Three Essays on Executive Compensation

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Vorwort

Die vorliegende Arbeit ist zwischen 2009 und 2013 an der Universität Konstanz entstanden. An dieser Stelle möchte ich mich bei einigen Personen für ihre Unterstützung und Begleitung während dieser Zeit bedanken.

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Summary

This dissertation is a collection of three research papers, which were written between 2009 and 2013 at the University of Konstanz. In early 2009, when the global financial crisis had just hit a new climax with the collapse of Lehman Brothers in September 2008, misguided incentives in compensation contracts were blamed for having contributed to the crisis. This allegation is still vivid in the media and executive compensation is still on the reform agenda of politicians and regulators. Motivated by the public debate, the three papers of this dissertation try to shed light on empirical facts and myths about executive compensation in Germany and the United States.

The first paper, *Executive Compensation and Firm Performance in Germany*, analyzes executive compensation in German firms. Since there is no publicly available compensation database for German firms, the analysis is based on hand-picked compensation data from annual reports. The paper presents empirical evidence that German executive compensation is related to accounting performance during the period 2005-2009, but not to stock market performance. The second paper, *Which Pay for what Performance? Evidence from Executive Compensation in Germany and the United States*, compares German executive compensation with compensation practices in the United States. It shows that there are differences in pay-performance sensitivities and the use of performance measures, and relates them to differences in corporate control between the two jurisdictions. The third paper, *Profit Sharing with Executives*, analyzes the fraction of earnings firms spent on executive compensation. This fraction differs substantially between firms and industries. The analysis shows that several firm characteristics, but also measures of managerial power determine the fraction of earnings dedicated to top management compensation.

In the remaining part of this summary, I provide an overview of the main ideas and results of each paper in the three chapters of this dissertation.

Chapter 1, *Executive Compensation and Firm Performance in Germany*, is joint work with Steffen Seemann (University of Konstanz). Motivated by the debate about executive compensation in Germany, we hand-picked data from annual reports to build a database of German compensation data. The analysis in Chapter 1 is based on this data and covers annual compensation of German executive board members during the period 2005-2009. We investigate the question discussed in the media, whether executive compensation is related to -and justified by- firm performance. We find that executive compensation in German firms is not related to stock performance, but it is related to accounting performance. Further, we investigate the impact of firm risk on the relation between compensation and performance, because U.S. studies have shown that firm risk influences compensation policies in U.S. firms. Indeed we find that the sensitivity of compensation to accounting performance (pay-performance sensitivity) is decreasing in firm risk, which is also in line with theoretical expectations. Our data allows us further to analyze compensation components separately. Pay-performance sensitivity in Germany is mainly driven by short-term cash bonus payments. Long-term compensation such as company stock, option grants, or firm-specific long-term incentives (LTI) are not related to firm performance. Executive compensation in Germany is also influenced by ownership and employee representation. We find that executives in firms with large owners earn less than their peers in firms without large shareholders. Finally, in a subsample of firms with low employee representation on the supervisory board, and unlike in the full sample, executive compensation is significantly related to stock performance. In such firms the sensitivity of compensation to accounting performance is generally lower than in firms with high employee representation on the supervisory board.

Chapter 2, *Which Pay for what Performance? Evidence from Executive Compensation in Germany and the United States*, is a follow-up project, also joint work with my co-author Steffen Seemann (University of Konstanz). This paper compares executive compensation in German and U.S. corporations. This is particularly interesting because firms in the two countries operate under different forms of corporate control. Whereas corporate control in Germany is based on a two-tier system with a supervisory board separate from the executive board, corporate control in the U.S. is based on a single board of executives and non-executive directors. Previous research has shown that differences in corporate control are reflected in executive compensa-

tion[1]. Hence we combine our self-collected German dataset with U.S. compensation data to analyze and compare compensation practices during the same time period and based on the same research methodology.

In particular, we compare the use of performance measures and pay-performance sensitivities in German and U.S. corporations during 2005-2009. We estimate the impact of stock returns and various accounting-based measures of firm performance on total annual compensation and on compensation components, such as cash bonuses and long-term compensation. We find that only firm earnings but not stock returns explain total executive compensation in both samples. However, there are differences for individual compensation components. Cash bonus payments of German executives are determined by firm earnings and not by stock returns, while U.S. bonuses are also determined by stock returns. Firm risk and firm size influence the pay-performance sensitivity of cash bonuses in both countries. We also provide evidence that firms choose performance measures which are less volatile than alternative measures. Moreover, our results show that the level of pay-performance sensitivities based on firm earnings does not differ significantly between the two countries, but U.S. executives face additional financial incentives tied to stock performance. Finally, we have no robust explanation how long-term compensation is granted in either country. There is only weak evidence for a correlation between this compensation type and firm performance in prior years.

Chapter 3, *Profit Sharing with Executives*, is motivated by the observation that not only the level of executive compensation has grown, but the ratio of executive compensation to income of U.S. firms has doubled between the early-1990s and the beginning of the new century[2]. Based on U.S. data, I document that the fraction of earnings firms spent on executive compensation varies substantially between firms and industries. So far the literature has not analyzed this cross-sectional variation. In particular, I calculate the fraction of operating cash flow paid to the top management in U.S. firms and show that the variation in this fraction is related to several firm characteristics. I find that the top management's cash-flow share is lower in larger firms and in firms spending more on investment, interest and dividends (all relative to firm size). It is also lower in more profitable firms, but positively related to stock returns and the dividend payout ratio. I also find evidence that the

[1] E.g. Fahlenbrach (2009).
[2] See the study by Bebchuk and Grinstein (2005).

top management's cash-flow share and ownership-providing long-term compensation are substitutes to align the interests of shareholders and managers. Finally, two measures of managerial entrenchment and CEO power are positively related to the fraction of cash flow paid as bonuses to the top management. Hence a high fraction of firm earnings captured by the top management may be a sign for agency problems and managerial rent extraction.

Zusammenfassung

Die vorliegende Dissertation besteht aus drei Forschungspapieren, die zwischen 2009 und 2013 an der Universität Konstanz angefertigt wurden. Zu Beginn des Jahres 2009, als die globale Finanzkrise mit dem Zusammenbruch von Lehman Brothers im September 2008 gerade einen neuen Höhepunkt erreicht hatte, wurden fehlgeleitete Anreizstrukturen in der Managervergütung mit für die Krise verantwortlich gemacht. Dieser Vorwurf ist in den Medien auch heute noch präsent und das Thema Managervergütung befindet sich auch weiter auf der Reformagenda von Politikern und Regulierungsbehörden. Durch die öffentliche Diskussion motiviert, liefern die drei Forschungspapiere dieser Dissertation empirische Erkenntnisse zu Fakten und Mythen der Managervergütung in Deutschland und den Vereinigten Staaten.

Das erste Forschungspapier, *Executive Compensation and Firm Performance in Germany*, analysiert die Vergütung von Vorstandsmitgliedern deutscher Aktiengesellschaften. Da es keine öffentlich zugängliche Datenbank mit Vergütungsdaten für deutsche Unternehmen gibt, basiert die Analyse auf eigenhändig aus Geschäftsberichten zusammengetragenen Daten. Die empirischen Ergebnisse zeigen, dass die Vorstandsvergütung in Deutschland zwischen 2005 und 2009 von buchhalterischen Erfolgskennzahlen abhängt, nicht aber von der Aktienrendite. Das zweite Forschungspapier, *Which Pay for what Performance? Evidence from Executive Compensation in Germany and the United States*, vergleicht Vergütungsmethoden in Deutschland mit jenen in den Vereinigten Staaten. Es wird gezeigt, dass es Unterschiede in der Erfolgsabhängigkeit und in der Auswahl von Erfolgskennzahlen gibt. Diese Unterschiede werden vor dem Hintergrund unterschiedlicher Systeme der Unternehmenskontrolle in den beiden Rechtsordnungen diskutiert. Das dritte Forschungspapier, *Profit Sharing with Executives*, untersucht den Gewinnanteil, den Firmen für die Vergütung des Top Managements ausgeben. Dieser Anteil variiert sehr stark zwischen Firmen und Branchen. Die Analyse zeigt, dass nicht nur verschiedene Unter-

nehmensmerkmale, sondern auch die Macht des Managements auf den Gewinnanteil Einfluss hat, den Firmen für die Vergütung des Top Managements ausgeben.

Kapitel 1, *Executive Compensation and Firm Performance in Germany*, ist eine Gemeinschaftsarbeit mit Steffen Seemann (Universität Konstanz). Motiviert durch die Debatte über die Managervergütung in Deutschland, haben wir eigenhändig Daten aus Geschäftsberichten zusammengetragen, um eine Datenbank mit deutschen Vergütungsdaten anzulegen. Die Untersuchung in Kapitel 1 basiert auf diesen Daten und deckt die Vergütung von Vorstandsmitgliedern deutscher Aktiengesellschaften für die Jahre 2005 bis 2009 ab. Wir untersuchen die in den Medien vielfach aufgeworfene Frage, ob die Managervergütung eigentlich vom Unternehmenserfolg abhängt bzw. durch diesen gerechtfertigt wird. Es zeigt sich, dass die Vorstandsvergütung in deutschen Unternehmen nicht von der Aktienrendite, sondern von buchhalterischen Erfolgskennzahlen abhängt. Zudem untersuchen wir den Einfluss des firmenspezifischen Risikos auf den Zusammenhang zwischen Vergütung und Unternehmenserfolg, da amerikanische Studien gezeigt haben, dass das firmenspezifische Risiko diesen Zusammenhang beeinflusst. Tatsächlich finden wir, dass die Abhängigkeit der Vergütung von Erfolgskennzahlen (Erfolgssensitivität) mit steigendem Risiko abnimmt, was wiederum mit theoretischen Überlegungen erklärbar ist. Unsere Daten lassen ferner eine Analyse unterschiedlicher Vergütungskomponenten zu. Die Erfolgssensitivität der Vorstandsvergütung in Deutschland ist hauptsächlich auf kurzfristige Bonuszahlungen zurückzuführen. Langfristige Vergütungskomponenten, wie beispielsweise Unternehmensanteile, Optionen oder firmenspezifische, langfristige Anreizsysteme, sind nicht an den Unternehmenserfolg gekoppelt. Außerdem wird die Vorstandsvergütung in Deutschland von der Eigentümerstruktur und der Stärke der Mitbestimmung durch Arbeitnehmer beeinflusst. Es zeigt sich, dass Vorstandsmitglieder in Unternehmen mit großen Anteilseignern weniger verdienen als ihre Kollegen in Unternehmen ohne große Anteilseigner. Schließlich zeigt sich in Unternehmen mit geringer Arbeitnehmervertretung im Aufsichtsrat, dass, anders als bei der Gesamtheit der Unternehmen, die Vorstandsvergütung positiv von der Aktienrendite abhängt. In diesen Unternehmen ist der Einfluss buchhalterischer Erfolgskennzahlen auf die Vergütung im Allgemeinen niedriger als in Unternehmen mit hoher Arbeitnehmervertretung im Aufsichtsrat.

Kapitel 2, *Which Pay for what Performance? Evidence from Executive Compensation in Germany and the United States*, ist ein Folgeprojekt, ebenfalls gemein-

schaftlich erarbeitet mit meinem Koautor Steffen Seemann (Universität Konstanz). Diese Arbeit vergleicht die Vergütung von Führungskräften in deutschen und amerikanischen Unternehmen. Dies ist von besonderem Interesse, weil die Unternehmenskontrolle in diesen zwei Ländern unterschiedlich organisiert ist. Während die Unternehmenskontrolle in Deutschland auf dem zweistufigem System mit einem vom Vorstand getrennten Aufsichtsrat beruht, basiert die Unternehmenskontrolle in den USA auf einem einstufigen System mit nur einem Gremium, in welchem sowohl Mitglieder der Unternehmensführung, als auch Mitglieder mit Kontrollfunktion sitzen. Studien haben gezeigt, dass sich Unterschiede in der Unternehmenskontrolle auch in der Managervergütung wiederfinden[3]. Daher führen wir unseren eigenhändig erstellten, deutschen Datensatz mit amerikanischen Vergütungsdaten zusammen, um die Vergütung von Führungskräften während desselben Zeitraums und mit derselben Methodik zu analysieren und zu vergleichen.

Insbesondere vergleichen wir die Auswahl von Erfolgskennzahlen und die Erfolgssensitivität der Vergütung in deutschen und amerikanischen Unternehmen in den Jahren 2005 bis 2009. Wir messen den Einfluss der Aktienrendite und verschiedener buchhalterischer Erfolgskennzahlen auf die Gesamtvergütung sowie auf einzelne Vergütungsbestandteile, wie beispielsweise Boni und langfristige Vergütungskomponenten. Es zeigt sich, dass in beiden Ländern die Gesamtvergütung vom Unternehmensgewinn, nicht aber von der Aktienrendite abhängt. Allerdings gibt es Unterschiede bei einzelnen Vergütungskomponenten. Bonuszahlungen deutscher Führungskräfte werden vom Unternehmensgewinn, nicht aber von der Aktienrendite bestimmt, während Bonuszahlungen amerikanischer Führungskräfte auch von der Aktienrendite determiniert werden. Das firmenspezifische Risiko und die Unternehmensgröße beeinflussen die Erfolgssensitivität von Bonuszahlungen in beiden Ländern. Wir zeigen auch, dass die Unternehmen Erfolgskennzahlen auswählen, die weniger volatil sind als alternative Kennzahlen. Außerdem zeigen unsere Ergebnisse, dass sich die Erfolgssensitivität der Vergütung in Bezug auf den Unternehmensgewinn nicht signifikant in den beiden Ländern unterscheidet, jedoch amerikanische Führungskräfte zusätzliche, an die Aktienrendite gekoppelte, finanzielle Anreize erhalten. Weder für Deutschland, noch für die USA finden wir eine robuste Erklärung wie langfristige Vergütung gewährt wird. Wir finden lediglich einen schwachen Zusammenhang zwischen dieser Vergütungskomponente und dem Unternehmenserfolg

[3]Siehe z.B. Fahlenbrach (2009).

zurückliegender Jahre.

Kapitel 3, *Profit Sharing with Executives*, entstand aus der Beobachtung, dass nicht nur die Höhe der Vergütung amerikanischer Führungskräfte gestiegen ist, sondern dass sich das Verhältnis der Ausgaben für die Managervergütung zum Unternehmensgewinn zwischen den frühen 1990er Jahren und dem Beginn des neuen Jahrhunderts verdoppelt hat[4]. Es zeigt sich, dass dieser Gewinnanteil, den amerikanische Unternehmen für die Vergütung von Führungskräften ausgegeben, stark variiert zwischen Firmen und Branchen. Bislang wurden in der Literatur diese Unterschiede nicht analysiert. In dieser Studie wird der Anteil am operativen Cashflow bestimmt, der an das Top Management in amerikanischen Unternehmen ausgezahlt wird. Es stellt sich heraus, dass dieser Anteil von verschiedenen Unternehmensmerkmalen abhängt. Der Anteil des Top Managements am Cashflow ist in größeren Unternehmen und in Unternehmen mit höheren Ausgaben für Investitionen, Zinsen und Dividenden niedriger (jeweils im Verhältnis zur Unternehmensgröße). Dieser Anteil ist auch niedriger in profitableren Unternehmen, er hängt aber positiv von der Aktienrendite und der Ausschüttungsquote ab. Außerdem zeigt sich, dass der Anteil des Top Managements am Cashflow und langfristige Vergütungskomponenten mit Beteiligungscharakter substitutiv eingesetzt werden, um die Interessen des Managements an denen der Eigentümer auszurichten. Schließlich hängt der Anteil am Cashflow, der dem Top Management als Boni ausbezahlt wird, auch positiv von zwei Kennzahlen ab, die die Macht des Managements abbilden. Insofern könnte ein hoher Anteil des Top Managements am Cashflow ein Hinweis auf Agency-Probleme und Selbstbereicherung des Managements sein.

[4]Siehe die Studie von Bebchuk und Grinstein (2005).

Chapter 1

Executive Compensation and Firm Performance in Germany

1.1 Introduction

In 2008 only 6 percent of the German corporations listed in the Prime Standard segment of the Frankfurt Stock Exchange generated positive shareholder value, but 90 percent of the executives in these firms received bonus payments.[1] This is surprising because bonus payments are supposed to reflect managerial performance. Bonus payments without shareholder value creation raise the question whether compensation is related to firm performance at all.

We collect compensation data from German annual reports and study the relationship between firm performance and annual executive compensation, including bonus payments, during 2005-2009. Unlike previous studies, we use detailed information on the structure of executive compensation in Germany, which is available since 2005. We can identify which payments are predetermined and fixed (base salary) and which are meant to vary with performance (bonuses). We also have information about the grant-date values of stock and option grants. Based on this data we investigate how sensitive these annual payments or grants are to the firm's stock market performance and accounting performance.[2]

[1] Own calculation from data in annual reports.

