. Europe where regulators have focused more on bonus caps (Reuters, 2013), but also implemented rules for "Say on Pay". Macey and O'Hara (2003) indicate that the Anglo-American and Franco-German approaches to governance differ in terms of shareholder focus. It could be of interest to examine how this, combined with the more concentrated ownership structure in Europe, would affect dynamics of shareholder importance and agency costs. Moreover, it would be relevant to expand the period of interest to some years before the implementation of the GLBA to see if our inferences on regulation/deregulation hold in our sample. Also, applying a longer time span both before and after the DFA may allow us to assess the impacts of regulation better as we could make a relative comparison with a time period before the regulation.

The second topic that would be interesting to examine is how our results may have changed with better information quality and a parallel qualitative study. First, in our elimination of missing observations, we are forced to leave out a large number of firms from the initial sample indicating the information quality is not adequate if the aim is to get a complete overview of US-listed firms. With the trend of increasing disclosure, it will be possible to collect more data which better reflects the entire population in the near future. Better information might help to shed some light on our unexpected findings, especially on vega, delta and bonus where our data for many firms was the most insufficient. Second, a parallel qualitative study composed of case studies of selected financial institutions as well as interviews with compensation committee members and industry experts could have nuanced the findings of our study.

Lastly, the relation between realized and expected pay could be examined. For instance, if stock awards are based on performance conditions which are not met, the CEO's realized pay will be lower than the expected. Thus, it would be of interest to compare expected pay with subsequent regulatory filings to compare differences.

13 References

Acrey, J., McCumber, W. and Nguyen, T. (2010). CEO incentives and bank risk. *Journal of Economics and Business*, 63(5), pp.456-471.

Adams, R. (2012). Governance and the Financial Crisis. *International Review of Finance*, 12(1), pp.7-38.

Adams, R. and Mehran, H. (2003). Is Corporate Governance Different for Bank Holding Companies?. *Economic Policy Review*, 9(1), pp.123-143.

Adams, R. and Mehran, H. (2012). Bank Board Structure and Performance: Evidence for Large Bank Holding Companies. *Journal of Financial Intermediation*, 21(2), pp.243-267.

Agarwal, A. and Nagarajan, N. (1990). Corporate Capital Structure, Agency Costs, and Ownership Control: The Case of All-Equity Firms. *The Journal of Finance*, 45(4), pp.1325-1331.

Alai, P. (2010). The Impact of the Financial Crisis on Trade and Investment. *The American Society of International Law.*

Bai, G. and Elyasiani, E. (2012). Bank stability and managerial compensation. *Journal of Banking Finance*, 37(3), pp.799-813.

Baker, G. and Hall, B. (2004). CEO Incentives and Firm Size. *Journal of Labor Economics*, 22(4), pp.767-798.

Baltagi, B. (1998). *Panel Data Methods.* In: A. Ullah, ed., Handbook of Applied Economic Statistics, 1st ed. CRC Press, pp.291-324.

Baltagi, B. (2013). *Econometric analysis of panel data.* 3rd ed. Chichester: John Wiley Sons Inc.

Baltagi, B. (2015). *The Oxford handbook of panel data.* 2nd ed. Oxford University Press, pp.149-171.

Barro, J. and Barro, R. (1990). Pay, Performance, and Turnover of Bank CEOs. *Journal of Labor Economics*, 8(4), pp.448-481.

Bebchuk, L. and Fried, J. (2004). *Pay without Performance: The Unfulfilled Promise of Executive Compensation.* 1st ed. First Harvard University Press.

Bebchuk, L. and Grinstein, Y. (2005). The Growth of Executive Pay. *Oxford Review of Economic Policy*, 21(2), pp.283-303.

Belkhir, M. and Chazi, A. (2010). Compensation Vega, Deregulation, and Risk-Taking: Lessons from the US Banking Industry. *Journal of Business Finance Accounting*, 37(9-10), pp.1218-1247.

Berk, J. and DeMarzo, P. (2017). *Corporate Finance.* Pearson.

Bodolica, V. and Spraggon, M. (2015). *Mergers and Acquisitions and Executive Compensation.* 1st ed. Taylor Francis.

Bryan, S., Nash, R. and Patel, A. (2006). Can the agency costs of debt and equity explain the changes in executive compensation during the 1990s?. *Journal of Corporate Finance*, 12(3), pp.516-535.

Bryman, A. and Bell, E. (2015). *Business Research Methods.* Oxford: Oxford University Press.

Cai, J., Garner, J. and Walking, R. (2009). Electing Directors. *The Journal of Finance*, 64(5), pp.2389-2421.

Center on Executive Compensation. (2018). *Tax Code §162(m) - Deductibility of Executive Compensation.* [online] Available at: http://www.execcomp.org/Issues/Issue /tax-treatment-of-executive-compensation/tax-code-162m-deductibility-of-executive -compensation [Accessed 5 May 2018].

Chan, M., Lin, C., Liang, H. and Chen, M. (2014). Does CEO incentive pay improve bank performance? A quantile regression analysis of US commercial banks. *Annals of Financial Economics*, 09(02)

Chen, C., Steiner, T. and Whyte, A. (2006). Does stock option-based executive compensation induce risk-taking? An analysis of the banking industry. *Journal of Banking Finance*, 30(3), pp.915-945.

Choe, C., Tian, G. and Yin, X. (2014). CEO power and the structure of CEO pay.