[2] We do not analyze the relation between firm performance and executive wealth in the form of company stock or option holdings. Data on executive wealth is not readily available in Germany. However, the relation between direct annual compensation and firm performance is of particular interest in the political debate about executive compensation. Unlike changes in executive wealth, regulators can target this annual flow of compensation, because it is under the control of the board

In our analysis we control for firm risk which was shown to have an impact on pay-performance sensitivity in U.S. firms (Aggarwal and Samwick, 1999). Moreover, we study two distinct characteristics of the German corporate governance system: Concentrated ownership and employee representation. We investigate whether Bertrand and Mullainathan's (2000) finding for U.S. firms that the relation between firm risk and pay-performance sensitivity only holds for firms with a large shareholder also holds for Germany. Finally, we analyze whether German executive compensation is influenced by employee representation on the supervisory board. This board overlooks the executive board and has the final say on executive compensation. Since up to one half of the board members represent employee interests and not shareholder interests, supervisory board composition is a potentially important factor to explain executive compensation in Germany.[3]

We are not the first to study executive compensation in Germany, but our study is the first to estimate pay-performance sensitivities for individual compensation components such as cash bonuses. Early studies on German executive compensation such as Schwalbach and Graßhoff (1997), Kraft and Niederprüm (1999) or Elston and Goldberg (2003) analyze aggregated compensation data. Most of these studies identify a positive relation between total executive compensation and some accounting-based measure of firm performance. For the recent time period 2005-2007, however, Rapp and Wolff (2010) find a rather low sensitivity of total executive compensation to stock performance, and, unlike earlier studies, an insignificant or even negative relation between total executive compensation and accounting performance. Hence bonus payments without shareholder value creation in 2008 may be due to German executive compensation being linked to accounting rather than stock performance, as suggested by evidence from earlier studies. On the other hand, the results of Rapp and Wolff (2010) suggest that German executive compensation has become less related to accounting performance in recent years. This conflicting evidence motivates us to analyze the individual compensation components separately to clearly identify whether bonus payments in Germany are determined by accounting or stock performance or not related to firm performance at all.

of directors or the firm's compensation committee (Kaplan, 2012). Other studies that explicitly abstract from changes in executive wealth and study direct, annual or "flow compensation" include Perry and Zenner (2001) and Aggarwal and Samwick (1999).

[3]German codetermination law requires 33 percent employee representation on the supervisory board in corporations with more than 500 but less than 2,000 employees, and 50 percent employee representation in firms with more than 2,000 employees.

For Germany, the relationship between firm risk and pay-performance sensitivity has not been documented since data has become available for individual executives and compensation components. Based on aggregated compensation data and for manufacturing firms only, Kraft and Niederprüm (1999) find support that risk has an impact on pay-performance sensitivity in Germany during 1987-1996. Moreover, the impact of concentrated ownership on the relation between firm risk and pay-performance sensitivity has never been investigated for Germany where most firms are controlled by a large shareholder in the sense of Bertrand and Mullainathan's (2000) definition of an investor holding more than five percent of equity. Finally, we contribute to the small literature on employee representation and executive compensation in Germany. We are aware of two other studies on this subject. Gorton and Schmid (2004) and Edwards et al. (2009) study the effect of employee representation[4] on pay-performance sensitivity based on aggregated compensation data from the early 1990s. We are the first to provide additional evidence since disclosure of compensation components for individual board members has become mandatory. This new data allows us to investigate the impact of supervisory board employee representation on granting different compensation components and on the pay-performance sensitivity of individual compensation components.

In contrast to Rapp and Wolff (2010), we find no relation between stock performance and total executive compensation. As suggested by the cited evidence for 2008, the analysis of compensation components reveals that this also holds for cash bonus payments and long-term compensation such as company stock and option grants. However, whereas long-term compensation turns out to be granted also independent of accounting performance, we find that bonus payments are significantly related to firm earnings. This suggests that bonus payments in 2008 were not unjustified, but in Germany performance evaluation for cash bonus payments builds on accounting performance and not on stock performance.

We offer two explanations for this finding. First, German corporate culture is less focused on the stock market, because for German firms banks are a more important source of funds than capital markets. Second, German codetermination law transfers part of the control rights from shareholders to employee representatives who may have different objectives than shareholder value maximization. In fact, unlike in the full sample we find evidence for a positive relation between executive

[4]They compare executive compensation in firms with 50 percent and 33 percent employee representatives on supervisory boards.

compensation and stock market performance in firms with low employee representation. In such firms the sensitivity of compensation to accounting performance is generally lower than in firms with higher employee representation on the supervisory board. Hence unlike Edwards et al. (2009), we identify a significant impact of employee representation on the sensitivity of executive compensation. Gorton and Schmid (2004) estimate that the relation between executive compensation and firm performance is positive in firms with low employee representation, but negative in firms with high employee representation. Our findings suggest that pay-performance sensitivity with respect to accounting performance is positive in both representation regimes, but higher in firms with high employee representation.

Moreover, similar to Kraft and Niederprüm (1999) for manufacturing firms, we also find in our broader sample that pay-performance sensitivities are lower in firms with higher firm risk measured by the variance of accounting performance. More importantly, we also find a negative effect of ownership concentration on compensation levels, but no effect of ownership concentration on the relationship between pay-performance sensitivity and firm risk, as documented by Bertrand and Mullainathan (2000) for U.S. firms.

The remainder of this work is structured as follows. In the next section we briefly review the related literature. We describe our self-collected dataset and present some summary statistics in section 1.3. In section 1.4 we derive our hypotheses and introduce our estimation methodology. Section 1.5 presents the main results of our analysis. In section 1.6 we show some robustness checks. We conclude in Section 1.7.

1.2 Related Literature

Instead of giving a broad literature overview on executive compensation, we present the empirical evidence on the relationship between executive compensation, firm performance and firm risk, which is related to our empirical study. There are extensive surveys of the executive compensation literature by Murphy (1999), Frydman and Jenter (2010) or Kaplan (2012). These surveys are strongly focused on U.S. executive compensation, because most of the empirical literature is based on U.S. data. Therefore, we discuss more broadly the available empirical evidence on executive compensation in Germany.

1.2.1 Empirical Evidence on Pay, Performance and Risk

Most empirical research on the relationship between executive compensation, firm performance and firm risk is motivated by theoretical work of Holmström and Milgrom (1987, 1991), who model how shareholders design a compensation scheme to align their interests with those of an employed manager. In particular, the principal (shareholder) employs an agent (manager) to run a project with an uncertain payoff. The agent can influence the project payoff. Since the principal cannot observe the agent's behavior, he designs a financial incentive scheme by relating the agent's compensation to the project payoff. This implies a risk transfer to the agent. Holmström and Milgrom (1987, 1991) assume that the principal is risk neutral while the agent is not. Hence the agent demands a risk premium for compensation risk which increases with payoff uncertainty (project risk). This leads to the key prediction of the model, namely that the sensitivity of compensation to firm performance (pay-performance sensitivity) is smaller in riskier firms with more volatile payoffs.

Despite the predicted relationship between executive compensation, performance and firm risk, estimates of pay-performance sensitivities from early empirical studies neglect firm risk. Jensen and Murphy (1990) find a significant, but very low sensitivity of CEO compensation to stock performance in U.S. corporations for the period 1974-1986. Hall and Liebman (1998) estimate pay-performance sensitivity of U.S. CEO compensation including the annual change in value of stock and option holdings. Similar to Jensen and Murphy (1990), they do not control for firm risk, but unlike them, they find a strong pay-performance relationship for U.S. CEO compensation in 1980-1994, mostly coming from stock and option holdings.

Unlike Jensen and Murphy (1990) and Hall and Liebman (1998), Core et al. (1999) control for firm risk (measured by the standard deviation of return on assets) and find a negative impact of risk on compensation of U.S. CEOs in 1982-1984. However, their research design cannot estimate the impact of firm risk on the link between compensation and firm performance, i.e. on pay-performance sensitivity as postulated by Holmström and Milgrom (1987, 1991). Aggarwal and Samwick (1999) measure the impact of firm risk on pay-performance sensitivity by controlling not only for firm risk but also for the interaction between firm risk and firm performance, measured by stock returns and by stock return variance, respectively. In their sample of U.S. executives in 1993-1996, Aggarwal and Samwick (1999) find a significantly positive pay-performance sensitivity which decreases, for given firm performance, in

firm risk. Cichello (2005) argues that one has to explicitly account for firm size when using the variance of stock market value as a measure for firm risk. For CEOs of U.S. corporations during 1993-2000, he finds that the negative relationship between firm risk and pay-performance sensitivity still holds, but pay-performance sensitivity is smaller for CEOs of larger firms.

These findings are empirical support for Holmström and Milgrom's (1987, 1991) hypothesis of a negative relationship between firm risk and pay-performance sensitivity. However, the empirical evidence is not always supportive. Instead of measuring pay-performance sensitivity directly, Core and Guay (1999) look at company stock and option grants to executives as an alternative measure for the degree to which executive compensation is linked to firm performance. They find a positive impact of firm risk, measured by stock return volatility, on the degree to which firms let executives participate in firm performance with stock and option grants. They argue that monitoring executives is costlier in firms operating in a risky environment. As a substitute, owners of riskier firms provide executives with more incentives to make sure they work toward firm value maximization.

Prendergast (2002) makes a similar argument. He surveys the empirical literature on the relationship between risk and incentives and concludes that empirical evidence in support of Holmström and Milgrom's (1987, 1991) prediction of a negative relationship between firm risk and pay-performance sensitivity is limited. His explanation for a positive relationship is that shareholders of firms operating in environments with a lot of uncertainty (risky firms) give managers more discretion over the choice of activities. The intuition is that uncertainty makes shareholders less confident how the management should operate the daily business of the firm and therefore they delegate more responsibility. This delegation is accompanied by output-based incentives and hence a positive relationship between firm risk and pay-performance sensitivity.

In this study we analyze pay-performance sensitivity based on stock market and accounting measures of firm performance. Therefore our work is also related to studies from the accounting literature about the use of different performance measures in executive compensation. Lambert and Larcker (1987) argue that the relative weight placed on performance measures in executive compensation should be related to the measure noisiness. They find that U.S. firms in the period 1970-1984 indeed place relatively more weight on stock market performance if its variance

is lower than the variance of an accounting-based measure.

Bushman and Indjejikian (1993) show that in a compensation contract with both earnings and stock price as performance measures, the role of earnings is to filter out non-performance related noise. Sloan (1993) provides support for this hypothesis. He finds that for U.S. CEOs in 1970-1988, compensation is more sensitive to earnings relative to stock returns if stock price is a relatively noisy measure of executive performance, with noise in stock prices measured by price changes related to market-wide movements in stock prices. Sloan (1993) argues that earnings-based measures are used to shield executives from performance fluctuations that are beyond their control.

1.2.2 German Evidence

The vast majority of empirical findings in the executive compensation literature is based on U.S. data. Evidence about executive compensation in German firms is particularly limited and most studies do not account for the impact of firm risk on the relationship between firm performance and executive compensation.[5] One reason for this lack of research is limited availability of German data. Before fiscal year 2006, public corporations in Germany were not required to publish compensation data. Hence, most studies are based on aggregated executive board compensation data from compensation surveys, which are limited in scope and industry coverage.

One of the first studies on German executive compensation is Elston and Goldberg (2003) for the period 1970-1986. Their focus is the influence of ownership structure with large stockholders[6] and bank influence (more than 50 percent bank ownership) on compensation levels in German firms and not the sensitivity of executive pay to firm performance. Another early study on executive compensation in Germany is Schwalbach and Graßhoff (1997) who analyze the impact of firm size, industry and firm performance on compensation of German CEOs for the period 1968-1992. They also provide estimates for pay-performance sensitivities. Whereas Schwalbach and Graßhoff (1997) only cover manufacturing firms, our study provides

[5]The only exception we are aware of is Kraft and Niederprüm (1999).

[6]Elston and Goldberg (2003) and most other German studies define large shareholders as investors holding at least 25 percent of a firm's equity. This equity stake is much larger than the five percent threshold typically used to define large shareholders of U.S. firms with a much more dispersed ownership structure, see e.g. Bertrand and Mullainathan (2000) Almost all public firms in Germany exhibit concentrated ownership according to the five percent threshold Haid and Yurtoglu (2006).

evidence on this issue for a much broader range of German firms and industries.

Schwalbach and Graßhoff (1997), Elston and Goldberg (2003) and the more recent study by Rapp and Wolff (2010) neglect the potential impact of firm risk on compensation levels or pay-performance sensitivities. For the period 1987-1996, Kraft and Niederprüm (1999) provide supportive evidence for Holmström and Milgrom's (1987, 1991) hypothesis that pay-performance sensitivity is lower in firms with higher risk. However, Kraft and Niederprüm (1999), similar to Schwalbach and Graßhoff (1997), use aggregated data, which only covers manufacturing firms and does not allow them to differentiate between fixed and variable compensation, and between individual executive board members.

The studies above analyze data from the 1970s, 80s and 90s. In a recent study, Rapp and Wolff (2010) investigate executive compensation in Germany for the period 2005-2007. They find that the impact of shareholder return on executive compensation is positive but economically very small, whereas the impact of a firm's operating performance[7] is not significant (in some specifications weakly significant but surprisingly negative). This result is contrary to Schwalbach and Graßhoff (1997) and Kraft and Niederprüm (1999) who identify accounting measures as explanatory variables for executive compensation in Germany. Rapp and Wolff's (2010) results suggest that German executive compensation has become less dependent on firm performance in general and on accounting performance in particular. However, they only investigate total compensation and use operating profit as a measure of accounting performance. In line with previous research we use firm earnings as a measure of accounting performance. Rapp and Wolff (2010) note that the valuation of stock and option grants is a critical issue when investigating total executive compensation. We investigate not only the sensitivity of total compensation to firm performance, but analyze cash bonuses and grants of stocks and options separately.

Our paper provides evidence on the relation between executive compensation and performance measures in Germany. In addition, it analyzes whether employee representation has an impact on compensation. The results in this paper raise the question whether differences in executive compensation reflect institutional and cultural differences between countries. In a companion paper, Heimes and Seemann (2012), we compare executive compensation in U.S. firms and German firms. The companion paper builds on the results of this work and tests whether firms in the

[7]Measured by operating income after depreciation divided by total assets.

two countries put different weight on several accounting and stock performance measures.

We are aware of two other studies that analyze the impact of employee representation on executive compensation in Germany.[8] Gorton and Schmid (2004) and Edwards et al. (2009) compare executive compensation in firms with 50 percent and 33 percent employee representatives on supervisory boards for the period 1989-1993. The two studies provide mixed evidence on the impact of employee representation on executive compensation. We add to this small literature and investigate whether employee representation explains the limited use of stock and option grants in Germany and whether employee representation affects pay-performance sensitivities.

1.3 Data Description

We assembled a database that contains information on executive compensation of German corporations that belong to the Prime Standard market segment of the Frankfurt Stock Exchange.[9] We hand-picked the respective data from annual reports. Our dataset covers the years 2005 to 2009 and contains individualized information on compensation of the executive board members including the CEO. For estimating pay-performance sensitivities we match this compensation dataset with firm data from Thomson Reuters' Datastream database.

1.3.1 Compensation Data

German law requires corporations listed in Germany to provide information on the compensation structure of their executive board members for fiscal years starting after August 15, 2005.[10] Some companies released compensation data already for the fiscal year 2005. The dataset is almost complete for the years 2006 to 2009. A small number of companies opted not to publish remuneration data.[11]

[8] Other studies on German employee representation such as Fauver and Fuerst (2006) or Wagner (2009) analyze the impact of employee representation on firm value or profitability. We do not discuss these studies in detail, because they do not directly address executive compensation.

[9] To be part of the Prime Standard segment, firms have to fulfill certain obligations concerning publication of quarterly reports, ad-hoc disclosure rules and accounting standards.

[10] This is governed in paragraph 4.2.4 of the German Corporate Governance Code.

[11] Before 2006 firms had to explicitly state why they did not follow this recommendation. In June 2006, the recommendation was substituted by the ruling that firms are required to publish this information unless it is decided otherwise at the general meeting by three-quarters majority. This explains why for most firms individualized compensation data is available since the fiscal year

The collected sample of firms for which individual compensation data was available contains firms of different industries and firm size. Since we match compensation data with accounting data, we exclude financial firms because accounting numbers are difficult to compare between financial and non-financial firms. We analyze annual compensation data and exclude an observation from our initial sample whenever a manager is not on the board for the whole fiscal year.[12]

The most restrictive requirement for our sample is a data history of up to ten years. We calculate firm performance volatility measures based on a stock price history of three years, and based on a firm-earnings history of ten years. For example, executive compensation in a firm that went public in 2003 cannot be included in 2005 but only in years 2006-2009. Similar restrictions apply with respect to firms that started publishing firm earnings after 1995. Thus our results are based on executive compensation in relatively mature firms that have been public for at least three years and have reported earnings data for at least 10 years.

We are left with a final sample of 1,603 observations for a total of 610 individual executives in 137 corporations. We have 56 executives with a complete time series of five years, 109 with four subsequent years, 148 with three years, 146 with two years and the remaining 141 with only one year on the executive board.

Table 1.1 in the appendix summarizes our data on the compensation structure of CEOs and all other executive board members who are not CEOs. Total compensation is the sum of all compensation components in a given year. We distinguish three different types of compensation. First, we identify payments that are not performance related, in particular the base salary and benefits in kind, such as company cars and insurance payments. Our second compensation type, short-term compensation, are annual cash bonuses that are paid out at the end of the fiscal year. Third, long-term compensation is the value of granted shares and stock options as well as compensation based on long-term incentive plans.

For the valuation of long-term components we rely on the numbers in annual reports. German law requires firms to publish the value of long-term incentives at the time they are granted. Long-term incentives can be stocks, options or grants from firm-specific long-term incentive programs. The variety of such programs is

2005 but not before.