International Review of Financial Analysis, 35, pp.237-248.

Coates, J. (2007). The Goals and Promise of the Sarbanes–Oxley Act. *Journal of Economic Perspectives*, 21(1), pp.91-116.

Cole, R. and Mehran, H. (2010). What can we learn from privately heldfirms about executive compensation?. *MPRA Paper*. [online] Available at: https://mpra.ub.uni-muenchen.de/29183/ [Accessed 12 May 2018].

Coles, J., Daniel, N. and Naveen, L. (2006). Managerial incentives and risk-taking. *Journal of Financial Economics*, 79(2), pp.431-468.

Conyon, M. (2013). Executive Compensation and Board Governance in US Firms. *The Economic Journal*, 124(574), pp.F60-F89.

Conyon, M. and He, L. (2016). *CEO compensation in US financial institutions*. In: C. Mallin, ed., Handbook on corporate governance in financial institutions. Edward Elgar Publishing, pp.87-121.

Cooper, E. and Kish, A. (2014). Executive compensation and securitization: pre-and post-crisis. *The Journal of Risk Finance*, 15(4), pp.437-457.

Core, J. (2000). The Directors' and Officers' Insurance Premium: An Outside Assessment of the Quality of Corporate Governance. *Journal of Law, Economics, Organization*, 16(2), pp.449-477.

Core, J. and Guay, W. (1999). The use of equity grants to manage optimal equity incentive levels. *Journal of Accounting and Economics*, 28(2), pp.151-184.

Core, J., Holthausen, R. and Larcker, D. (1999). Corporate governance, chief executive officer compensation, and firm performance. *Journal of Financial Economics*, 51(3), pp.371-406.

Core, J. and Guay, W. (2002). Estimating the Value of Employee Stock Option Portfolios and Their Sensitivities to Price and Volatility. *Journal of Accounting Research*, 40(3), pp.613-630.

Core, J., Guay, W. and Larcker, D. (2003). Executive Equity Compensation and Incentives: A Survey. *Economic Policy Review*, 9(1), pp.27-50.

Core, J. and Guay, W. (2010). Is There a Case for Regulating Executive Pay in the Financial Services Industry?. *SSRN Electronic Journal.*

Core, J., Holthausen, R. and Larcker, D. (1999). Corporate governance, chief executive officer compensation, and firm performance. *Journal of Financial Economics*, 51, pp.371-406.

Correa, R. and Lel, U. (2016). Say on pay laws, executive compensation, pay slice, and firm valuation around the world. *Journal of Financial Economics*, 122(3), pp.500-520.

Crawford, A., Ezzell, J. and Miles, J. (1995). Bank CEO Pay-Performance Relations and the Effects of Deregulation. *The Journal of Business*, 68(2), pp.231-256

Cuaresma, J. (2002). The Gramm-Leach-Bliley Act. *Berkeley Technology Law Journal*, 17, pp.497-517.

DeAngelo, H. and Stulz, R. (2013). Why High Leverage is Optimal for Banks. *NBER Working Paper*.

Deloitte US. (2018). *Executive Compensation: Plan, Perform Pay.* [online] Available at: https://www2.deloitte.com/us/en/pages/financial-services/articles /executive-compensation-plan-perform-pay.html [Accessed 5 May 2018].

DeYoung, R., Peng, E. and Yan, M. (2013). Executive Compensation and Business Policy Choices at U.S. Commercial Banks. *Journal of Financial and Quantitative Analysis*, 48(01), pp.165-196.

Dong, G. (2014). Excessive financial services CEO pay and financial crisis: Evidence from calibration estimation. *Journal of Empirical Finance*, 27, pp.75-96.

Dunning, A. (2010). The Changing Landscape of Executive Compensation after Dodd-Frank. *Review of Banking Financial Law*, 30, pp.64-72.

Edmans, A. (2016). *How to regulate CEO pay (and how not to do it)* | VOX, CEPR's Policy Portal. [online] Voxeu.org. Available at: https://voxeu.org/article/how-regulate-ceo-pay-and-how-not-do-it [Accessed 6 May 2018].

Edmans, A. and Gabaix, X. (2016). Executive Compensation: A Modern Primer. *Journal of Economic Literature*, 54(4), pp.1232-1287.

Ertugrul, M. and Hegde, S. (2008). Board compensation practices and agency costs of debt. *Journal of Corporate Finance*, 14(5), pp.512-531.

Fama, E. and French, K. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance*, 47(2), pp.427-465.

Federalreserve.gov. (2018). *FRB: Selected Interest Rates (Daily) - Historical Data - H.15*. [online] Available at: https://www.federalreserve.gov/releases/h15/data.htmfn11 [Accessed 11 Apr. 2018].

Financial Stability Forum (2009). *FSF Principles for Sound Compensation Practices.* [online] Available at: http://www.fsb.org/wp-content/uploads /r_0904b.pdf?page_moved=1 [Accessed 5 May 2018].

Flick, U. (2006). *An introduction to qualitative research.* 1st ed. London: Sage Publications.

Forbes. (2016). *Ex-Valeant CEO's Pay Structure May Have Increased Dangerous Risk-Taking, Study Says*. [online] Available at: https://www.forbes.com/sites/danielkleinman/2016 /06/08/ex-valeant-ceos-pay-structure-may-have-increased-dangerous-risk-taking-study-says /6e1542f670ed [Accessed 11 May 2018].