[12]Moreover, compensation data for managers leaving or joining the board during the fiscal year may contain payments that are associated with the job change (e.g. severance payments), but cannot be identified in compensation reports because they are not reported separately from other variable payments.

quite large and may include non-standard payout structures with grants in cash, deferred cash, equity, restricted or time vesting stock, stock appreciation rights or similar types of awards. Since we do not have detailed information about these incentive programs, we cannot calculate the value of such grants and have to rely on the numbers in annual reports.

In this study we analyze the sensitivity of direct, annual compensation to firm performance. Hence we include the value of company stock and options granted, but not the change in value of total stock and option holdings or any gains from selling stock or exercising options. Data on executive wealth in the form of company stock and option holdings is generally unavailable for German executives.[13] To estimate the sensitivity of annual compensation to performance in a given fiscal year, we have to exclude any payments that are related to previous years. For example, compensation from long-term incentive plans is sometimes paid out with a time lag of some years. Such remuneration is included in our compensation measure when it is granted, not when lagged payouts are actually made. This way we make sure that we only capture compensation that is directly related to performance during the respective fiscal year. Finally, our data does not include any payments to pension plans. Information on such payments is not available in a standardized form. We share this deficiency with empirical studies based on U.S. data.

Table 1.1 shows that during our sample period total compensation for CEOs was in the range of 113,000 to 12 million Euro with a mean (median) value of 1.6 (0.99) million Euro. Board members other than CEOs received 1.2 million Euro on average. The average fixed part of CEO compensation was 575,000 Euro or 51 percent of total compensation, which is slightly more than the 46 percentage share for non-CEOs. With 38 (39) percent for CEOs (non-CEOs), the yearly cash bonus accounted for a large share of total compensation. Long-term compensation appears to play a much smaller role in executive remuneration schemes. The average share of such components is 11 percent for CEOs and 15 percent for non-CEOs. Excluding executives who receive no long-term compensation at all, increases the long-term compensation shares to 20 percent and 23 percent, respectively.

Tables 1.2 to 1.4 describe executive compensation in firms of different size mea-

[13]Long-term oriented compensation in the form of company stock and options is much less frequent in German executive compensation than in the U.S. where such components often account for a large share in total compensation and thus executives may accumulate substantial firm-related wealth in the form of company stock and options. 43 percent of the executives in our sample do not receive any long-term compensation at all.

sured by total assets. On average, CEOs and other executive board members in small firms[14] earn only 17-20 percent of what their peers at large firms[15] earn. CEOs of small firms receive on average 63 percent of their compensation as fixed pay, whereas this number is 40 percent and only 31 percent for CEOs of mid-size firms[16] and large firms, respectively. Cash bonuses account for 30 (45) [49] percent of total CEO compensation in small (mid-size) [large] firms. The average share of long-term compensation components is only 7 percent for CEOs of small firms but 21 percent for CEOs of large firms. In sum, larger firms tend to pay more in total, a higher share of variable compensation and more long-term compensation compared to smaller firms.

The summary statistics suggest that there are no substantial differences in the compensation structure of CEOs and non-CEOs. This holds throughout the years and across firms of different size. However, there are differences in compensation levels between CEOs and non-CEOs, and between firms of different size. Thus in our regressions we control for CEO status and firm size.

1.3.2 Firm Performance Data

For estimating pay-performance sensitivities we match our compensation dataset with measures of firm performance and firm risk. We use annual stock returns and earnings before interest and taxes (EBIT) as measures for firm performance. We calculate the variance of these performance measures as measures for firm risk.

Stock prices are taken from Thomson Reuters' Datastream database. These prices are adjusted for stock splits and dividend payments. We further adjust stock prices for inflation and calculate annual real stock returns based on 2005 price levels. Column 1 of Table 1.5 shows percentiles of the return distribution for our sample period 2005-2009.[17] Annual returns in the sample period range from a loss of 77.4 percent to a gain of 429 percent.

In order to compute the variance of stock returns we use monthly data. This firm

[14] We call a firm "small" whenever its total assets in a given fiscal year are below or equal to 1 billion Euro. Firms around the threshold of 1 billion Euro may thus belong to different size categories over time.

[15] Firms with total assets above 10 billion Euro.

[16] Firms with total assets of more than 1 billion Euro but no more than 10 billion Euro.

[17] Table 1.5 shows our final sample we later use for estimating pay-performance sensitivities. The top and bottom 0.5 percent of the original stock return and EBIT distributions are excluded to account for outliers.

risk measure is based on the three-year period preceding the fiscal year for which the manager is paid. For example, we match executive compensation data from 2008 with firm risk measured by the variance of monthly stock returns from January 2005 to December 2007.[18] We chose to measure firm risk over a three-year period and not only during the fiscal year for which the manager is paid, because we do not assume that firms adjust the link between compensation and performance in compensation contracts every year to account for realized firm risk. The assumption is rather that firms observe the general riskiness of their operations (measured by performance variance) before they specify the link between compensation and performance in compensation contracts with a duration of more than one year. Moreover, excluding the year when the manager is paid from the calculation of the firm risk measure avoids a possible feedback effect of managerial compensation on risk taking in the same year. We calculate real monthly returns and variances of real monthly returns and annualize them. The distribution of the standard deviation of stock returns is given in column 2 of Table 1.5. The standard deviation of returns ranges from 7.6 percent to 263 percent.

We use earnings before interest and taxes (EBIT) as an alternative firm performance measure. The data for this variable is also taken from Thomson Reuters' Datastream database. Again we standardize all values to 2005 price levels. Specifically, our performance measure is the EBIT reported together with the compensation figures at the end of the fiscal year. The distribution of this performance measure is characterized in column 3 of Table 1.5. The annual EBIT reaches from a loss of 0.9 billion Euro to a positive 9 billion Euro. With 608 million Euro the mean is substantially larger than the median EBIT with 44 million Euro.[19]

Computing a volatility measure based on EBIT is not as straight forward as for stock returns. Because EBIT is an annual variable we need a long data history to calculate its variance with a reasonably large number of observations. However, we aim to measure firm risk at the time the manager is employed by the firm and should thus include only recent data. We try to balance this trade-off by using ten years of EBIT data. This measure requires a 10-year EBIT history before the compensation date which reduces our sample size. Kraft and Niederprüm (1999)

[18]This applies for companies whose fiscal year is the calendar year. If the fiscal year deviates from the calendar year, we adjust the period for the variance calculation.

[19]In the robustness section we run median regressions to show that our findings are not driven by outliers.

as the only other German compensation study controlling for risk circumvent this problem by measuring the variance of annual accounting data over the entire 9-year sample period as a time-invariant risk measure. Our time-varying risk measure based on historical data is the more common approach chosen in U.S. studies such as Aggarwal and Samwick (1999). Column 4 of Table 1.5 shows the percentiles of the distribution.

1.4 Hypothesis Development and Methodology

1.4.1 Hypotheses for German Compensation

In this section we develop hypotheses about executive compensation in Germany. We expect that the positive relation between executive compensation and firm performance, which is well documented for Anglo-Saxon firms, also holds for German firms. Firm owners link executive compensation to firm performance in order to mitigate agency problems and align management interests with their own. This implies a positive sensitivity of executive compensation to firm performance (pay-performance sensitivity).

Contracting theory suggests that firms choose performance measures based on their informativeness about the manager's effort.[20] Whether accounting performance or stock performance is the more informative performance measure is not obvious, ultimately this is an empirical question. However, two features of the German corporate governance system suggest that stock performance is not the decisive performance measure for executive compensation in Germany: (1) Compared to the Anglo-Saxon world, German corporate culture is less focused on the stock market[21], and (2) German corporate control is organized as a stakeholder system in which not only shareholders influence management decisions but also the interests of employees are represented in a supervisory body.

First, in the literature it is argued that German corporate culture is less focused on the stock market, because for German firms debt financing through banks is a more important source of funds than the capital market.[22] Banks only offer funding

[20] See Holmström and Milgrom (1987, 1991), Lambert and Larcker (1987) or Bushman and Indjejikian (1993).

[21] For an extensive analysis of German corporate governance with less shareholder orientation and more bank influence than in the Anglo-Saxon system, see Jürgens et al. (2000) or Vitols (2004).

[22] See Chirinko and Elston (2006) for a critical discussion of the role of bank influence and funding

to firms which have sound earnings and are likely to repay their debt. We expect that the importance of earnings is also reflected in compensation contracts. This suggests that executive compensation is linked closer to accounting performance than to stock market performance.

Second, in the German two-tier corporate control system the members of the separate supervisory board, which is supposed to control the executive board, are only partially shareholder representatives. German codetermination law follows the idea that firm owners and employees run the firm collectively (Gorton and Schmid, 2004) and assigns part of the seats on the supervisory board to employee representatives.[23] Since the supervisory board has the final say about executive compensation in German firms[24], this particularity of corporate control should be reflected in compensation contracts. Employee representatives on German supervisory boards possibly have different objectives than shareholder representatives (see also Gorton and Schmid (2004)). We suppose that their main interest is not shareholder value maximization but job security and wages of employees below top management. Hence we do not expect employee representatives to opt for a tight link between top management compensation and performance measured by shareholder value creation.

Instead, we argue that employee representatives are more concerned with firm earnings. In Germany, the dominant form of employee participation are profit sharing schemes and not employee ownership programs. Whereas in the U.S., about one-fifth of American employees hold stock in the company in which they work (see Kruse (2002)), German survey data indicates that one quarter to one third of firms let employees participate in firm earnings, but only around 5 percent report employee stock ownership programs.[25] For example, in 2007 German automakers let employees participate in their strong profits by making cash bonus payments at

in the German economy.

[23]For details on the codetermination rules also see the discussion of Hypothesis 4.

[24]The duties and responsibilities of the supervisory board in deciding on executive compensation are governed in '§87 Aktiengesetz' and in '4.2.2 German Corporate Governance Code' from 2002. The latter has been revised several times with the latest version being from May 2010. Also '§87 Aktiengesetz' was revised in 2009 to make the supervisory board's duties and responsibilities for executive compensation more explicit.

[25]The "IAB-Betriebspanel", a survey by the Federal Employment Agency, reports for the year 2005 (2009) profit sharing programs in 28 (26) percent of the firms with 205-499 employees, and in 34 (35) percent of the firms with more than 500 employees. Employee stock ownership programs were much less frequent with 4 and 7 percent, respectively, in the two firm categories and in both years. Survey results are published in Bellmann and Möller (2006, 2011).

the end of the year. Employees at Daimler received an average payment of 3,750 Euro, their colleagues at BMW 5,600 Euro and Volkswagen employees received a bonus payment of 3,700 Euro. The labor agreement from 2006 between Volkswagen and its employees explicitly states that employees receive 10 percent of operating profits as bonus payments. Hence we expect employee representatives on German supervisory boards to favor a strong link between top management compensation and firm profits instead of stock returns, because they are more interested in sound firm earnings than in shareholder value creation.[26]

We summarize the discussion on the importance of accounting-based and stock market-oriented performance measures in our first hypothesis.

Hypothesis 1: Accounting performance is the main performance measure for executive compensation in German corporations.

Our second hypothesis pertains the nature of pay-performance sensitivity. Holmström and Milgrom (1987, 1991) argue that pay-performance sensitivity is decreasing in firm risk. In their model risk-averse managers demand compensation for the risk transfer in performance-related compensation. Hence pay-performance sensitivity is lower in (riskier) firms with higher performance volatility.

Many studies test this theoretical result empirically, but only some find support. Prendergast (2002) gives a summary of the empirical evidence on the link between pay-performance sensitivities and risk. He develops a model where risk has a positive impact on pay-performance sensitivity. He argues that firms in uncertain environments delegate more responsibilities to managers, because shareholders are less certain about the optimal firm strategy. To constrain managerial action to performance-enhancing activities, shareholders relate management compensation stronger to performance.

Hence theoretical models allow for the impact of risk on pay-performance sensitivities to be positive or negative. Empirical studies also deliver mixed findings for this relation. As a result we only hypothesize pay-performance sensitivity is related to firm risk and make no prediction about the sign of this relation.

Hypothesis 2: The sensitivity of German executive compensation to firm performance is influenced by the riskiness of the firm.

[26]If employee bonus payments are 10 percent of operating profit, firm earnings after such payments and operating profits are still highly correlated.

The next hypothesis pertains the influence of ownership structure on executive compensation. Executive compensation is the result of a bargaining process between firm owners (or their representatives on the supervisory board) and executives. Previous research suggests that concentrated ownership has an impact on executive compensation. Concentrated ownership refers to the presence of strong owners who hold a significant fraction of voting rights. Elston and Goldberg (2003), Kraft and Niederprüm (1999), Haid and Yurtoglu (2006) and Rapp and Wolff (2010) find that executives at German firms with a concentrated ownership structure earn less than their peers at firms with more dispersed ownership. This finding is explained with the view that strong owners set executive pay, whereas executives pay themselves by manipulating the compensation committee in firms with dispersed ownership (Bertrand and Mullainathan, 2000). This leads to our third hypothesis:

Hypothesis 3: German executives earn less at firms with a more concentrated ownership structure.

Finally, we investigate the influence of employee representation on executive compensation. German codetermination law requires employee representation on the supervisory board for firms with more than 500 employees. One third of the supervisory board members are employee representatives in these firms. When firms have more than 2,000 employees the share of employee representatives is one half of the supervisory board members. If employee representatives on the supervisory board can influence executive compensation, there should be differences in compensation between firms with different degrees of employee representation. We first discuss the potential impact of employee representation on long-term compensation and then turn to the link between employee representation and pay-performance sensitivities.

Employee representation may explain why long-term oriented compensation accounts for a relatively small share of executive compensation in Germany.[27] Long-term compensation consists of company stock, options or company-specific long-term incentives (LTIs) with payouts related to future stock price developments. If employee representatives are less interested in stock returns than shareholder representatives, then they are unlikely to opt for granting the top management company

[27]The share of long-term compensation in total compensation of executives in our sample is 11-15 percent, whereas this share is typically 40 percent or more for U.S. executives, see for example Bebchuk and Grinstein (2005) or Fernandes et al. (2013).

stock, options or LTIs. This suggests that, ceteris paribus, more employee representation on the supervisory board should be related to lower long-term compensation.[28]

Hypothesis 4a: A higher share of employee representation on the supervisory board is related to lower long-term oriented executive compensation.

We argued that employee representatives favor accounting-based performance measures (Hypothesis 1). This should also be visible in pay-performance sensitivities. A higher fraction of supervisory board members representing employees is equivalent to a higher fraction of board members who prefer a strong link between executive compensation and accounting performance, and a lower fraction of board members who represent shareholder interests and prefer a strong relation between compensation and stock market performance. This should be visible in higher accounting pay-performance sensitivities and lower stock market pay-performance sensitivities in firms with higher employee representation.

Hypothesis 4b: Executive compensation is more sensitive to accounting performance and less sensitive to stock market performance in firms with a high share of employee representatives on the supervisory board than in firms with a low share of employee representatives.

1.4.2 Estimation Methodology

We estimate the sensitivity of manager compensation with respect to firm performance with a panel regression model of executive pay on firm performance and firm risk. In the first specification, executive pay is the total compensation of executive i at firm j in year t and denoted by w_{ijt}. The firm performance measure, denoted by π_{jt}, is either the annual stock return or EBIT of firm j in year t. As a measure for firm risk we use the variance of stock returns (EBIT) measured over 3 (10) years prior to year t and denoted by σ^2_{jt}. We follow Aggarwal and Samwick (1999) in that we standardize the risk measure by using a rank measure $Rank(\sigma^2_{jt})$. This measure is calculated as the rank of σ^2_{jt} divided by the number of observations in our sample.

All regressions include executive fixed effects to control for executive-specific characteristics which we do not observe although they may have explanatory power

[28] Alternatively, higher employee representation may imply that a lower share of total compensation is granted as long-term compensation.

for compensation, e.g. biographical variables (age, tenure, education) or bargaining power. Hence we specify the following linear fixed effects model:

$$w_{ijt} = \gamma_1 \pi_{jt} + \gamma_2 Rank(\sigma^2_{jt})\pi_{jt} + \gamma_3 Rank(\sigma^2_{jt}) + \lambda_i + \mu_t + \epsilon_{ijt}, \tag{1.1}$$

where λ_i is an executive fixed effect, μ_t is a year dummy, and ϵ_{ijt} is the error term. Note that by using the rank measure we ensure that our estimates of γ_2 are not affected by a possible relationship between our risk measure and the level of compensation.[29] Moreover, we do not include control variables such as board size, ownership structure or industry which are (almost) time invariant during the relatively short sample period. Since no executive moves from one firm to another during this period, such (almost) time-invariant differences in the cross section are captured by executive fixed effects. There should be little variation over time in firm size either, but we confirm the robustness of the basic estimation results by adding firm size as a control variable in separate regressions.

The estimated coefficients γ_1 and γ_2 can be transformed into pay-performance sensitivities at any percentile of the distribution. The pay-performance sensitivity for a manager employed by a firm with given risk is $\gamma_1 + \gamma_2 Rank(\sigma^2_{jt})$. Thus the pay-performance sensitivity at the firm with median risk is $\gamma_1 + \gamma_2 0.5$, and the pay-performance sensitivities at firms with the minimum and maximum observed risk levels ($Rank(\sigma^2_{jt})$ values of zero and one) are γ_1 and $\gamma_1 + \gamma_2$, respectively.

1.5 Results

1.5.1 Pay-Performance Sensitivities Based on Stock Returns

We first estimate equation (1.1) with firm performance measured by annual stock returns. The estimation results for the sample period 2005-2009 are given in Table 1.6. Column 1 shows the results without firm size as a control variable. However, Core and Guay (2002) and Cichello (2005) found that it is essential to explicitly control for firm size when looking at the relationship between executive compensation and firm risk because of the observed negative relationship between pay-performance sensitivity and firm size. Columns 2 and 3 of Table 1.6 show the results when we

[29] This argument is less an issue for the stock return variance because this risk measure is not related to firm size. The rank measure is more important when we measure firm risk by EBIT variance which is, as a firm-size related measure, likely to be correlated with total compensation.

control for firm size, measured by total assets and the number of employees[30], respectively. All regressions include executive fixed effects, year effects and a dummy variable for executives serving as CEOs during the respective compensation year.

The results are very similar in all three specifications. The coefficients of stock return are not significant. The firm risk measure is statistically significant at 5 percent and indicates that firms with higher risk pay less. The interaction variable between risk and stock performance is not significant. Total assets (column 2) and the number of employees (column 3) are not significant[31] The significantly positive CEO dummy indicates higher compensation for CEOs.[32]

The time dummies indicate that compensation levels change over the sample period. Compensation in 2006 is higher than in 2005 and increases even further in 2007. In 2008 compensation drops almost to the same level as in 2006. Total compensation increases slightly in 2009, but is still substantially below the peak in 2007.

Hence, we find that compensation in German firms is not based on stock returns. Note that this finding is not driven by the specification of the stock performance measure. Replacing the relative change in market value with the absolute change in market value does not change the result (not reported). There is also no significant relation between compensation and relative stock performance to a benchmark which we discuss in the robustness section.

1.5.2 Pay-Performance Sensitivities Based on EBIT

We now add yearly earnings before interest and taxes (EBIT) as a measure of firm performance. The choice of this accounting measure is motivated by anecdotal evidence from annual reports. Only few German firms explicitly state to which performance measure variable executive compensation is linked, but among these firms a frequently mentioned performance measure is EBIT. Firm risk is measured by the rank of EBIT volatility, calculated over 10 years preceding the compensation

[30]In this specification the number of observations is 1,594 instead of 1,603 because of missing employee data.

[31]Including the fixed effects seems to leave very little variation in the firm size measures. When we estimate the model without fixed effects the two firm size measures become highly significant (see robustness section 6.3).

[32]Note that this result is based on the increase in compensation when executives become CEO during the sample period. Higher compensation of executives who are CEOs throughout the sample period is captured by executive fixed effects.

year. Table 1.7 shows the regression results. In all specifications the coefficients of EBIT and the interaction term of EBIT and firm risk are highly significant.[33] Median pay-performance sensitivities are shown in the lower part of the table. We estimate that an executive board member at the firm with median risk receives 432 Euro for generating 1 million Euro EBIT.

In combination with the results from the stock market section this is strong support for Hypothesis 1. Compensation in German firms is not related to stock performance, but to accounting performance. We also find support for Hypothesis 2. The significant interaction term indicates that pay-performance sensitivity is related to firm risk. The negative coefficient supports the Holmström and Milgrom (1987, 1991) model which predicts that pay-performance sensitivity is decreasing in firm risk.

Hence, although shareholders should be most concerned about returns from their investment in stock, public German firms do not base executive compensation on shareholder value creation. We have two explanations for this result. First, we have argued that shareholders cannot decide about compensation on their own. Employee representatives on German supervisory boards can influence compensation and may not favor a strong link between executive compensation and shareholder return. Instead, they may be more interested in strong firm earnings because employee participation schemes in Germany are predominantly designed as earnings-based bonus programs and not employee stock ownership. Second, because stock returns are not as much under managerial control as accounting results, compensation based on stock returns poses extra, uncontrollable risk on managers for which they demand higher compensation. Accounting-based performance measures shield executives from uncontrollable, market-wide factors in stock prices (see the discussion in Sloan (1993)). Shareholders may agree to accounting-based contracts because they expect firm earnings to be eventually reflected in stock performance.

Our study provides an explicit and direct test for the joint evidence from various

[33] In the robustness section we address two issues pertaining EBIT. First, EBIT and total assets are correlated which may lead to multicollinearity in a regression with both EBIT and total assets as explanatory variables. Although one can see from Table 1.7 that there is almost no difference in the coefficient of EBIT between the specifications with and without total assets (which are insignificant because of the fixed effects), we confirm the robustness of our results by substituting EBIT for (1) EBIT orthogonalized with respect to total assets, and (2) EBIT divided by total assets. Second, EBIT is fairly skewed, as can be see from Table 1.5. EBIT divided by total assets may mitigate the impact of outliers. Moreover, we confirm our main results with quantile regression analysis in the robustness section.

studies on executive compensation in Germany. We confirm a positive impact of accounting performance on executive compensation which was found by earlier studies.[34] We also confirm earlier studies that found only little influence of shareholder return on executive compensation in Germany.[35] Our study suggests that compensation in Germany is very different from compensation in the U.S. Whereas stock returns play no role for compensation in our sample, empirical evidence from other studies suggests that stock returns are an important determinant of U.S. executive compensation.[36]

1.5.3 Pay-Performance Sensitivities of Compensation Components

In our dataset we can identify individual components of total compensation. In this subsection, we estimate the sensitivity of compensation components to firm performance to find out which (variable) compensation component drives pay-performance sensitivity.

We first replace total compensation, w_{ijt}, in equation (1.1) with variable compensation (total compensation excluding the fixed salary and benefits in kind). Since only the variable part of total compensation should be sensitive to firm performance, this regression should yield very similar pay-performance sensitivities as the regression for total compensation. Next we split variable compensation and replace it first with short-term variable compensation (cash bonus) and second with long-term variable compensation (stock, options, incentive plans).

Column 1 of Table 1.8 shows the results with variable compensation as the dependent variable. The coefficient estimates of EBIT and the interaction term of EBIT and firm risk are very similar to those estimated for total compensation in Table 1.7. With 465 Euro for 1 million Euro generated EBIT, the median pay-performance sensitivity is of similar magnitude as the 432 Euro calculated from Table 1.7. Stock return is again insignificant. The CEO dummy indicates a slightly smaller CEO effect on variable compensation than on total compensation. The year dummies show a similar pattern as for total compensation in Table 1.7.

Column 2 of Table 1.8 shows the results for cash bonuses, the short-term oriented

[34] E.g. Schwalbach and Graßhoff (1997), Elston and Goldberg (2003), Kraft and Niederprüm (1999) or Haid and Yurtoglu (2006).

[35] See Rapp and Wolff (2010) or Haid and Yurtoglu (2006).

[36] See, for example, Bebchuk and Grinstein (2005).

part of variable compensation. Based on the estimated coefficients of EBIT and the interaction term, the median pay-performance sensitivity of cash bonuses is 353 Euro for 1 million Euro EBIT. Hence most of the overall pay-performance sensitivity of variable compensation comes from cash bonuses. Stock return is insignificant also for cash bonuses.

Finally, column 3 of Table 1.8 shows the results for long-term compensation. Long-term compensation is only weakly related to EBIT. Stock return is again insignificant. The interaction term of EBIT and firm risk is also insignificant. Also we find no CEO effect on the level of long-term compensation. The year dummies suggest that compared to 2005, long-term compensation was significantly higher in 2006 and 2007, but not different from 2005 levels in the crisis years 2008 and 2009. Overall the results for long-term compensation are not very strong. In fact, the weakly significant impact of EBIT on long-term compensation disappears altogether when we analyze sub-periods separately (see the robustness section). Because a substantial fraction of executives does not receive any long-term compensation, a Tobit specification might be a more suitable regression approach. Also the Tobit model identifies no robust impact of EBIT or stock return on long-term compensation (not reported).

We conclude that the sensitivity of manager compensation to EBIT is mainly driven by cash bonuses. The results support Hypotheses 1 and 2. EBIT determines cash bonuses, whereas stock returns do not. Pay-performance sensitivity with respect to EBIT is (negatively) related to firm risk. Hence we find an explanation for cash bonuses during the financial crisis. In Germany, bonuses are not related to shareholder value creation but to firm performance measured by EBIT.

1.5.4 Executive Compensation and Ownership

In this subsection we analyze the effect of ownership concentration on German executive compensation to test Hypothesis 3. In studies about ownership concentration in U.S. firms, a strong owner is typically defined as an investor holding at least five percent of a firm's equity (see for example Bertrand and Mullainathan (2000)). Because most German firms exhibit concentrated ownership with a strong owner according to this definition (Haid and Yurtoglu, 2006), studies on ownership and executive compensation in Germany typically refer to strong owners as investors holding 25 percent or more (see Elston and Goldberg (2003), Kraft and Niederprüm

(1999), Haid and Yurtoglu (2006) and Rapp and Wolff (2010)).

Similar to Bertrand and Mullainathan (2000), we collect ownership data for one sample year (2009) and divide the firms in our sample into two groups; firms with a strong owner and firms without a strong owner.[37] In different specifications, we define a strong owner as a shareholder who holds at least 25 or 50 percent of the voting rights.[38] We exclude a firm from the strong owner group when the CEO is the shareholder with the 25 (50) percent ownership stake.

We first investigate the impact of a strong owner on executive compensation levels. It is straightforward to test for this effect with a dummy variable which is one for firms with a strong owner and zero else. We use industry fixed effects in this regression, because firm or executive fixed effects would absorb this dummy variable. Columns 1 and 2 of Table 1.9 show the results for strong owners with a share of at least 25 and 50 percent, respectively. The dummy for a strong owner is negative and significant in both regressions, indicating that strong owners grant lower total executive compensation.[39] In addition, the coefficient in the regression with 50 percent owners is larger (in absolute terms) which implies that stronger owners use their position to decrease executive compensation. As an additional test we include the free float of a stock in our regression. We define the free float as the fraction of shares held by shareholders who own less than 5 percent of the outstanding shares.[40] This measure controls not only for the presence of a large owner, but for the aggregated fraction of outstanding shares not owned by shareholders holding 5 percent or more. Column 3 of Table 1.9 shows that the larger the free float the higher is the level of executive compensation. This implies once more that more concentrated ownership is related to lower executive compensation. Hence, as documented in previous studies on German executive compensation, we find a negative effect of ownership concentration on executive compensation levels in the three specifications of Table 1.9. This is support for Hypothesis 3.

Moreover, Bertrand and Mullainathan (2000) find that for U.S. data the negative

[37]For a subsample of firms we checked the variation in ownership over time and found that ownership concentration was fairly stable over the 5-year sample period. Therefore we decided to follow Bertrand and Mullainathan (2000) and collected ownership data for one year to construct the two subsamples.

[38]Owners holding at least 25 percent of the voting rights can block major decisions at the annual meeting. Separating our sample according to strong ownership defined as five percent or more is inappropriate because only 10 firms in our sample are not controlled by a strong owner according to this definition.

[39]We find this effect also for the components of total compensation.

[40]This is the definition of free float used by the Frankfurt Stock Exchange.

relation between pay-performance sensitivity and firm risk only holds when strong owners are present. They do not find this relation in a sample of firms without strong owners. To test whether our finding of a negative relation between pay-performance sensitivity and firm risk in Germany also holds only when strong owners are present, we interact the performance and risk measures with the strong owner dummy variables. We also analyze two samples of firms with and without strong owners separately, as in Bertrand and Mullainathan (2000). The analysis shows no significant differences between the two groups and we omit the regression results to save space. This finding is not in contrast to Bertrand and Mullainathan (2000). Almost all firms in our sample have a shareholder with at least 5 percent ownership (Bertrand and Mullainathan's (2000) definition of a strong owner). If it is sufficient to have one shareholder with 5 percent ownership to enforce the negative relation between firm risk and pay-performance sensitivities, we should expect to find this negative relation in any subsample of German firms, regardless of the presence of an investor holding 25 or even 50 percent of the voting rights.[41]

1.5.5 Executive Compensation and Employee Representation

We investigate potential effects of supervisory board employee representation on executive compensation with respect to (1) long-term compensation and (2) pay-performance sensitivity. We start with the impact of employee representation on long-term compensation (Hypothesis 4a). We create two dummy variables for firms with zero and 33 percent employee representation. We estimate equation (1.1) with the two dummy variables as additional regressors, industry fixed effects[42] and with long-term compensation or the ratio of long-term to total compensation as the dependent variable. This regression shows no significant relation between long-term compensation and the two dummy variables indicating zero and 33 percent employee representation, respectively (not reported).

[41] Note that this does not imply that the pay-performance sensitivities are identical in subsamples with and without a strong owner holding 25 (or 50) percent. Not only compensation levels but also pay-performance sensitivities are lower when strong owners with a 25 (50) percent ownership stake are present (this confirms the findings of Kraft and Niederprüm (1999)), but the negative relation between firm risk and pay-performance sensitivity does not depend on the presence of such strong owners.

[42] Similar to the ownership dummy variable, these dummy variables would be absorbed by firm or executive fixed effects, because no firm changes representation status over the sample period.

However, because employee representation is a function of the number of employees, this approach may be unsuitable to separate the effect of employee representation from the effect of firm size on executive compensation. To mitigate this empirical identification problem, we use a matching procedure to construct subsamples of firms which differ with respect to employee representation on the supervisory board, but not in average firm size measured by total assets.[43] In particular, we compare two sets of firms. First, we compare firms with below 50 percent (i.e. 0 or 33 percent) employee representation on the supervisory board and firms with 50 percent employee representation. Second, we compare firms with 33 percent employee representation and firms with 50 percent employee representation. For both comparisons we create subsamples containing an equal number of firms with low employee representation (0 or 33 percent in the first setup, and 33 percent in the second setup) and high representation (50 percent in both setups). We create these subsamples by matching two firms that are similar in terms of total assets, but differ with respect to employee representation. For each firm in the group with lower employee representation (i.e. 0 or 33 percent in the first, and 33 percent in the second setup), we search for the firm in the much larger pool of 50-percent representation firms which is closest in terms of total assets.[44] A test on differences in means shows that in both setups on average firms with low and high employee representation do not differ in terms of firm size measured by total assets.

We include all executives of the matched firms in the subsamples for the two comparison setups and reestimate equation (1.1) for long-term compensation as the dependent variable and with the dummy variables indicating lower employee representation in the two subsamples. We still do not find any significant impact of supervisory board employee representation on long-term compensation (not reported).[45] Hence, we do not find support for Hypothesis 4a.

Next we turn to the effect of supervisory board employee representation on pay-performance sensitivity (Hypothesis 4b). Again a straightforward test of Hypothesis

[43]Firms in the subsamples differ in the average number of employees and thus employee representation on the supervisory board, but not in average firm size measured by total assets. Hence we make use of the fact that there are firms in the sample that are of similar size in terms of total assets, but differ in the number of employees such that they fall into different categories of required employee representation on the supervisory board.

[44]We require that total assets of the two matched firms differ at most by a factor of 1.5. If no such match is found, we drop the firm from the analysis.

[45]There is also no significant impact of employee representation on the fraction of executive compensation that is granted as long-term compensation, measured as the ratio of long-term compensation to total compensation.

4b in the full sample would be to interact the performance measures EBIT and stock return with dummy variables indicating the degree of employee representation. However, similar to compensation levels, pay-performance sensitivity may vary with firm size. A dummy variable indicating the degree of employee representation then fails to separate this size effect and a potential employee representation effect. Instead we base the analysis on the two matched subsamples and estimate equation (1.1) with firm fixed effects and interaction terms between firm performance measures and a dummy variable indicating lower employee representation in each setup.[46]

The results are presented in Table 1.10. Columns 1 and 2 show regression results with total compensation and cash bonuses as dependent variables, respectively, which are based on the subsample containing firms with 50-percent employee representation and firms with 0 or 33 percent employee representation on the supervisory board. Columns 3 and 4 show the corresponding results for the subsample containing firms with 50 percent and 33 percent employee representation. Again we find no robust determinants of long-term compensation and skip the regression results.

The coefficient of the interaction term between EBIT and the low-representation dummy[47] is negative in all specifications, and significant in three out of four (it is not significant in the cash bonus regression for the sample containing only 50-percent and 33-percent representation firms, last column of Table 1.10). The coefficient of the interaction term between stock return and the low-representation dummy is positive in all specifications, and again significant in all specifications but the last one. These results are supportive to Hypothesis 4b. They suggest that pay-performance sensitivity based on EBIT is higher in firms with 50-percent employee representation than in firms with less employee representation on the supervisory board. Moreover, stock returns determine executive compensation in firms with low employee representation, but not in firms with 50-percent employee representation. Since the vast majority of firms in our full sample are of the latter type, we did not identify stock returns as a significant determinant of average executive compensation in the full

[46] Calculating pay-performance sensitivities does not require the coefficient estimate of the employee representation dummy itself. Hence we can include fixed effects on the firm level which capture the employee representation effect on compensation levels. Executive-level fixed effects are unfeasible because the matching procedure does not guarantee that we include executives in consecutive years into our subsamples. Firm fixed effects also control for industries and other firm-level differences between firms with lower and higher employee representation.