Frydman, C. and Jenter, D. (2010). CEO Compensation. *Annual Review of Financial Economics*, 2(1), pp.75-102.

Frydman, C. and Saks, R. (2010). Executive Compensation: A New View from a Long-Term Perspective, 1936–2005. *Review of Financial Studies*, 23(5), pp.2099-2138.

FW Cook (2017). *2016 Annual Incentive Plan Report*. [online] Available at: https: //www.fwcook.com/content/documents/publications/1-16-17_FWC_2016_Incentive_Plan _Report.pdf [Accessed 12 May 2018].

Gabaix, X. and Landier, A. (2008). Why Has CEO Pay Increased So Much?. Quarterly *Journal of Economics*, 123(1), pp.49-100.

Gabaix, X., Landier, A. and Sauvagnat, J. (2013). CEO Pay and Firm Size: An Update After the Crisis. *The Economic Journal*, 124(574), pp.F40-F59.

Goergen, M. and Renneboog, L. (2011). Managerial compensation. *Journal of Corporate*

Finance, 17(4), pp.1068-1077.

Gregg, P., Jewell, S. and Tonks, I. (2012). Executive Pay and Performance: Did Bankers' Bonuses Cause the Crisis?. *International Review of Finance*, 12(1), pp.89-122.

Gujarati, D. and Porter, D. (2009). *Basic Econometrics*. 5th ed. Singapore: McGraw-Hill/Irwin.

Hall, B. and Liebman, J. (1998). Are CEOs Really Paid Like Bureaucrats?. *The Quarterly Journal of Economics*, 113(3), pp.653-691.

Handley-Schachler, M., Juleff, L. and Paton, C. (2007). Corporate governance in the financial services sector. *Corporate Governance: The international journal of business in society*, 7(5), pp.623-634.

Harjoto, M. and Mullineaux, D. (2003). The Transformation of Banking and CEO Compensation. *The Journal of Financial Research*, 16(3), pp.341-354.

Himmelberg, C. and Hubbard, R. (2000). Incentive Pay and the Market for CEOs: An Analysis of Pay-For-Performance Sensitivity. *SSRN Electronic Journal.*

Holmstrom, B. (1979). Moral Hazard and Observability. *The Bell Journal of Economics*, 10(1), pp. 74-91.

Holmström, B. (2005). Pay Without Performance and the Managerial Power Hypothesis: A Comment. *The Journal of Corporation Law*, 30(4), pp.703-715.

Houston, J. and James, C. (1995). CEO compensation and bank risk Is compensation in banking structured to promote risk taking?. *Journal of Monetary Economics*, 36(2), pp.405-431.

Hubbard, R. and Palia, D. (1995). Executive pay and performance Evidence from the U.S. banking industry. *Journal of Financial Economics*, 39(1), pp.105-130.

Jaggia, S. and Thosar, S. (2017). Pay-for-performance incentives in the finance sector and the financial crisis. *Managerial Finance*, 43(6), pp.646-662.

Jensen, M. and Meckling, W. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), pp.305-360.

Jensen, M. and Murphy, K. (1990). Performance Pay and Top-Management Incentives. *Journal of Political Economy*, 98(2), pp.225-264.

John, K., Mehran, H. and Qian, Y. (2010). Outside monitoring and CEO compensation in the banking industry. *Journal of Corporate Finance*, 16(4), pp.383-399.

John, T. and John, K. (1993). Top-Management Compensation and Capital Structure. *The Journal of Finance*, 48(3), p.949.

Kirkpatrick, G. (2009). Corporate Governance Lessons from the Financial Crisis. Financial Market Trends. *OECD Journal*, pp.61-87.

Kroszner, R. and Rajan, R. (1994). Is the Glass-Steagall Act Justified?. *The American Economic Review*, 84(4), pp.810-831.

Larcker, D., McCall, A. and Tayan, B. (2013). And Then A Miracle Happens!: How Do Proxy Advisory Firms Develop Their Voting Recommendations?. *Stanford Closer Look Series.*

Lord, R. and Saito, Y. (2010). Trends in CEO compensation and Equity Holdings for SP 1500 Firms: 1994-2007. *Journal of Applied Finance*, 20(2), pp.40-56.

Macey, J. and O'Hara, M. (2003). The Corporate Governance of Banks. *FRBNY Economic Policy Review* April 2003.

MarketWatch. (2009). *Citigroup CEO pay, perks, stock-based awards $38.2M.* [online] Available at: https://www.marketwatch.com/story /citigroup-ceo-pay-perks-stock-based [Accessed 6 May 2018].

Mayers, D. and Smith, C. (1992). Executive Compensation in the Life Insurance Industry. *The Journal of Business*, 65(1), p.51.

McRitchie, J. (2016). *The 100 Most Overpaid CEOs.* [online] Corporate Governance. Available at: https://www.corpgov.net/2016/02/the-100-most-overpaid-ceos-take-action/ [Accessed 5 May 2018].

Mehrotra, V., Tian, G. and Yang, F. (2013). CEO Incentive Compensation in the U.S. Financial Services Industry. *International Review of Financial Analysis*, 34, pp.64-75.

Meridian Compensation Partners LLC (2011). *Stock Option Fundamentals.* Compensation Committee Handbook.