[47] The low-representation dummy itself drops out in a regression with firm-fixed effects, because no firm in our matched subsamples changes from low representation to 50-percent representation status or vice versa.

sample. We conclude that more employee representatives on the supervisory board indeed shift performance-related executive compensation away from stock returns and towards accounting performance.

The proper separation of size and employee representation is a critical issue in this analysis. The number of employees not only determines employee representation, it is also an indicator for firm size. However, a potential size effect in the dummy variable biases the results against finding the effects postulated in Hypotheses 4a and 4b. First, consider Hypothesis 4a. The summary statistics in Tables 1.2 to 1.4 show that small firms grant lower long-term compensation than large firms. Smaller firms have less employee representation, but Hypothesis 4a states that firms with less employee representation grant more long-term compensation. If our dummy is to some extent a small firm dummy, this may offset the employee representation effect. Our results suggest that the employee representation effect is either not there or that it is too weak to dominate a potential size effect. Now consider Hypothesis 4b. Assume that the dummy fails to identify employee representation status and (at least to some extent) measures firm size instead. This implies that the dummy represents small firms, which according to Cichello (2005) have higher pay-performance sensitivities than large firms.[48] Hence, if the dummy captures firm size rather than employee representation status, it should have a positive sign. Our results show a negative sign for the dummy variable, which implies that the employee representation effect is strong enough to outweigh the potential size effect.

1.6 Robustness

1.6.1 Performance Measures, Risk Measure and Fixed Effects

The first robustness test pertains the performance measures. The summary statistics in Table 1.5 show that EBIT is skewed to the right. In addition it is correlated with firm size. We test whether these two factors drive our results. To address the skewness of EBIT we re-run our regressions and replace EBIT with return on assets, which we define as EBIT divided by total assets. This robustness test confirms

[48] Jensen and Murphy (1990) and Murphy (1999) also provide evidence for a negative relationship between firm size and pay-performance sensitivities.

the result that pay is linked to accounting performance and that pay-performance sensitivities decrease in firm risk (not tabulated). Although replacing EBIT with return on assets also mitigates the problem of correlation between EBIT and total assets, we also run a regression in which we orthogonalize EBIT with respect to total assets. We regress EBIT on total assets and use the residual of this auxiliary regression instead of EBIT to estimate pay-performance sensitivities. The results for the pay-performance sensitivities are identical to the results where we include EBIT without orthogonalization. Kennedy (1982) and Pearce and Reiter (1985) show that the estimated coefficient of the residual is the same as the coefficient of EBIT in the original specification. Only the coefficient of total assets changes. Total assets now have significant explanatory power when we use orthogonalized EBIT.

As a further robustness test we measure stock performance relative to a peer group. Executive compensation contracts may include firm performance evaluation relative to a firm's peer group. The obvious goal of applying peer-group related performance measures is to make sure managers are not paid for running the company during good times (pay for luck) but for truly outperforming the market.

We lack the information whether firms pay managers for outperforming a peer group and how such peer groups are defined. Anecdotal evidence from annual reports suggests that peer groups consist of firms that are of similar size and/or belong to the same industry. We use a simple benchmarking approach to investigate relative performance evaluation. Most companies in the sample are a member of one of the major indices of the Frankfurt Stock Exchange.[49] As a proxy for peer group returns we use these index returns and compute a firm's relative stock market return as the difference between its stock return and the corresponding index return. We do not report our estimation results because benchmark stock returns also have no explanatory power for executive compensation.

The next robustness test concerns the risk measure. We replace the rank of EBIT variance with the variance itself. This alternative specification yields qualitatively similar results (not reported) as the base specification. The estimates for the pay-performance sensitivities are smaller compared to the base specification, but they

[49]These indices are the DAX, MDAX, SDAX or TecDAX indices of the Frankfurt Stock Exchange. The DAX index includes the 30 largest German companies in terms of order book volume and market capitalization. The MDAX contains 50 companies that rank immediately below the DAX, excluding the technology sector. The SDAX contains the next 50 below the MDAX shares. TecDAX firms belong to the technology sector. The TecDAX consists of the 30 largest technology firms below those included in the DAX.

are still economically meaningful.

We also checked the robustness with respect to alternative fixed effects specifications. In the basic specification we use individual fixed effects for each executive. We expect much of the variation in compensation within the sample of executives to be due to individual characteristics. These could be age or work experience (observable but not part of our dataset) and also factors such as bargaining power (not observable). Executive fixed effects should capture such individual characteristics we cannot explicitly account for.

In this robustness check we use firm-level and industry-level fixed effects instead of executive fixed effects. Apart from this the regressions remain unchanged. The coefficients of EBIT and the interaction term remain highly significant (results not tabulated). The estimates for the pay-performance sensitivities are of similar magnitude compared to the specification with individual fixed effects. Hence, the basic results with executive fixed effects are confirmed with alternative fixed effects. We also performed the robustness checks with alternative fixed effects and the risk measure for the specification with stock returns, but stock returns have no significant explanatory power for executive compensation.

1.6.2 Sub-Period Analysis

Disclosure of executive compensation in Germany became mandatory for fiscal years starting after August 2005. Firms that published compensation data for the fiscal year 2005 did so voluntarily. This potentially introduces a selection bias to our sample. We exclude all observations for the fiscal year 2005 to test whether this selection bias influences our results. The regression based on the reduced sample yields estimates which are similar to the ones from the full sample (not tabulated).

As a further robustness check we split the sample in a pre-crisis (2005-2007) and a crisis (2008-2009) sample and analyze the two periods separately.[50] Because of the short time spans, these regressions include industry fixed effects instead of executive fixed effects.[51] We found in previous robustness checks that both types of fixed effects yield qualitatively similar results. However, we cannot directly compare pay-

[50] We cannot split the data for 2007, because executive compensation is based on whole fiscal years. We decided to include the year 2007 in the pre-crisis sample, because the crisis started only in August/September 2007.

[51] We look at very short time spans and do not have many observations in the sub-samples. Hence, including executive fixed effects would leave almost no variation in these samples.

performance sensitivities quantitatively. The sub-period specification with industry fixed effects misses executive characteristics such as age, education or bargaining power, which are captured by executive fixed effects, but not by industry fixed effects. Columns 1 and 2 of Table 1.11 show the results for the pre-crisis and crisis periods, respectively, with total compensation as the dependent variable. The pay-performance sensitivities are very similar in the two periods and the pay-performance sensitivities are decreasing in firm risk in both sub-periods.

Columns 3 and 4 of Table 1.11 display the results for the two sub-periods with cash bonuses as the dependent variable. Pay-performance sensitivities are again very similar in the two periods. As before in the full sample analysis, the pay-performance sensitivities of total compensation and cash bonuses are of similar magnitude. This indicates that cash bonuses drive most of the pay-performance sensitivity of total compensation also in the sub-periods. We skip the results for long-term compensation because neither EBIT nor stock returns are significant in the sub-periods.

Splitting the sample does not change the results for stock returns. Neither in the 2005-2007 nor in the 2008-2009 period stock returns have explanatory power for total compensation or cash bonuses. Together with the EBIT results of the sub-period analysis, this gives more support for Hypothesis 1. Our results suggest that compensation of German executives is based on accounting performance and not on stock returns. Hence, it is not surprising that German executives received bonus payments in the crisis despite negative stock returns.

1.6.3 Quantile Regression

Summary statistics in Tables 1.1 to 1.5 indicate that compensation as well as firm performance variables are skewed. This raises the question whether observations in the right tale of the distributions drive mean estimates of pay-performance sensitivities. An obvious method to address this concern is quantile regression. This allows us to estimate the impact of the explanatory variables at different quantiles of the compensation distribution instead of estimating the mean effect over the whole distribution.

Applying quantile regression to panel data is not straightforward. Koenker (2004) argues that simply including dummies for every group in the panel delivers biased coefficient estimates. He proposes a method to estimate coefficents that

vary for different quantiles, but fixed effects that are constant over the whole range of quantiles. However, the discussion in Bache et al. (2011) shows that this estimator only delivers unbiased results if either the periods or the groups (executives in our case) in the panel are sufficiently large. Our sample is small in terms of both time periods and groups, which makes quantile regression with a panel structure infeasible. Instead we run a quantile regression model without fixed effects.

The results from quantile regression without fixed effects are not comparable to the results of the original fixed effects specificition. Hence, we compare the results from the quantile regression with coefficient estimates for the mean effects from an ordinary least squares regression, also without fixed effects. This gives us an indication whether the skewness of the variables has an impact on mean estimates.

Table 1.12 shows the results from the ordinary least squares regression in column 1. The sum of the first two lines of Table 1.12 is the pay-performance sensitivity. With 1.105 the estimate for the pay-performance sensitivity from the ordinary least squares regression is considerably larger compared to the 0.433 estimate from the panel regression (Table 1.7). This difference arises because we do not control for executive-specific variation in this regression. Note that without executive fixed-effects firm size has significant explanatory power for total compensation.

Columns 2 to 10 of Table 1.12 show the effects at different quantiles of the total compensation distribution. The pay-performance sensitivity is strictly increasing from 0.584 at the lowest to 1.979 at the highest quantile. At the median the pay-performance sensitivity of 1.125 is very similar to the mean estimate of 1.105 from the ordinary least squares regression. Executives at the top of the compensation distribution earn more for generating EBIT than their colleagues at the bottom of the compensation distribution. The same effect occurs for the CEO status. CEOs earn higher total compensation and the gap between CEOs and non-CEOs grows when we look at higher percentiles of the distribution. The effect of firm size on the other hand is almost constant over the whole distribution.

The estimates for the quantiles are largely in line with the results from the ordinary least squares regression. The mean pay-performance sensitivity is very similar to the pay-performance sensitivity at the median. The two regression approaches also deliver very similar estimates for the effect of firm size on total pay. Only the mean effect of being a CEO is quite different from the effect at the median. Overall results from the quantile regression suggest that the mean estimates for the pay-

performance sensitivities from the panel regression are not driven by the skewness of the variables.

1.7 Concluding Remarks

This paper analyzes the impact of firm performance and risk on executive compensation in German corporations. We use a self-collected dataset to estimate the sensitivity of executive pay to firm performance for total compensation as well as for different compensation components. We also investigate whether ownership structure and employee representation have an impact on compensation.

We do not find a significant relationship between executive compensation and firm performance measured by stock returns. However, firm earnings (EBIT) explain executive compensation in Germany. We estimate that a manager at the firm with median risk in the sample receives between 428 and 615 Euro for generating 1 million Euro in EBIT. We also find that the sensitivity of compensation to EBIT is decreasing in firm risk which gives support to the model of Holmström and Milgrom (1987, 1991).

Our dataset allows us to analyze the relationship between firm performance and the various components of total compensation. EBIT explains cash bonus payments but not long-term compensation in German firms. Stock returns cannot explain either of the two compensation components. These results also hold when we analyze the periods 2005-2007 and 2008-2009 separately. Hence we find an explanation for cash bonuses in years with poor stock market performance. In Germany, bonus payments are not based on shareholder value creation but on accounting performance.

We investigate whether the presence of a strong owner, a shareholder that owns 25% or 50% of the voting rights, has an impact on compensation levels and pay-performance sensitivities. Our results suggest that the presence of a strong owner implies lower executive pay. We find that pay-performance sensitivities are decreasing in firm risk in firms with and without a strong owner. For the U.S., Bertrand and Mullainathan (2000) find that this relation only holds in firms with a strong owner, defined as a shareholder with more than 5% of the voting rights. In Germany almost all firms have a strong owner according to this definition, which may explain why we find a negative link between pay-performance sensitivities and firm risk for all firms in our sample.

The focus on accounting performance in German executive compensation may partly be due to employee representatives on the supervisory board. Our results show that, unlike in the full sample, there is evidence for a positive relation between executive compensation and stock market performance in firms with low employee representation. In firms with high employee representation, the sensitivity of compensation to accounting performance is generally higher than in firms with lower employee representation on the supervisory board. We interpret these results as support for the hypothesis that employee representatives on the supervisory board push for the use of accounting performance measures instead of stock performance measures.

This work calls for future research. We do not know what determines long-term oriented compensation in German corporations. One reason could be that our sample period from 2005 to 2009 is rather short. Maybe long-term oriented compensation can be better explained with firm performance measured over several years. We expect additional insights when more German compensation data becomes available in the next years. Moreover, we provide new evidence for an effect of employee representation on executive compensation, but more research is needed to understand the influence of employee representatives on executive compensation in Germany. For example, descriptive statistics suggest that employee representatives on supervisory boards oppose long-term compensation, but with the data at hand we cannot identify a clear causal relation.

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Appendix

Table 1.1: Compensation Components 2005-2009, CEOs vs. Other Executives

	Chief Executive Officers [N=438]				Other Executives [N=1165]			
	Mean	**Median**	**Minimum**	**Maximum**	**Mean**	**Median**	**Minimum**	**Maximum**
Total	1,641	992	113	12,057	1,197	893	55	5,927
Fixed	575	417	96	3,096	409	333	38	2,329
Short Term	728	340	0	4,575	529	370	0	2,755
Long Term	338	0	0	5,882	259	38	0	3,665
Share Fixed	0.51	0.47	0.06	1	0.46	0.40	0.06	1
Share Short Term	0.38	0.39	0	0.94	0.39	0.41	0	0.94
Share Long Term	0.11	0	0	0.81	0.15	0.05	0	0.90

Other executives are members of the executive board other than the CEO. All numbers in the first four lines are in thousands of 2005 Euros. Fixed compensation is not performance related such as the base salary and benefits in kind. Short-term compensation are annual cash bonuses. Long-term compensation is the value of shares, options and compensation based on incentive plans. The values of long-term compensation components are taken from the respective annual reports. The last three lines show the respective shares with respect to total compensation.

Table 1.2: Compensation Components in Small Firms, 2005-2009

	Chief Executive Officers [N=228]				Other Executives [N=430]			
	Mean	**Median**	**Minimum**	**Maximum**	**Mean**	**Median**	**Minimum**	**Maximum**
Total	657	486	113	3,746	432	358	55	2,794
Fixed	352	303	112	2,280	234	203	38	1,552
Short Term	237	141	0	2,254	147	98	0	1,309
Long Term	68	0	0	2,720	52	0	0	1,700
Share Fixed	0.63	0.64	0.14	1	0.62	0.62	0.15	1
Share Short Term	0.30	0.29	0	0.84	0.30	0.30	0	0.84
Share Long Term	0.07	0	0	0.75	0.08	0	0	0.77

Small firms are defined as firms with total assets of no more than 1 billion Euro in a given fiscal year. All numbers in the first four lines are in thousands of 2005 Euros. Fixed compensation is not performance related such as the base salary and benefits in kind. Short-term compensation are annual cash bonuses. Long-term compensation is the value of shares, options and compensation based on incentive plans. The values of long-term compensation components are taken from the respective annual reports. The last three lines show the respective shares with respect to total compensation.

Table 1.3: Compensation Components in Mid-Size Firms, 2005-2009

	Chief Executive Officers [N=125]				Other Executives [N=359]			
	Mean	**Median**	**Minimum**	**Maximum**	**Mean**	**Median**	**Minimum**	**Maximum**
Total	1,949	1,548	196	12,057	1,092	924	59	5,927
Fixed	622	486	96	3,096	358	327	59	1,208
Short Term	843	716	0	4,075	494	388	0	2,717
Long Term	484	0	0	5,882	241	25	0	3,665
Share Fixed	0.40	0.37	0.06	1	0.41	0.38	0.06	1
Share Short Term	0.45	0.46	0	0.94	0.44	0.45	0	0.94
Share Long Term	0.14	0	0	0.81	0.15	0.03	0	0.90

Mid-size firms are defined as firms with total assets above 1 billion Euro but no more than 10 billion Euro in a given fiscal year. All numbers in the first four lines are in thousands of 2005 Euros. Fixed compensation is not performance related such as the base salary and benefits in kind. Short-term compensation are annual cash bonuses. Long-term compensation is the value of shares, options and compensation based on incentive plans. The values of long-term compensation components are taken from the respective annual reports. The last three lines show the respective shares with respect to total compensation.

Table 1.4: Compensation Components in Large Firms, 2005-2009

	Chief Executive Officers [N=85]				Other Executives [N=376]			
	Mean	**Median**	**Minimum**	**Maximum**	**Mean**	**Median**	**Minimum**	**Maximum**
Total	3,830	3,327	1,554	9,195	2,172	2,139	430	4,687
Fixed	1,104	1,037	421	3,066	648	615	165	2,329
Short Term	1,877	1,552	121	4,575	1,000	921	0	2,755
Long Term	848	638	0	4,286	514	454	0	1,987
Share Fixed	0.31	0.30	0.06	0.63	0.32	0.30	0.12	1
Share Short Term	0.49	0.50	0.08	0.84	0.46	0.48	0	0.83
Share Long Term	0.21	0.19	0	0.63	0.22	0.21	0	0.63

Large firms are defined as firms with total assets above 10 billion Euro in a given fiscal year. All numbers in the first four lines are in thousands of 2005 Euros. Fixed compensation is not performance related such as the base salary and benefits in kind. Short-term compensation are annual cash bonuses. Long-term compensation is the value of shares, options and compensation based on incentive plans. The values of long-term compensation components are taken from the respective annual reports. The last three lines show the respective shares with respect to total compensation.