Meridian. (2016). *2016 CEO Pay Trends Report.* [online] Available at: http://www.meridiancp.com/insights/thought-leadership/2016-ceo-pay-trends-report/ [Accessed 28 Feb. 2018].

Minhat, M. and Dzolkarnaini, N. (2016). Is executive compensation a substitute governance mechanism to debt financing and leasing?. *Applied Economics*, 48(14), pp.1293-1302.

Murphy, K. (1999). *Executive compensation.* In: O. Ashenfelter and D. Card, ed., Handbook of Labor Economics. Elsevier Science BV, pp.2486-2557.

Murphy, K. (2013). Regulating Banking Bonuses in the European Union: a Case Study in Unintended Consequences. *European Financial Management*, 19(4), pp.631-657.

Oreilly, C. and Main, B. (2007). Setting the CEO's Pay:. *Organizational Dynamics*, 36(1), pp.1-12.

Ortiz-Molina, H. (2007). Executive compensation and capital structure: The effects of convertible debt and straight debt on CEO pay. *Journal of Accounting and Economics*, 43(1), pp.69-93.

Qian, Y. and John, K. (2003). Incentive Features in CEO Compensation in the Banking Industry. *FRBNY Economic Policy Review*, 9(1), pp.109-121.

Reuters. (2013). *Europe moves towards Swiss-style executive pay curbs.* [online] Available at: https://www.reuters.com/article/us-eu-pay-idUSBRE9250WM20130306 [Accessed 5 May 2018].

S&P Global. (2018). S*P Composite 1500® - SP Dow Jones Indices.* [online] Available at: https://us.spindices.com/indices/equity/sp-composite-1500 [Accessed 16 Apr. 2018].

Schneider, P. (2009). The Post-Stimulus Bill Era of Executive Compensation. *Journal of Financial Service Professionals*, pp.21-24.

Schneider, P. (2011). Dodd-Frank Financial Reform Legislation Addresses Executive Compensation. *Journal of Financial Service Professionals*, pp.27-31.

SEC (2008). *Proxy Statement Pursuant to Section 14(a) of the Securities Exchange Act of 1934* - JP Morgan. p.16.

SEC (2017). *Proxy Statement Pursuant to Section 14(a) of the Securities Exchange Act of 1934 - JP Morgan.* [online] Available at: http://investor.shareholder.com/JPMorganChase /secfiling.cfm?filingID=19617-17-340CIK=19617JPMC2017DEFINITIVEPROXY _HTM_S1AA7747DB170462975D7791C71B3ECC6 [Accessed 5 May 2018].

Siccode.com. (2018). *SIC Directory.* [online] Available at: https://siccode.com/en/siccode/list/directory [Accessed 16 Apr. 2018].

Sierra, G., Talmor, E. and Wallace, J. (2006). An Examination of Multiple Governance Forces within Bank Holding Companies. *Journal of Financial Services Research*, 29(2), pp.105-123.

Smith, C. and Watts, R. (1992). The investment opportunity set and corporate financing, dividend, and compensation policies. *Journal of Financial Economics*, 32(3), pp.263-292.

Sonenshine, R., Larson, N. and Cauvel, M. (2016). Determinants of CEO Compensation before and after the Financial Crisis. *Modern Economy*, 07(12), pp.1455-1477.

Spong, K. (2000). Banking regulation: its purposes, implementation, and effects. *Federal Reserve Bank of Kansas City.*

Statista. (2018). *Assets of U.S. financial institutions by type 2002-2015.* [online] Available at: https://www.statista.com/statistics/421749/financial-institutions-assets-usa-by-institution-type/ [Accessed 17 Apr. 2018].

Stock, J. and Watson, M. (2012). *Introduction to Econometrics.* Boston: Pearson Education.

The Conference board, NASDAQ and the Stanford Rock Center for Corporate Governance (2012). *The influence of proxy advisory firm voting recommendations on say on pay votes and executive compensation decisions.* [online] Available at: http://www.gsb.stanford .edu/cldr/research/surveys/proxy.html [Accessed 5 May 2018].

The Economist. (2012). *Executive pay and performance.* [online] Available at: https ://www.economist.com/blogs/graphicdetail/2012/02/focus-0 [Accessed 5 May 2018].

The Economist. (2016). *Cheques need balances.* [online] Available at: https ://www.economist.com/news/leaders/21701122-right-ways-fix-flawed-system-cheques-need-balances [Accessed 5 May 2018].

The Financial Crisis Inquiry Commission (2011). *THE FINANCIAL CRISIS INQUIRY REPORT*. [online] Available at: https://www.gpo.gov/fdsys/pkg/GPO-FCIC/pdf/GPO-FCIC.pdf [Accessed 12 May 2018].

The Financial Times. (2018). *Confusion over Basel bank capital requirements fails us all.* [online] Available at: https://www.ft.com/content/a7ad01a4-16fa-11e8-9c33-02f893d608c2 [Accessed 5 May 2018].

The New York Times. (2009a). *Citi Chief's Compensation Is $38.2 Million for '08.* [online] Available at: https://www.nytimes.com/2009/03/17/business/17citi.html [Accessed 6 May 2018].

The New York Times. (2009b). *JPMorgan and 9 Other Banks Repay TARP Money.* [online] Available at: https://dealbook.nytimes.com/2009/06/17/jpmorgan-repays-treasury-as-tarp-exits-continue/ [Accessed 11 May 2018].

The New York Times. (2013). *End of the Options Backdating Era.* [online] Available at: https://dealbook.nytimes.com/2013/08/19/end-of-the-options-backdating-era/ [Accessed 5 May 2018].

Tian, G. and Yang, F. (2014). *CEO incentive compensation in U.S. financial institutions.* International Review of Financial Analysis, 34, pp.64-75.

Tobin, J. (1969). A General Equilibrium Approach To Monetary Theory. *Journal of Money, Credit and Banking*, 1(1), pp.15-29.

Torres-Reyna, O. (2010). *Getting started with fixed/random effects models using R.* Princeton University.

Webb, E. (2008). Regulator Scrutiny and Bank CEO Incentives. *Journal of Financial Services Research*, 33(1), pp.5-20.

Wharton Valuation Associates. (2018). *Stock Option Accounting Under FAS 123R.* [online] Available at: http://www.whartonvaluation.com/stock-option-accounting-under-fas-123r/ [Accessed 5 May 2018].

Wintoki, M., Linck, J. and Netter, J. (2012). Endogeneity and the dynamics of internal corporate governance. *Journal of Financial Economics*, 105(3), pp.581-606.

Wooldridge, J. (2012). *Introductory Econometrics - A Modern Approach.* 5th ed. South-Western Cengage Learning.

WRDS. (2018). *Wharton Research Data Services.* [online] Available at: https://wrds-web.wharton.upenn.edu/wrds/ [Accessed 16 Apr. 2018].

Yermack, D. (1997). Good Timing: CEO Stock Option Awards and Company News Announcements. *The Journal of Finance*, 52(2), p.449.

Zhang, I. (2007). Economic consequences of the Sarbanes–Oxley Act of 2002. *Journal of Accounting and Economics*, 44(1-2), pp.74-115.

14 Appendix

14.1 Gauss-Markov theorem

If the following three least squares assumptions hold and if errors are homoscedastic, the OLS estimator is the "Best Linear conditionally Unbiased Estimator" (BLUE):

1. Linear model in parameters
2. E(u|x)=0 and E(u)= 0
3. No perfect multicollinearity

Source: Stock and Watson, 2012

A BLUE estimator possesses some statistically ideal or optimum properties and it means that the OLS estimator from the sample is the best estimate of the true population coefficient (Gujarati and Porter, 2009).

The Gauss-Markov theorem has two main limitations. First, its conditions rarely hold in practice. Especially the error term is often heteroskedastic. However, this can be solved with heteroskedasticity robust standard errors, though it implies that the OLS is no longer the efficient conditionally linear estimator (Stock and Watson, 2012). Second, if all conditions hold other estimators have shown to prove more efficient than OLS (Stock and Watson, 2012).

14.2 Heteroskedasticity

One of the main assumptions of the OLS regressions is the assumption of homoskedasticity, which roughly translates to equal (homo) spread (skedasticity), or equal variance (Gujarati and Porter, 2009). The assumption requires that the distribution of the error term conditional on the chosen values of explanatory variables has a mean of zero. The variance tells us how spread out the data are. If the variance of this conditional distribution does not depend on the value of the explanatory variable(s), that is, it is a constant, then the errors are said to be homoskedastic. Thus, under homoskedasticity we assume that the variance is constant for all observations. This implies that the data are equally spread out over our whole sample. If this is not the case, the error term is heteroskedastic (Stock and Watson, 2012). Learning effects, scale effects, technology improvement, outliers, skewness in the distribution of one or more regressors included in the model are some of the reasons why the variances of the error terms may vary (Gujarati and Porter, 2009).

For the OLS estimators to be unbiased, the three least squares assumptions described above must hold. Under heteroskedasticity, none of these variables are violated, such that the estimators are still linear and unbiased. However, heteroskedasticity implies that the estimates of their standard errors become biased in that they are no longer efficient with minimum variance (Stock and Watson, 2012). Thus, under heteroskedasticity the normal t- and F-statistics are no longer valid and we can no longer rely on the confidence intervals employed in the hypothesis tests. By using the usual homoskedastic variance formulas, the variance of the estimators will on average be over- or underestimated. Thus, conclusions or inferences drawn from the usual testing procedures (under homoskedasticity) are likely to be misleading (Gujarati and Porter, 2009).

14.3 Autocorrelation

The classical linear regression model assumes that the error term relating to any observation is not influenced by the error term relating to any other observation (Gujarati Porter, 2009). Symbolically:

$$cov(u_i, u_j | x_i, x_j) = E(u_i, u_j) = 0, i \neq j$$

In time series data the observations can have an intercorrelation, so an observation tends to be correlated with its value in the next period (Stock and Watson, 2012).

In panel data, serial correlation in the error term can arise. The error term, uit, consists of time varying factors that are determinants of Yit but not included as regressors, so some of these omitted factors may be autocorrelated. If omitted factors exist over multiple years, autocorrelated regression errors will arise (Stock and Watson, 2012).

The consequences of autocorrelation are similar as those of heteroskedasticity. While the OLS estimators remain unbiased, they are no longer efficient (minimum variance) and standard errors are biased downwards meaning that the t and F tests are no longer valid for statistical inferences (Gujarati and Porter, 2009).

14.4 Multicollinearity

One of the least squares assumptions is that the regressors are not perfectly multicollinear. Multicollinearity is present when there is a linear relationship between the explanatory variables.