Table 1.5: Distribution of Performance and Risk Measures, 2005-2009

Percentile	Stock Return	Standard Deviation of Stock Return	EBIT	Standard Deviation of EBIT
0	-0.774	0.076	-945	1
10	-0.500	0.112	-3	4
20	-0.342	0.135	4	8
30	-0.172	0.152	8	11
40	-0.042	0.171	20	21
50	0.052	0.190	44	30
60	0.150	0.211	92	47
70	0.273	0.239	169	104
80	0.438	0.269	587	346
90	0.649	0.328	1,957	981
100	4.288	2.632	9,111	9,784
Mean	0.114	0.218	608	352
N	485	485	485	485

Annual stock returns and annual EBIT are taken from Thomson Reuters' Datastream database and adjusted for inflation. EBIT are total firm earnings before interest and taxes in a given fiscal year denominated in millions of 2005 Euros. The standard deviation of stock returns is calculated based on monthly returns over the three years preceding the year of the corresponding executive compensation data. The standard deviation of EBIT is calculated over ten years preceding the year of the corresponding executive compensation data.

Table 1.6: Regression Results for Stock Market Data, 2005-2009

Dependent Variable:	Total Compensation		
Stock Return	97.81	94.87	116.1
	(1.13)	(1.10)	(1.33)
Stock Return x Rank(risk)	-163.1	-157.1	-178.5
	(-1.49)	(-1.43)	(-1.60)
Rank(risk)	-308.1**	-313.1**	-324.1**
	(-2.40)	(-2.44)	(-2.52)
2006	186.7***	184.3**	183.1**
	(2.58)	(2.55)	(2.55)
2007	272.3***	267.9***	256.6***
	(3.84)	(3.79)	(3.68)
2008	196.6**	196.6**	192.1**
	(2.42)	(2.43)	(2.39)
2009	203.7***	201.5**	193.2***
	(2.69)	(2.67)	(2.57)
CEO	622.1***	629.5***	628.6***
	(4.33)	(4.33)	(4.35)
Total Assets	-	0.002	-
		(1.02)	
Number of	-	-	0.004
Employees			(1.61)
Observations	1,603	1,603	1,594

Estimates are based on a panel regression with executive fixed effects. Standard errors are heteroscedasticity-robust and adjusted for clustering at the executive level. The dependent variable is total compensation and measured in thousands of 2005 Euros. Stock returns are annual returns adjusted for inflation. Rank(risk) is the rank of the return volatilities divided by the number of observations. Total assets (in millions of 2005 Euros) and the number of employees are measured at the end of the respective fiscal year. CEO is a dummy variable for board members that are chief executive officer of their firm. For each estimate t-values are given in parentheses. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 1.7: Regression Results for Accounting Data, 2005-2009

Dependent Variable:	Total Compensation		
EBIT	0.808***	0.811***	0.813***
	(2.77)	(2.74)	(2.75)
EBIT x Rank(risk)	-0.754**	-0.756**	-0.763**
	(-2.21)	(-2.20)	(-2.22)
Rank(risk)	780.4	787.5	673.0
	(1.49)	(1.45)	(1.03)
Stock Return	-23.28	-23.44	-19.19
	(-0.89)	(-0.91)	(-0.78)
2006	225.4***	225.5***	255.4**
	(4.65)	(4.65)	(4.61)
2007	329.7***	329.7***	323.6***
	(4.91)	(4.91)	(4.80)
2008	256.2***	256.0***	259.3***
	(3.02)	(3.01)	(3.04)
2009	276.2***	276.4***	276.9***
	(3.35)	(3.31)	(3.39)
CEO	583.5***	582.9***	585.6***
	(3.33)	(3.31)	(3.33)
Total Assets	-	-0.0002	-
		(-0.08)	
Number of	-	-	0.002
Employees			(0.74)
Observations	1,603	1,603	1,594
Pay-Performance Sensitivities			
Median	0.432	0.433	0.432

Estimates are based on a panel regression with executive fixed effects. Standard errors are heteroscedasticity-robust and adjusted for clustering at the executive level. The dependent variable is total compensation and measured in thousands of 2005 Euros. EBIT are total firm earnings before interest and taxes in fiscal year t, measured in millions of 2005 Euros. Rank(risk) is the rank of EBIT volatility divided by the number of observations. Stock returns are annual returns adjusted for inflation. CEO is a dummy variable for board members that are chief executive officer of their firm. Total assets (in millions of 2005 Euros) and the number of employees are measured at the end of the respective fiscal year. For each estimate t-values are given in parentheses. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.
A Median Pay-Performance Sensitivity of 0.432 indicates that an executive at the firm with median risk in our sample receives roughly 432 Euro for generating 1 million Euro EBIT.

Table 1.8: Regression Results for Compensation Components, Accounting Data, 2005-2009

Dependent Variable:	Variable Pay	Cash Bonus	Long-Term
EBIT	0.855***	0.615***	0.240*
	(3.34)	(2.97)	(1.67)
EBIT x Rank(risk)	-0.781***	-0.524**	-0.257
	(-2.70)	(-2.24)	(-1.57)
Rank(risk)	941.2	390.4	550.8
	(1.61)	(0.86)	(1.36)
Stock Return	-27.15	-21.95	-5.20
	(-1.08)	(-1.32)	(-0.30)
2006	173.3***	50.7	122.7**
	(3.79)	(1.09)	(2.75)
2007	266.6***	125.5***	141.0**
	(4.19)	(3.52)	(2.49)
2008	176.8**	71.9*	104.9
	(2.14)	(1.66)	(1.46)
2009	184.1**	96.00**	88.10
	(2.34)	(2.08)	(1.04)
CEO	433.9***	348.9***	89.0
	(2.92)	(2.47)	(1.04)
Total Assets	0.0004	0.002	-0.001*
	(0.22)	(1.07)	(-1.74)
Observations	1,603	1,603	1,603
Pay-Performance Sensitivities			
Median	0.465	0.353	-

Estimates are based on a panel regression with executive fixed effects. Standard errors are heteroscedasticity-robust and adjusted for clustering at the executive level. The dependent variables are different compensation components in thousands of 2005 Euros and are given in the first line of the table. EBIT are total firm earnings before interest and taxes in fiscal year t, measured in millions of 2005 Euros. Rank(risk) is the rank of EBIT volatility divided by the number of observations. CEO is a dummy variable for board members that are chief executive officer of their firm. Total assets (in millions of 2005 Euros) are measured at the end of the respective fiscal year. For each estimate t-values are given in parentheses. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.
A Median Pay-Performance Sensitivity of 0.465 indicates that an executive at the firm with median risk in our sample receives roughly 465 Euro for generating 1 million Euro EBIT.

Table 1.9: Regression Results with Ownership, 2005-2009

Dependent Variable:	Total Compensation		
EBIT	2.07**	1.97**	2.05***
	(2.93)	(2.81)	(3.03)
EBIT x Rank(risk)	-1.99**	-1.86**	-1.96**
	(-2.73)	(-2.59)	(-2.83)
Rank(risk)	1,695***	1,675***	1,599***
	(10.11)	(8.84)	(7.55)
Stock Return	-2.11	-28.27	-16.36
	(-0.03)	(-0.39)	(-0.22)
2006	122.8	132.5	117.5
	(1.39)	(1.57)	(1.34)
2007	111.5	115.1	102.7
	(0.83)	(0.90)	(0.77)
2008	58.69	44.93	49.31
	(0.34)	(0.27)	(0.29)
2009	54.12	59.49	55.97
	(0.42)	(0.52)	(0.46)
CEO	763.4***	767.5***	770.9***
	(5.79)	(5.71)	(5.78)
Total Assets	0.003	0.002	0.002
	(1.68)	(1.12)	(1.41)
Owner 25	-263.1***	-	-
	(-3.45)		
Owner 50	-	-368.2***	-
		(-2.99)	
Free Float	-	-	5.71***
			(3.56)
Observations	1,603	1,603	1,603

Estimates are based on a panel regression with industry fixed effects. Standard errors are heteroscedasticity-robust and adjusted for clustering at the executive level. The dependent variable is total compensation and measured in thousands of 2005 Euros. EBIT are total firm earnings before interest and taxes in fiscal year t, measured in millions of 2005 Euros. Rank(risk) is the rank of EBIT volatility divided by the number of observations. Stock returns are annual returns adjusted for inflation. CEO is a dummy variable for board members that are chief executive officer of their firm. Total assets (in millions of 2005 Euros) are measured at the end of the respective fiscal year. Owner 25(50) is a dummy for firms which have an owner with at least 25(50) percent of the shares. Free float is the sum of all ownership shares lower than 5 percent of all shares. For each estimate t-values are given in parentheses. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 1.10: Regression Results for Different Degrees of Employee Representation, 2005-2009

	0 or 33% vs 50% Representation		33% vs 50% Representation	
	Total	Cash Bonus	Total	Cash Bonus
EBIT	10.22***	6.51**	12.66***	20.19**
	(2.89)	(2.08)	(2.84)	(2.26)
EBIT x Low Representation	-8.25***	-5.55**	-6.77***	-3.01
	(-2.76)	(-2.43)	(-3.45)	(-1.02)
EBIT x Rank(EBIT risk)	-10.85*	-2.94	-10.92*	-24.08*
	(-1.69)	(-0.55)	(-1.73)	(-1.85)
Rank(EBIT risk)	-1,896***	-1,088**	-1,435***	236.3
	(-2.76)	(-2.34)	(-4.08)	(0.23)
Stock return	45.61	110.3*	88.14	-38.88
	(0.44)	(1.85)	(1.19)	(-0.28)
Stock return x Low Representation	165.26**	99.62**	145.8***	94.25
	(2.42)	(2.12)	(3.24)	(1.58)
Stock return x Rank(Stock risk)	-117.4	-218.4**	-221.5**	6.58
	(-0.90)	(-2.49)	(-2.19)	(0.03)
Rank(Stock risk)	-660.4*	-68.23**	-223.1	-263.2
	(-1.73)	(-0.53)	(-1.52)	(-1.51)
2006	45.03	150.9**	250.5***	161.9**
	(0.25)	(2.43)	(2.82)	(2.04)
2007	284.9**	179.5***	312.1***	165.4*
	(2.56)	(2.77)	(2.99)	(1.69)
2008	365.2***	277.0***	384.5***	273.6***
	(2.75)	(3.70)	(3.28)	(2.94)
2009	345.6*	259.1***	492.6***	286.6***
	(1.97)	(2.81)	(3.65)	(2.94)
CEO	639.9***	210.9***	446.0***	223.7***
	(3.04)	(3.77)	(4.73)	(3.04)
Total Assets	0.46***	-0.15	0.22	-0.22
	(3.03)	(-1.51)	(0.55)	(-0.42)
Observations	311	311	245	245

Columns 1 and 2 include observations with 0 and 33 percent employee representation and their closest match in terms of total assets with 50 percent employee representation. Both firms are included if the ratio of total assets is lower than 1.5. When matching is successful all executives from the two firms are included in the sample. Sample construction for Columns 3 and 4 is identical, only with 33 percent employee representation firms and 50 percent employee representation firms.
Estimates are based on a panel regression with firm fixed effects. Standard errors are heteroscedasticity-robust and adjusted for clustering at the firm level. The dependent variables are different compensation components in thousands of 2005 Euros and are given in the first line of the table. EBIT are total firm earnings before interest and taxes in fiscal year t. Low representation is a dummy and equals 0 if the firm has 50% employee representation and 1 otherwise. Rank(EBIT risk) is the rank of EBIT volatility divided by the number of observations. Stock returns are annual returns adjusted for inflation. Rank(Stock risk) is the rank of the return volatility divided by the number of observations. CEO is a dummy variable for board members that are chief executive officer of their firm. Total Assets are measured at the end of the respective fiscal year. For each estimate t-values are given in parentheses. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 1.11: Sub-period Analysis for Total and Short-Term Compensation and Accounting Data

	Total		Cash Bonuses	
	2005-2007	2008-2009	2005-2007	2008-2009
EBIT	1.77**	2.81***	1.22***	2.31***
	(2.35)	(3.99)	(3.03)	(3.83)
EBIT x Rank(risk)	-1.66**	-2.77***	-1.15**	-2.35***
	(-2.18)	(-3.63)	(-2.85)	(-3.82)
Rank(risk)	1,889***	1,225***	766.7***	280.6***
	(5.32)	(5.83)	(3.65)	(2.61)
Stock return	-5.72	17.80	-31.75	-19.13
	(-0.06)	(0.50)	(-0.58)	(-0.66)
2006	80.41	-	-47.79	-
	(0.87)		(-0.54)	
2007	83.80	-	-0.26	-
	(0.60)		(-0.00)	
2009	-	-16.72	-	46.50
		(-0.26)		(0.72)
CEO	849.1***	662.6***	388.26***	308.1***
	(4.78)	(6.38)	(4.54)	(4.88)
Total Assets	-0.0004	0.01***	-0.001	0.006***
	(-0.22)	(2.63)	(-1.36)	(5.18)
Observations	812	786	812	786
Pay-Performance Sensitivities				
Median	0.945	1.419	0.648	1.140

Estimates are based on a panel regression with industry fixed effects. Standard errors are heteroscedasticity-robust and adjusted for clustering at the industry level. The dependent variables are different compensation components in thousands of 2005 Euros and are given in the first line of the table. EBIT are total firm earnings before interest and taxes in fiscal year t. Rank(risk) is the rank of EBIT volatility divided by the number of observations. CEO is a dummy variable for board members that are chief executive officer of their firm. Total Assets are measured at the end of the respective fiscal year. For each estimate t-values are given in parentheses. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.
A Median Pay-Performance Sensitivity of 0.945 indicates that an executive at the firm with median risk in our sample receives roughly 945 Euro for generating 1 million Euro EBIT.

Table 1.12: Comparison of Ordinary Least-Squares and Quantile Regression

Dependent Variable:	Total Compensation									
	OLS	Quantiles								
		10	20	30	40	50	60	70	80	90
EBIT	2.13***	1.06***	1.17***	1.47***	1.72***	2.13***	2.57***	2.71***	3.21***	3.89***
	(7.62)	(7.33)	(7.22)	(7.97)	(13.45)	(7.90)	(14.46)	(10.97)	(8.36)	(14.38)
EBIT x Rank(risk)	-2.04***	-0.95***	-1.06***	-1.38***	-1.65***	-2.01***	-2.49***	-2.64***	-3.15***	-3.82***
	(-7.19)	(-6.17)	(-6.15)	(-6.95)	(-12.26)	(-7.31)	(-13.24)	(-10.70)	(-8.05)	(-12.47)
Rank(risk)	1,551***	473.3***	697.6***	814.3***	967.2***	1,131***	1,183***	1,349***	1,522***	1,896***
	(10.33)	(6.83)	(13.56)	(12.59)	(10.46)	(13.75)	(16.51)	(15.25)	(11.89)	(14.15)
Stock return	-52.95	-27.22	-4.53	4.30	-0.72	-5.12	9.99	-0.18	16.79	112.20*
	(-1.17)	(-1.47)	(-0.18)	(0.18)	(-0.03)	(-0.19)	(0.42)	(-0.01)	(0.42)	(1.93)
CEO	761.9***	115.8***	163.6***	222.8***	264.1***	294.5***	371.9***	581.7***	778.1***	1,279***
	(7.30)	(4.81)	(7.25)	(8.73)	(9.62)	(7.95)	(7.23)	(7.45)	(7.96)	(7.53)
Total Assets	0.002**	0.004***	0.003***	0.003***	0.003***	0.003	0.004***	0.004***	0.003*	0.002
	(2.07)	(6.67)	(6.19)	(5.06)	(3.63)	(1.55)	(3.09)	(3.22)	(1.95)	(0.63)
Observations	1,603									

The first column shows the estimated coefficients from an OLS regression and standard errors adjusted for clustering at the executive level. Columns 2-10 show the results of a quantile regression and bootstrapped standard errors. All regressions include year dummies (not shown in the table). The dependent variable is total compensation and measured in thousands of 2005 Euros. EBIT are total firm earnings before interest and taxes in fiscal year t, measured in millions of 2005 Euros. Rank(risk) is the rank of EBIT volatility divided by the number of observations. Stock returns are annual returns adjusted for inflation. CEO is a dummy variable for board members that are chief executive officer of their firm. Total assets (in millions of 2005 Euros) and the number of employees are measured at the end of the respective fiscal year. For each estimate t-values are given in parentheses. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Chapter 2

Which Pay for what Performance? Evidence from Executive Compensation in Germany and the United States

2.1 Introduction

Executive compensation has been on the political agenda in the United States and Germany since the onset of the financial crisis in 2007/08. In both countries the public discussion arose around executives receiving bonus payments although their firms had lost substantially in market value. The media and politicians started questioning for what performance these executives were actually paid, and whether executive pay was linked to performance at all. In both countries, public objections against excessive bonus payments became visible in bonus restrictions for companies that received government support during the crisis.

Hence we observed a similar discussion about a mismatch between executive compensation and performance in the U.S. and Germany, despite the fact that corporate control is organized very differently in the two jurisdictions. Whereas U.S. companies operate under a single-tier system with one board of executives and non-executive directors, which may be chaired by the CEO, German companies are governed by a two-tier system with a supervisory body separated from the executive board. The German supervisory board's function is to control the executive board

and also to decide upon executive compensation. Hence German executives are monitored by an institutionalized supervisory body, whereas U.S. executives do not face such an institutionalized control mechanism within the firm. Moreover, U.S. corporate governance grants shareholders the right to elect all non-executive directors, whereas seats on the German supervisory board are split between representatives of shareholders and employees[1]. Therefore, not only shareholder representatives but also employee representatives determine executive compensation in Germany.

Previous research such as Fahlenbrach (2009) shows that differences in corporate control are reflected in executive compensation. Therefore we start by comparing executive compensation and the link between compensation and performance to understand whether U.S. and German executive compensation is actually similar despite differences in corporate control. Since the public debate centers around bonus payments, we analyze the individual compensation components separately. Typically, executive compensation packages consist of base salaries, cash bonuses, company stock and options, but the composition of these packages differs between the U.S. and Germany. Moreover, we do not limit our search for a link between compensation and performance to shareholder value (market-based performance), but also look at various accounting-based measures and compare the use of such measures between the U.S. and Germany.

In this study we analyze annual executive compensation which excludes any changes in executive wealth, because the public discussion in the press and among politicians and regulators has focused on the link between direct annual compensation and firm performance, not on changes in executive wealth[2]. The link between annual compensation and firm performance is of political interest because regulation can target this annual flow of compensation. As Kaplan (2012) notes, annual compensation, but not changes in executive wealth, is directly influenced by the board of directors or the firm's compensation committee[3].

[1] In listed corporations with more than 2,000 employees, one half of the supervisory board members represent shareholders and the other half are elected employee representatives. For corporations with less than 2,000, but more than 500 employees, German codetermination law prescribes one third employee representation on the supervisory board.

[2] Annual compensation includes the base salary, cash bonuses and the grant-date value of company stock and options. Annual compensation is also analyzed and discussed in Perry and Zenner (2001), Aggarwal and Samwick (1999) and Kaplan (2012), whereas in many other studies executive compensation includes gains from exercising options, the change in value of company stock holdings or other measures of changes in (firm-related) executive wealth.

[3] See also the discussion in Perry and Zenner (2001).

Generally, our analysis is related to two major strands of the executive compensation literature. As Murphy (1999) describes in a survey, both financial economists and accountants have studied executive compensation. Whereas financial economists have mainly focused on the link between compensation and performance, accountants have studied the use of accounting-based versus stock market-based performance measures. Surprisingly, however, the two disciplines remain fairly separated. Our study combines elements from both research areas. Related to earlier studies by financial economists such as Jensen and Murphy (1990) or Aggarwal and Samwick (1999), we investigate the association between executive compensation and firm performance and calculate pay-performance sensitivities. Related to earlier accounting studies such as Lambert and Larcker (1987) or Sloan (1993), we analyze the use of accounting-based versus market-based performance measures. Finally, our work contributes to the small literature that compares executive compensation across countries with different forms of corporate control.

Our findings are as follows. First, total compensation of both German and U.S. executives is related to firm earnings, but there is no robust link between total compensation and stock market performance. Other measures of firm performance such as sales growth play a minor role for total compensation. Second, cash bonuses are related to firm earnings in both countries, but only cash bonuses of U.S. executives are also determined by stock market returns. Moreover, the sensitivity of cash bonuses to firm performance is decreasing in firm risk. We also find evidence that firms choose performance measures for cash bonus compensation which are less volatile than alternative measures. Third, our results indicate that the level of pay-performance sensitivities based on firm earnings does not differ significantly between the U.S. and Germany, but U.S. executives face additional financial incentives tied to stock market performance. Finally, there is no robust explanation for what determines long-term variable compensation. In both countries there is only weak evidence for a correlation between long-term compensation and firm performance in prior fiscal years.

Hence, contrary to the perception in the public debate, we find a positive link between executive compensation and firm performance. In Germany, cash bonuses are determined by accounting performance, but not by stock market performance, whereas cash bonuses in the U.S. are linked to both stock market and accounting performance. We have two explanations for this observed difference. By establishing

a link between bonus payments and stock market performance, U.S. shareholders provide financial incentives to make sure managerial action is beneficial to shareholder value. German shareholders may be able to control managerial action more explicitly, because of the institutionalized supervisory body within the firm[4]. Second, employee representatives on this supervisory body are probably less concerned about shareholder value than shareholder representatives, and may not vote for a strong link between executive compensation and shareholder returns in Germany.

The paper is organized as follows. In section 2.2 we present findings from related studies on executive compensation. In sections 2.3 and 2.4, respectively, we describe our data and the analytical approach of our empirical study. Section 2.5 presents the regression results. After some robustness checks in section 2.6, we conclude in section 2.7.

2.2 Related Literature

This study is connected to the existing compensation literature along different dimensions. First, our work is related to previous work by financial economists and accountants. We investigate the association between executive compensation and performance and calculate pay-performance sensitivities similar to other studies in financial economics. We measure firm performance by various market- and accounting-based figures as did other accounting studies.

Second, our work can be classified within the existing compensation literature along the geographical dimension. Most of the empirical literature is based on U.S. data. Few studies investigate executive compensation outside the U.S.. Even fewer studies compare compensation practices between countries. This lack of evidence is due to the limited availability of non-U.S. compensation data. Studies on executive pay in countries other than the U.S. are usually based on hand-collected data from annual reports and filings with national authorities, or data from compensation consultancies.

In this short literature review we first present related literature on the pay-performance link and the choice of performance measures which is based on U.S. data. We then discuss the relevant literature on executive compensation in Ger-

[4]This argument is closely related to the 'substitution hypothesis' by Fahlenbrach (2009).

many[5]. Only few studies compare executive compensation in two or more countries. Since we contribute to this small literature, we conclude this literature review with some comparative studies in which one country is either the U.S. or Germany.

2.2.1 Evidence from the U.S.

Discussing the whole literature on executive compensation in the U.S. would go beyond the scope of this paper. For a more detailed overview we refer to extensive surveys by Murphy (1999), Frydman and Jenter (2010), Kaplan (2012) or Murphy (2013). Our study is related to studies that analyze the sensitivity of executive compensation to firm performance (pay-performance sensitivity) in U.S. firms. A first notable study is Jensen and Murphy (1990). They find a significant but surprisingly low sensitivity of CEO compensation to a firm's stock market returns for the period 1974-1986. Hall and Liebman (1998) estimate the sensitivity of CEO compensation to stock market returns for the period 1980-1994 by including in their compensation measure the annual change in value of stock and stock option holdings. Unlike Jensen and Murphy (1990), they find a strong relationship between CEO compensation and firm performance which comes mostly from CEO holdings of stock and stock options[6]. Unlike previous studies on CEO compensation, Aggarwal and Samwick (1999) have data on individual compensation of the top five executives in large U.S. firms for the period 1993-1996. They find for both CEOs and other executives that the sensitivity of compensation to stock market returns decreases with the variance of returns[7].

The focus of Bebchuk and Grinstein (2005) is the growth in CEO pay levels during 1993-2003 after controlling for firm size and firm performance. They measure firm performance by stock return and return on assets and find that stock return is a significant control for CEO compensation levels, whereas the effect of accounting performance on compensation is less pronounced. However, the authors do not calculate and interpret any pay-performance sensitivities since they are only interested

[5]We present the few available studies on German executive compensation to compare our evidence with earlier findings from German data. We do not cover the entire and much broader literature on executive compensation in the U.S. because this would go beyond the scope of this comparative study. For a recent overview we refer to Frydman and Jenter (2010).

[6]Hall and Liebman (1998) note that executive stock options became very popular only at the end or shortly after the period covered by Jensen and Murphy (1990).

[7]This holds true whether or not they include the change in value of stock and stock option holdings in their compensation measure.

in the growing level of compensation.

A recent U.S. study is Fahlenbrach and Stulz (2011) who investigate the impact of CEO incentives on the performance of U.S. banks during the financial crisis. They find that CEOs whose incentives are better aligned[8] with the interests of the shareholders did not outperform their peers with poorer incentives. They test this for different choices of market- and accounting-based performance measures and find that stronger incentives do not lead to better firm performance.

The second major type of studies related to our work is accounting literature about the use of different performance measures in executive compensation. In an early study, Lambert and Larcker (1987) model the use of accounting and market measures of performance in executive compensation. They hypothesize that the relative weight placed on a performance measure should be related to the noisiness of the measure. They empirically examine this hypothesis in a sample of U.S. firms during the period 1970-1984 and confirm that firms place relatively more weight on market performance if the variance of the accounting measure[9] is high relative to the market measure variance. They also find that firms with high growth rates place more weight on market performance than on accounting performance.

Similarly, Sloan (1993) finds in a U.S. sample for the period 1970-1988 that CEO compensation is more sensitive to firm earnings relative to stock returns if the stock price is a relatively noisy measure of executive performance, where noise in stock returns is defined as movements in stock returns related to market-wide changes in equity values. He concludes that earnings-based performance measures are used to shield executives from fluctuations in firm value that are beyond their control[10].

More recently, De Angelis and Grinstein (2010) investigate the association between firm characteristics and firm performance measures. Based on S&P 500 companies in 2007, they identify firm characteristics that determine the choice of perfor-

[8]They assume that CEOs who own a higher percentage share of outstanding stocks have better aligned incentives.

[9]Their market measure is the security market return defined as the sum of capital gains and dividends divided by the stock price at the beginning of the year. Their accounting measure is the return on equity defined as firm earnings before extraordinary items and discontinued operations divided by the average common shareholders' equity.

[10]Bushman and Indjejikian (1993) provide a theoretical model with a wage contract containing both stock price and earnings as performance measures and show that the role of earnings is to filter non-output related noise. The information content of earnings drives the relative weights put on the two performance measures in the wage contract.

mance measures in CEO compensation. They find, for example, that smaller firms reward performance in terms of sales growth whereas larger firms use earnings-based performance measures.

Our study is related to these studies on U.S. executive compensation. First, we estimate pay-performance sensitivities similar to Jensen and Murphy (1990), Hall and Liebman (1998) and Aggarwal and Samwick (1999), and we provide new evidence for a link between compensation and performance for a time period including a financial crisis. Second, our compensation measure is similar to "flow compensation" in Aggarwal and Samwick (1999) or "grant-date" compensation as discussed in Kaplan (2012) and Murphy (2013), in that it excludes changes in executive wealth from stock and option holdings. Finally, similar to Lambert and Larcker (1987), Sloan (1993) and De Angelis and Grinstein (2010) we analyze the use of different firm performance measures and firm characteristics, but we go beyond their analysis in that we estimate pay-performance sensitivities and relate these to firm characteristics.

2.2.2 Evidence from Germany

Elston and Goldberg (2003) investigate executive compensation in Germany for the period 1970-1986. Controlling for firm fixed effects, they find that the average pay level of a member of the management board is mainly determined by firm size (measured by sales), but also by firm performance measured by book return on equity[11]. They also look at ownership structures and find that both concentrated ownership of large stockholders and bank influence (more than 50 percent ownership of financial institutions) have a negative influence on compensation levels.

Another early study on executive compensation in German firms is Kraft and Niederprüm (1999) for the period 1987-1996. They find that firm profitability measured by book return on equity has a positive and significant impact on compensation of management board members. In their analysis, they control for firm risk[12], firm size and ownership structure of the firm. For given profits firm risk has a negative impact on compensation. Moreover, in firms that are dominated by a large

[11]The latter result is not very robust though. When they split their sample by industries and run the same analysis with firm fixed effects, firm size survives the robustness check but return on equity cannot explain executive compensation in any of the six analyzed industries.

[12]Firm risk is measured by the variance of book return on equity.

shareholder compensation is lower and the sensitivity to firm profitability is smaller.

Schwalbach and Graßhoff (1997) analyze the relationship between firm performance and compensation of German CEOs using several model specifications and alternative measures of firm performance. Throughout their analysis they find a significantly positive impact of earnings per share on CEO compensation for the period 1968-1990 and a significantly positive impact of return on sales for the years 1988-1992.

Haid and Yurtoglu (2006) investigate executive compensation and ownership structures of German firms for the period 1987-2003. They also identify firm size as the most important determinant of total compensation but firm performance (measured by return on assets) also explains a large part of compensation. They further control for firm ownership structures and find that in firms with more concentrated ownership the relationship between pay and performance is weaker and the overall level of compensation is significantly lower. Moreover, executives in bank-owned companies (companies with more than 50 percent bank ownership) earn less than executives in family-owned companies (more than 50 percent ownership of a family or an individual). The authors also estimate the sensitivity of executive pay to firm performance measured by shareholder returns. They find that pay-performance sensitivity is very small, with managers receiving on average an additional \$0.005 for every \$1,000 increase in shareholder value.

A recent study about determinants of executive compensation in German firms is Rapp and Wolff (2010) for the period 2005-2007. They find that firm size, industry and time effects are important explanatory variables but firm performance does not add much to explaining executive compensation in German firms. In particular, they find a positive but economically very small effect of total shareholder return on executive compensation, and no significant (in some specifications weakly significant but surprisingly negative) effect of a firm's operating performance[13] on executive compensation.

For the time period 2005-2009, Heimes and Seemann (2011) discuss German executive compensation and analyze the relationship between pay-performance sensitivity, firm risk and German codetermination with employee representation on the

[13]They measure operating performance as operating income after depreciation divided by total assets.

supervisory board.

We note that most studies on executive compensation in German firms have related compensation to accounting performance rather than stock market returns. This is different from much of the U.S. literature and may be attributable to a less pronounced stock market orientation in the German economy. Our study adds new evidence for this by explicitly comparing accounting- and market-oriented performance measures.

2.2.3 Comparative Studies

Finally, our study is related to cross-country studies which compare executive compensation in different jurisdictions. Results from such studies are important contributions to the literature because of the difficulty to assess and compare results from single-country studies which are not based on the same compensation measures, performance measures, time periods, or estimation methodology. One example of a cross-country study is Kaplan (1994) who analyzes differences in the sensitivity of compensation to firm performance of U.S. and Japanese executives in the 1980s. He investigates the impact of firm performance on executive pay in a sample of 119 Japanese firms[14] and compares his findings to the largest 150 U.S. industrial companies[15]. He measures firm performance by accounting figures (earnings, sales growth) and by stock market performance and finds that executive compensation in Japan is most sensitive to earnings whereas U.S. executive pay is more tied to stock market performance. The author argues that this finding arises from institutional differences between the "bank and relationship oriented" Japanese system and the "(stock) market oriented" U.S. system (p. 511). He also finds that U.S. executives own significantly more shares of the firms they manage and, thus, he concludes that they have stronger incentives to increase stock returns.

Conyon and Schwalbach (1999) analyze executive pay in Europe. Their sample consists of more than 30,000 individuals in 2,800 European companies in 1996. They

[14]Taken from the *Fortune* magazine list of the 500 largest foreign industrials in 1980 measured by sales.

[15]From *Fortune*'s list of the largest U.S. industrials in 1980 by sales. The two samples differ substantially in that the median U.S. firm is much larger (measured by sales), has a higher equity market value and an income-to-asset ratio which is about twice as high as the one for Japanese firms.

use information about job positions[16] and company size measured by number of employees. They find that much of the variation in European executive compensation is explained by job level and company size. However, country effects remain significant throughout their analysis. They conclude that country-specific differences prevail and factor price equalization has not yet led to similar executive pay across Europe[17]. They also find some differences in compensation structure between countries. For example, in the UK the ratio of long-term compensation (e.g. executive stock and options) to cash compensation is 25 percent whereas this ratio is close to 0 percent in Germany.

In another study, Conyon and Schwalbach (2000) compare executive compensation in the UK and Germany during the period 1969-1995. They find that the average pay in UK firms is much higher than in German firms[18]. Also the compensation structure differs. Since the mid 1980s, UK firms use much more long-term compensation provided through long-term incentive plans than German firms. Although the authors find that firm size rather than stock returns explain executive compensation to a large part, they still identify for both German and UK firms a significantly positive link between cash compensation and firm performance. For German firms the pay-performance sensitivity of cash compensation is slightly lower than for UK firms.

Conyon et al. (2011) compare the compensation packages of U.S. and UK CEOs. Their dataset consists of 391 CEO-year observations for UK firms in the years 1997 and 2003. To make findings comparable, they use a propensity-score-matching procedure to obtain two samples that are similar in terms of firm structure[19]. Their main finding is that U.S. CEOs are paid more, but also face more compensation uncertainty as their pay packages contain more stocks and options. They conclude that risk-adjusted CEO compensation is not significantly higher in the U.S. than in the UK.

[16]They classify executives on five job levels from "most senior full time executive" to "middle manager" (p. 20).

[17]The ten countries they consider are Austria, Belgium, Denmark, Germany, Ireland, Italy, Netherlands, Spain, Switzerland and the UK.

[18]More precisely, the authors find that average pay in UK firms is about twice as high as in German firms. However, at least part of the pay gap is probably due to differences in data availability. For UK firms the authors have information about the compensation of the "highest paid director" whereas for German firms they calculate the average "per capita income of the management board"(see data description in Appendix B of their paper).

[19]We use a similar matching approach to confirm our findings in a robustness check.

In a recent study, Fernandes et al. (2013) compare compensation levels of U.S. CEOs in the year 2006 with the level of CEO compensation in 13 other countries. They find that U.S. CEOs do not earn significantly more than CEOs in other Anglo-Saxon countries[20] once they control for country differences in ownership structure[21] and board characteristics[22]. However, the authors still find a significant pay gap between U.S. CEOs and CEOs in continental European countries like Germany and France.