Perfect multicollinearity is the case when one regressor is the exact linear function of one or more of the other regressors. A consequence of perfect multicollinearity is that the regression coefficients of the multicollinear explanatory variables are indeterminate and their standard errors are not defined (Gujarati and Porter, 2009). Solving perfect multicollinearity then requires changing the set of regressors.

A typical situation where this problem arises is when multiple binary variables are used as regressors, in situations such as the following: i) When there are several binary variables and each observation falls into one and only one category, ii) if there is an intercept in the regression and iii) if all binary variables are included as regressors. In any of these cases, the regression will fail because of perfect multicollinearity. This is called the dummy variable trap (Stock and Watson, 2012). To solve the dummy variable trap one must exclude one of the dummy variables or take away the intercept (Stock and Watson, 2012).

Imperfect multicollinearity arises when one of the regressors is very highly, but not perfectly, correlated with the other regressors. In the presence of multicollinearity, the OLS estimators are still unbiased, still have minimum variance and the population model is still correctly specified. Thus, imperfect multicollinearity does not violate any of our OLS-assumptions. However, large variances and covariances makes precise estimation difficult. We have wider confidence intervals, the t-ratio tends to be statistically insignificant, and the R-squared values tends to be very high. Additionally, the OLS estimators and their standard errors can be sensitive to small changes in the data (Stock and Watson, 2012). However, if the objective is to estimate linear relationships among these coefficients, this can be done even in the presence of perfect multicollinearity (Gujarati and Porter, 2009).

To deal with multicollinearity, there are a few rule-of-thumb procedures one can use, however none of them certain. Some of these procedures include i) using "a priori" information, ii) combining cross-sectional and time-series data, iii) omitting a highly collinear variable, iv) transforming data/variables, and v) obtaining additional or new data (Gujarati and Porter, 2009).

14.5 Outliers

A problem with OLS is that it is sensitive to outliers. The inclusion or exclusion of an outlier can substantially alter the results of a regression analysis, especially if the sample size is small (Stock and Watson, 2009). This is because OLS gives equal weight to every observation in the sample when minimizing the sum of squares. However, if the effect of outliers is large, every observation may not have equal impact on the regression results (Gujarati and Porter, 2009).

To treat outliers, you can use three approaches: Keep the outlier, winsorize it, or drop it from the sample altogether (Baltagi, 2013). According to Draper and Smith (1998, [p xx]), one should be careful with dropping outliers as they sometimes provide "information that other data points cannot due to the fact that it arises from an unusual combination of circumstances, which may be of vital interest and requires further investigation, rather than rejection". They suggest a general rule of only rejecting outliers if they can be identified as actual errors in the data collection, such as observation recording errors or errors in setting up the apparatus in physical experiments.

14.6 Model specification bias

Before running a regression, one must determine which variables to test for - that is, the model specification. If the regression model is erroneously specified, the OLS estimators of the coefficients in the regression will likely be biased. Model specification bias can occur in two cases: 1) Through a misspecification of the functional form of the model, and 2) by omitting (including) explanatory (non-explanatory) variables. Stock and Watson (2012, p. 807) define functional form misspecification as when "the form of the estimated regression function does not match the form of the population regression function; for example, when a linear specification is used, but the true population regression function is quadratic". Furthermore, omitted variable bias occurs if two conditions are met. First, the omitted variable must be a determinant of the dependent variable. Second, it must be correlated with (at least) one of the included regressors (Stock and Watson, 2012). If both conditions are true, at least one of the regressors is correlated with the error term, violating the first least squares assumption.

14.7 Descriptive statistics & mean difference test for financial/non-financial firms

	Financial firms			**Non-financial firms**			**Comparison**	
Statistic	Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean dif [Fin - non-fin]	Significance
Total compensation	4,681.4	3,227.1	4,236.9	4,891.0	3,427.1	4,291.5	-209.6	<1%
Salary	697.8	676.0	295.8	704.3	660.0	309.7	-6.5	-
Bonus	155.9	0.0	316.2	89.2	0.0	240.4	66.7	<1%
Stock awards	1,833.1	995.8	2,178.1	1,799.5	950.0	2,166.3	33.5	-
Option awards	436.6	0.0	897.2	751.0	195.2	1,095.0	-314.4	<1%
ln(total compensation)	8.0	8.1	1.0	8.1	8.1	0.9	-0.1	<1%
ln(salary)	6.4	6.5	0.5	6.5	6.5	0.5	0.0	-
ln(bonus)	5.7	6.1	1.5	5.4	5.7	1.6	0.3	<1%
ln(stock awards)	6.4	6.5	1.3	6.7	6.8	1.1	-0.4	<1%
ln(option awards)	7.1	7.3	1.3	7.2	7.3	1.2	0.0	<1%
Salary (%)	25.4	20.6	16.0	23.5	19.1	14.7	1.9	<1%
Bonus (%)	4.1	0.0	7.5	2.3	0.0	5.8	1.8	<1%
Stock (%)	31.1	31.9	21.9	29.7	30.0	22.3	1.3	<1%
Option (%)	7.6	0.0	12.0	14.0	9.9	15.6	-6.4	<1%
Size	4,506,680.0	1,580,519.0	6,879,343.0	4,136,168.0	1,341,152.0	6,481,306.0	370,512.0	<1%
ln(size)	14.3	14.3	1.5	14.2	14.1	1.5	0.1	<1%
Performance	1.064	0.074	2.664	1.197	0.022	2.938	-0.133	5%
Leverage (%)	68.8	0.6	32.9	40.0	0.2	30.3	28.9	<1%
Firm growth opportunities	9.6	3.1	13.3	6.2	1.6	10.7	3.3	<1%
Age	54.6	54.0	7.6	53.6	53.0	7.4	1.0	<1%
Risk (%)	31.8	29.3	12.2	36.6	35.9	11.5	-4.9	<1%
Delta	320.2	121.9	453.5	266.7	109.5	389.4	53.5	<1%
Vega	58.8	14.5	99.8	76.2	28.8	106.9	-17.4	<1%
ln(delta)	4.9	4.8	1.4	4.7	4.7	1.4	0.2	<1%
ln(vega)	2.3	2.7	2.4	3.0	3.4	2.2	-0.7	<1%

Table 14 provides a key summary statistics and a mean difference test for all variables in our 2007-2016 sample of 4571 firm year observations. However, for the bonus variable only 1036 firm year observations are included. All dollar values are in thousands. Note that the following variables are denoted with and without the natural logarithm in the above for clarity: "Total compensation", "salary", "bonus", "stock awards", "option awards", "delta", "vega", "size" and "performance".

Table 14: Descriptive statistics & mean difference test for financial/non-financial firms

14.8 Descriptive statistics & mean difference test for commercial/non-bank financial firms

	Commercial			**Non-bank**			**Comparison**	
Statistic	Mean	Median	St. Dev.	Mean	Median	St. Dev.	Mean dif [Com - non-com]	Significance
Total compensation	3,467.7	2,189.9	3,546.8	5,065.9	3,651.1	4,246.0	-1,598.2	<1%
Salary	707.0	693.0	281.2	690.9	675.0	300.3	16.1	-
Bonus	107.9	0.0	315.2	272.2	0.0	591.1	-164.3	<1%
Stock awards	1,221.5	495.0	1,849.0	2,080.8	1,265.5	2,312.1	-859.3	<1%
Option awards	267.7	0.0	576.0	447.2	0.0	824.8	-179.5	<1%
ln(total compensation)	7.7	7.7	0.9	8.1	8.2	0.9	-0.4	<1%
ln(salary)	6.5	6.5	0.4	6.4	6.5	0.5	0.0	<1%
ln(bonus)	5.3	5.6	1.7	6.0	6.3	1.6	-0.7	<1%
ln(stock awards)	6.6	6.7	1.3	7.3	7.5	1.2	-0.7	<1%
ln(option awards)	5.8	5.8	1.2	6.5	6.7	1.2	-0.7	<1%
Salary (%)	33.2	31.6	17.1	22.6	17.7	15.3	10.6	<1%
Bonus (%)	4.3	0.0	9.3	5.8	0.0	10.6	-1.5	<1%
Stock (%)	25.0	25.2	19.2	33.6	35.4	22.7	-8.6	<1%
Option (%)	6.2	0.0	9.4	7.1	0.0	10.4	-0.9	5%
Size	3,266,030.0	657,890.0	6,007,057.0	3,392,763.0	780,939.0	6,230,565.0	-126,733.0	-
ln(size)	13.7	13.4	1.6	13.8	13.6	1.5	-0.1	-
Performance	0.939	0.031	1.945	0.782	0.031	1.939	0.158	-
Leverage (%)	85.4	69.3	19.0	63.0	69.3	34.5	22.4	<1%
Firm growth opportunities	8.0	2.4	12.5	5.6	0.9	11.5	2.3	<1%
Age	55.7	55.0	6.9	54.2	54.0	7.8	1.6	<1%
Risk (%)	29.9	28.1	10.8	33.0	30.2	12.8	-3.0	<1%
Delta	293.5	81.8	549.3	444.3	155.5	697.7	-150.8	<1%
Vega	33.4	5.3	71.6	74.4	29.0	105.3	-41.0	<1%
ln(delta)	4.6	4.4	1.4	5.1	5.0	0.1	-0.5	<1%
ln(vega)	1.4	1.7	2.7	2.7	3.4	1.4	-1.2	<1%

Table 15 provides a key summary statistics and a mean difference test for all variables in our 2007-2016 sample of 1,205 financial firm year observations. However, for the bonus variable only 217 firm year observations are included. All dollar values are in thousands. Note that the following variables are denoted with and without the natural logarithm in the above for clarity: "Total compensation", "salary", "bonus", "stock awards", "option awards", "delta", "vega", "size" and "performance".

Table 15: Descriptive statistics & mean difference test for commercial/non-bank financial firms

14.9 Regression output - compensation level

	Dependent variable:		
	Total compensation	Salary	Bonus
	(14)	(15)	(16)
Commercial	−0.522***	−0.061	−1.492
	(0.177)	(0.084)	(2.057)
Size	0.079	−0.005	−0.011
	(0.055)	(0.029)	(0.431)
Performance	−0.087**	−0.017	−0.076
	(0.037)	(0.021)	(0.263)
Leverage	0.797***	0.473***	0.674
	(0.270)	(0.165)	(2.019)
Firm growth opportunities	0.022***	0.007***	0.028
	(0.006)	(0.002)	(0.053)
Age	0.205*	0.051	0.204
	(0.111)	(0.064)	(0.428)
Age^2	−0.002*	−0.0004	−0.002
	(0.001)	(0.001)	(0.004)
Risk	−0.603	−0.292	0.192
	(0.778)	(0.406)	(6.019)
Constant	0.472	4.610**	−0.118
	(3.365)	(1.960)	(13.642)
Year fixed effects	Yes	Yes	Yes
Observations	1,205	1,205	217
R^2	0.339	0.268	0.197
Adjusted R^2	0.330	0.258	0.152
F Statistic	35.810*** (df = 17; 1187)	25.564*** (df = 17; 1187)	2.872*** (df = 17; 199)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 16: Regression output - compensation level

	Dependent variable:	
	Option awards	Stock awards
	(17)	(18)
Commercial	−0.741	−0.806***
	(0.605)	(0.270)
Size	0.152	0.090
	(0.181)	(0.087)
Performance	−0.085	−0.089
	(0.145)	(0.056)
Leverage	0.793	0.942**
	(0.827)	(0.473)
Firm growth opportunities	0.026	0.028***
	(0.018)	(0.008)
Age	0.338	0.219
	(0.309)	(0.150)
Age^2	−0.003	−0.002
	(0.003)	(0.001)
Risk	1.048	−0.063
	(2.943)	(1.099)
Constant	−6.450	−1.498
	(9.394)	(4.691)
Year fixed effects	Yes	Yes
Observations	1,205	1,205
R^2	0.257	0.306
Adjusted R^2	0.234	0.295
F Statistic	24.152*** (df = 17; 1187)	30.787*** (df = 17; 1187)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 17: Regression output - compensation level

14.10 Regression output - compensation structure

Table 18

	Dependent variable:			
	Salary %	Bonus %	Option awards %	Stock awards %
	(19)	(20)	(21)	(22)
Commercial	0.101***	−0.022	−0.022	−0.056
	(0.032)	(0.016)	(0.019)	(0.038)
Size	−0.018*	0.0002	0.005	0.011
	(0.010)	(0.005)	(0.005)	(0.013)
Performance	0.014*	0.003	−0.003	−0.007
	(0.007)	(0.004)	(0.004)	(0.008)
Leverage	−0.067	−0.032	−0.012	0.069
	(0.049)	(0.039)	(0.036)	(0.068)
Firm growth opportunities	−0.003***	−0.0001	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.002)
Age	−0.030*	−0.010	0.013	0.024
	(0.017)	(0.010)	(0.010)	(0.022)
Age^2	0.0003*	0.0001	−0.0001	−0.0002
	(0.0002)	(0.0001)	(0.0001)	(0.0002)
Risk	0.112	0.086	−0.019	−0.094
	(0.143)	(0.084)	(0.085)	(0.179)
Constant	1.385***	0.313	−0.330	−0.542
	(0.497)	(0.305)	(0.284)	(0.648)
Year fixed effects	Yes	Yes	Yes	Yes
Observations	1,205	217	1,205	1,205
R^2	0.256	0.076	0.053	0.120
Adjusted R^2	0.247	0.064	0.041	0.109
F Statistic	24.025*** (df = 17; 1187)	0.963*** (df = 17; 199)	3.908*** (df = 17; 1187)	9.521*** (df = 17; 1187)

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

Table 19: Regression output - compensation structure

14.11 Regression output - delta and vega

	Dependent variable:	
	Delta	Vega
	(23)	(24)
Commercial	−0.235	−0.880
	(0.343)	(0.725)
Size	0.090	0.122
	(0.111)	(0.216)
Performance	−0.066	−0.157
	(0.062)	(0.191)
Leverage	−0.225	0.214
	(0.590)	(1.047)
Firm growth opportunities	0.023*	0.012
	(0.013)	(0.024)
Vega	0.234***	
	(0.061)	
Delta		0.850***
		(0.213)
Age	−0.115	0.526
	(0.269)	(0.481)
Age^2	0.001	−0.005
	(0.002)	(0.004)
Risk	−0.986	−2.792
	(1.503)	(3.594)
Constant	5.249	−17.246
	(7.839)	(14.640)
Year fixed effects	Yes	Yes
Observations	904	904
R^2	0.429	0.407
Adjusted R^2	0.417	0.395
F Statistic (df = 18; 886)	36.940***	33.745***
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 20: Regression output - delta and vega

	Dependent variable:	
	Delta	Vega
	(25)	(26)
Regulation	0.119	1.063
	(0.296)	(0.709)
Commercial	−0.345	−0.603
	(0.500)	(1.068)
Size	0.092	0.122
	(0.110)	(0.215)
Performance	−0.071	−0.140
	(0.063)	(0.192)
Leverage	−0.245	0.101
	(0.587)	(1.036)
Firm growth opportunities	0.023*	0.011
	(0.013)	(0.024)
Vega	0.238***	
	(0.058)	
Delta		0.879***
		(0.212)
Age	−0.116	0.571
	(0.271)	(0.472)
Age^2	0.001	−0.005
	(0.002)	(0.004)
Risk	−0.559	−2.995
	(1.333)	(3.174)
Regulation*commercial	0.173	−0.335
	(0.385)	(0.954)
Constant	5.268	−18.469
	(7.920)	(14.456)
Year fixed effects	Yes	Yes
Observations	904	904
R^2	0.423	0.390
Adjusted R^2	0.415	0.381
F Statistic (df = 11; 893)	59.448***	51.845***
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 21: Regression output - delta and vega