2.3 Data Description

We combine data from several sources. Firms in Germany and the U.S. have to publish compensation data in their annual reports. U.S. firms also report compensation data in filings with the Securities and Exchange Commission (SEC). We collected the compensation data and combine them with firm performance data from Thomson Reuters' Datastream database. In the following we provide details on the data collection process and some descriptive statistics.

2.3.1 Compensation Data

We have two comparable sets of compensation data. For U.S. executives, compensation data is readily available in S&P's Execucomp database and in the SEC EDGAR database for the five highest paid executive board members[23]. Since there is no similar platform for German compensation data, we hand-picked compensation data for German executive board members ("Vorstand") from annual reports on company websites.

Our German sample contains listed firms that are currently part of the Prime Standard market segment of the Frankfurt Stock Exchange[24]. Our sample includes

[20]They find effective parity in CEO pay levels among the U.S., U.K., Ireland, Australia, Canada and, as an exception, Italy.

[21]In particular, they control for institutional ownership and ownership by insiders such as officers, directors and related individuals or corporations.

[22]Such as board size, the fraction of independent directors, and duality of CEO and board chairman.

[23]The respective SEC filing is form "DEF 14A" ("definite proxy statement") in which listed U.S. companies have to disclose the compensation of their CEO and the next four highest paid executive board members.

[24]To be part of the Prime Standard segment, firms have to fulfill certain obligations concerning publication of quarterly reports, ad-hoc disclosure rules and accounting standards.

209 firms for which we have individualized compensation data and sufficient performance data[25]. The U.S. sample consists of 1,141 firms from the S&P 1500 Composite Index. Both datasets cover the years 2005 to 2009[26]. We have information on individual compensation of the executive board members for a wide cross section of firms of different size and industries.

We try to exclude executives who are not with the same company for the whole fiscal year. For such observations compensation data may contain payments that are associated with the job change (e.g. severance payments). Often these payments cannot be identified and separated from other compensation in the data and thus we try to remove such observations. In our hand-collected German sample we can identify executives who are not with the company for the whole fiscal year because this information is given in annual reports. For U.S. executives we do not have this information. We use the following proxy to identify U.S. executives joining or leaving the company. For each executive we exclude the first (last) available year of observation if her base salary in that year is only 75 percent or less of her base salary in the following (previous) year[27].

Moreover, in both samples we exclude the top and bottom 0.5 percent of observations in the compensation and performance data to make sure our regression results are not driven by extreme outliers. We are left with a German sample of 2,404 observations for a total of 896 individual executives in 209 corporations. The U.S. sample is much larger and contains 25,515 observations for a total of 9,297 individuals in 1,141 corporations. Table 2.1 in the appendix shows the compensation structure of executives in German (left panel) and U.S. firms (right panel) for the whole sample period 2005-2009. Total compensation is the sum of all compensation components an executive receives in a given year. We distinguish three different components of total compensation: (1) Compensation that is not performance related such as base salary, the value of company cars and insurance payments, (2)

[25]In both samples we exclude firms in the financial industry (banking, insurance, real estate) because some of the firm performance measures we use in our regression analysis are not comparable between financial and non-financial firms (e.g earnings, growth in sales). Moreover, we exclude those firms from our analysis for which (some) firm performance measures are not available.

[26]The time period is determined by the availability of compensation data for German executives. German law requires corporations listed in Germany to provide information on the compensation structure of their executive board members for fiscal years starting after August 15, 2005.

[27]We use the base salary as a signal for joining or leaving the company because we expect (and have anecdotal evidence that this is indeed the case) an executive to receive a monthly paid salary only for the months she is actually with the company.

short-term compensation which is paid out as cash bonuses at the end of the fiscal year, and (3) long-term compensation which comprises the value of granted shares, stock options and company-specific long-term incentive plans. The variety of such incentive plans is quite large across firms and may include non-standard payout structures with grants in cash, deferred cash, equity, phantom stock, restricted or time vesting stock, stock appreciation rights or similar types of awards.

For the valuation of long-term compensation of German executives we rely on the numbers given in the annual reports. German law requires firms to publish the value of long-term incentives at the time they are granted. We have to rely on the values at grant date as stated in the annual reports because we do not have further information about the details of these incentive programs. Also U.S. companies publish the grant-date value of long-term incentives in SEC filings.

Total executive compensation is thus the sum of salary and cash bonus plus the grant-date value of any long-term compensation components. We interpret this measure as the total value of "direct" compensation that shareholders grant executives for serving as firm managers for a given year. This measure is similar to "flow compensation" in Aggarwal and Samwick (1999) or "grant-date" compensation as discussed in Kaplan (2012) and Murphy (2013), because it excludes changes in executive wealth from stock and option holdings. Moreover, we explicitly exclude any gains from exercising managerial stock options or selling company stock.

Table 2.1 shows that during the sample period 2005-2009 the mean (median) of total compensation for German executives was 1.0 (0.6) million Euro whereas U.S. executives earned on average 2.2 (1.3) million U.S. Dollar[28]. There are substantial differences in compensation structure between the two samples. Whereas German executives received on average 53 percent of total compensation as fixed compensation, this share was only 33 percent for U.S. executives[29]. The yearly cash bonus accounted for 35 percent of German executive pay, but only 24 percent of U.S. executive pay. Conversely, the share of long-term components was much higher in

[28]The average (median) values are adjusted for inflation with 2005 serving as the base year.

[29]Since 1993, U.S. tax legislation limits the deductibility of fixed (i.e. non-performance related) compensation to a maximum of 1 million U.S. Dollar (Internal Revenue Code Section 162(m)), whereas any performance-based compensation is deductible regardless of the amount. Perry and Zenner (2001) find that firms reduced salaries in response to this legislation but increased performance-related pay instead. From Table 2.1 we see that on average U.S. executives receive fixed compensation well below 1 million U.S. Dollar, which accounts for a much lower share in total compensation than for German executives.

U.S. executive compensation with an average of 43 percent. German executives received only 12 percent of total compensation as long-term components (and for many German executives this share was zero or negligibly small as can be seen in the median share of 0 percent)[30]. Hence the fraction of long-term components in total compensation is much larger for U.S. executives than for the German peer group. This finding confirms earlier studies such as Conyon and Schwalbach (1999) or Abowd and Bognanno (1995) who find that U.S. executives receive substantially more long-term oriented pay (both in level and as a fraction of total pay) than executives in 11 other OECD countries[31] including Germany.

Table 2.2 shows the development of executive compensation over time. The left part shows that average total compensation of German executives was around 1.1 million Euro during the years 2005-2007 but slightly below 1.0 million Euro in 2008 and 2009. From these summary statistics, however, it is not obvious whether there was truly a reduction in compensation levels during the years 2008 and 2009. From the bottom of Table 2.2 we see that there is a change in the sample composition over time. In 2005 and 2006 we cover fewer executive observations in fewer firms than in 2007-2009 because fewer firms published individual compensation data. Those firms publishing compensation data already in 2005 and 2006 were large firms as is evident in larger average and median firm size in those years. Since we know from earlier studies that large firms tend to pay more, the decline in compensation levels over time may be due to an increasing proportion of smaller firms in our sample. For U.S. executives we observe only a minor reduction in average compensation levels from around 2.2 million U.S. Dollar in 2005 to 2.1 million U.S. Dollar in 2009. The sample size of U.S. executives and the average U.S. firm size does not change as much over time as in the German sample. We also observe that in every year of our sample period, except for 2009, the average firm in the German sample is larger than the average U.S. firm, while the median firm size is substantially larger in the U.S. sample throughout the sample period.

Table 2.2 also presents the composition of total compensation over time. In both

[30]These numbers are very similar to the numbers presented for Germany and the U.S. in Fernandes et al. (2013) for the year 2006.

[31]Abowd and Bognanno (1995) do not have an explanation for this finding. For long-term compensation components such as stock options tax treatment and disclosure rules differ between countries. However, tax treatment cannot explain why non-U.S. executives receive much less of this type of compensation and disclosure rules are generally more restrictive in the U.S. than in other OECD countries (p. 90).

samples the shares of fixed (not performance-related) compensation, short-term cash bonuses and long-term incentive pay are fairly stable from 2005 to 2009. However, we note that in 2009 for German executives the share of fixed compensation was a few percentage points higher than in previous years (58 percent) while the share of cash bonuses was somewhat lower (32 percent). We do not observe such a change for U.S. executives.

2.3.2 Performance Data

To measure firm performance we start like previous studies with stock returns[32], but also extend the analysis to the accounting-based measures earnings before interest and taxes (EBIT), net income (EBIT reduced by interest and tax expenses), and sales growth. We extract all performance data from Thomson Reuters' Datastream database. Table 2.3 shows the distribution of these firm performance measures over the period 2005-2009 for which we have 791 German and 5,103 U.S. firm-year observations[33]. With an average annual stock return of 12.4 percent (median 5.0 percent), stock market performance of German firms was better than average stock market performance of U.S. firms was with 7.1 percent (median 0.6 percent). There is not much difference between sales growth in the two samples. However, in terms of firm size (measured by total assets), firm earnings (EBIT) and net income (i.e. performance measures related to firm size) the two samples differ widely. With 282 million Euro the median firm size in the German sample is much smaller than the 1,810 million U.S. Dollar median firm size in the U.S. sample, whereas the average German firm is of similar size as the average U.S. firm in the sample (7,732 million Euro and 6,714 million U.S. Dollar, respectively).

2.4 Research Design

Principal-agent theory suggests that shareholders (acting as principals) link the compensation of the employed managers (the agents) to some measure of success which

[32]Calculated as the stock market value at the end of the fiscal year divided by the stock market value at the beginning of the fiscal year. Our results do not change when we calculate stock returns based on stock prices instead of market values.

[33]Table 2.3 contains the final sample of firm-year observations we use in our empirical analysis. For each performance measure we excluded the top and bottom 0.5 percent of the original distribution to account for outliers.

is linked to the managers' effort. It is, however, not obvious what this measure is. We have no precise information about performance measures used in executive compensation contracts, because such contracts are generally not observable[34]. Shareholders probably care most about shareholder return and thus measure success by stock market performance. This may explain why most empirical studies in the financial economics literature investigate the link between executive compensation and firm performance by measuring the latter through stock returns.

However, as research in the accounting literature suggests, accounting measures are also used to evaluate executives. In addition, we have anecdotal evidence from German companies which in some cases explicitly explain in their annual report what determines the variable part of compensation. Much of this evidence suggests that variable compensation is not only based on stock market performance but also - and sometimes exclusively - on accounting-based performance measures such as firm earnings, income or sales growth. In fact, as Murphy (2013) argues, executives may prefer accounting-based measures because they understand their impact on accounting figures but they understand less how to influence stock prices[35].

We want to investigate this further by estimating pay-performance sensitivities based on several performance measures for both U.S. and German executives. The starting point of our analysis is the sensitivity of total compensation to performance. This will provide first insights whether executive pay is actually tied to some measure of firm performance or not. Then we continue the analysis with the variable components of total compensation, cash bonuses and long-term compensation. Analyzing compensation components individually is important because the link between firm performance and granting these different components may not be the same. Whereas cash bonuses are designed to reward performance ex post, stock price-oriented long-term compensation may also be granted ex ante to provide a link between executive compensation and shareholder value. Thus we expect a strong pay-performance link for cash bonuses, but there is no clear expectation for long-term compensation. Moreover, analyzing compensation components individu-

[34] As De Angelis and Grinstein (2010) point out, in the U.S. disclosure is required only for some contractual terms regarding equity awards and no specific disclosure is required for what determines cash bonuses. Both U.S. firms and German firms (the latter only since 2005) have to disclose the total amount and the structure of the annual executive compensation package.

[35] This gives rise to the problem of earnings management (manipulation), which is discussed in the accounting literature but goes beyond the scope of this paper.

ally is interesting because the incentives arising from cash bonuses and long-term compensation may differ. Many studies argue that the dominant incentives for executives come from company stock and options, i.e. long-term compensation, because these ownership-providing instruments align the interest of shareholders (owners) and managers. However, cash bonuses may also provide strong incentives because risk-averse, undiversified executives are likely to favor cash payments over company stock and options with restrictions such as vesting periods. While we expect executives and companies to attach the same value to cash payments, risk-averse and undiversified executives are likely to value restricted company stock and options lower than book values[36]. This may shift the focus of executives toward maximizing cash bonuses and away from maximizing the value of stock and option holdings. Finally, we analyze pay-performance sensitivities for compensation components individually to investigate whether executives receive bonuses despite poor performance as was suggested by the public debate in the financial crisis.

We further investigate a potential association between pay-performance sensitivities and several firm characteristics. Empirical evidence, e.g. Aggarwal and Samwick (1999) and Cichello (2005), suggests that the sensitivity of total CEO wealth to shareholder value depends on firm characteristics such as firm risk. We investigate if this is also true for the sensitivity of cash bonuses to firm performance.

After running separate regressions for German and U.S. executives, we also construct two matched samples to test the significance of differences between the two countries. Institutional differences in corporate control between the German two-tier board system and the one-tier board system in the U.S. may imply differences in pay-performance sensitivities. German corporate governance is based on institutionalized control by a supervisory board separated from the executive board, whereas Anglo-Saxon corporate governance with a one-tier board structure does not require this separation and CEOs often serve as chairman of the board. Hence U.S. corporate governance relies less on institutionalized control mechanisms within the firm, but more on market forces to discipline executives (Conyon and Schwalbach, 2000). Moreover, employee representatives on German supervisory boards[37] may be less interested in aligning management objectives with those of shareholders. This also

[36] See the discussion in Murphy (2013).

[37] German codetermination law requires one third (half) of the supervisory board members to be employee representatives for firms with more than 500 (2,000) employees.

calls for executive compensation in Germany to be less tied to stock-market performance. Due to these differences we expect more highly-powered incentives in U.S. executive compensation with a stronger focus on stock market performance than in Germany.

Evidence from other studies also calls for lower pay-performance sensitivities in Germany than in the U.S. Fahlenbrach (2009) argues that pay-performance sensitivities function as a substitute for weak corporate governance. He finds that U.S. firms in which the CEO is also the chairman of the board (one of the author's measures for weak corporate governance) implement higher pay-performance sensitivities in compensation contracts. By German law, CEO and chairman (of the supervisory board) cannot be the same person which calls for pay-performance sensitivities in German firms to be lower than in U.S. firms.

Finally, Hüttenbrink et al. (2011) identify high ownership concentration as a substitute for pay-performance sensitivity to align executive decisions with shareholder interests. Since ownership concentration has traditionally been higher in Germany than in the U.S., this again calls for lower pay-performance sensitivities in German firms. The same authors argue that transparency in executive compensation is important for shareholders to assess compensation incentives and detect malfunctions faster. Higher disclosure requirements would thus make pay-performance contracts more effective which should empirically become visible in higher pay-performance sensitivities. Indeed, they find that higher disclosure requirements defined by national corporate law are complementary to higher pay-performance sensitivities. This again calls for higher pay-performance sensitivities in U.S. firms because disclosure requirements in the U.S. have traditionally been much higher than in Germany [38].

We calculate pay-performance sensitivities from the coefficient estimates in a regression of annual executive compensation on firm performance. Since it is well documented that larger firms pay their managers more, we control for firm size. We also include executive fixed effects to control for executive-specific characteristics which we do not observe although they may have explanatory power for compensation, e.g. biographical variables (age, tenure, education) or a manager's bargaining

[38] For example, German law had not required disclosure of individual compensation per executive board member before 2005.

power. Finally, we include year dummies to account for time effects in executive compensation during our sample period.

Note that in our basic specification with executive fixed effects we do not include other control variables such as board size, ownership structure or industry. During our relatively short sample period such variables change little over time (or not at all). Since only few executives move from one firm to another within our sample period, time-invariant differences in the cross section are captured by executive fixed effects[39]. We are interested in pay-performance sensitivities and thus estimate the impact of firm performance on compensation but we are not interested in the impact of, e.g., board size or education on compensation. Hence we choose executive fixed effects to cover as much unobserved cross-sectional variation as possible to estimate the explanatory power that is left for firm performance measures[40].

We denote annual compensation of executive i at firm j in year t by w_{ijt} and estimate the following linear fixed effects model:

$$w_{ijt} = \boldsymbol{p}'_{jt}\boldsymbol{\beta} + \gamma s_{jt} + \lambda_i + \mu_t + \epsilon_{ijt}, \tag{2.1}$$

where $\boldsymbol{p}'_{jt} = (p_{1jt}...p_{kjt})'$ is a vector of k performance measures for firm j in year t, s_{jt} is a measure for firm size (total assets), λ_i is an executive fixed effect, μ_t is a year dummy, and ϵ_{ijt} is the error term.

[39]We are confident that our coefficient estimates of firm performance (which we use to calculate pay-performance sensitivities) would not differ much with additional ownership and board-level variables instead of executive fixed effects. We lack the data but the results in Fernandes et al. (2013) show that additional variables controlling for ownership and board structure are significant in a regression of compensation on firm performance and industry-level fixed effects, but hardly change the coefficient estimates of the performance measures.

[40]In the literature, we are no exception in following this approach. For example, Bebchuk and Grinstein (2005) are interested in the growth of CEO pay levels that is not explained by growth in firm size and firm performance. Hence they explicitly control for firm size and performance, and add firm-level fixed effects (which corresponds to executive effects in a regression with CEOs alone) to account for remaining cross-sectional variation. On the other hand, Fernandes et al. (2013) are interested in the explanatory power of ownership and board structure on executive compensation. Of course, they do not add executive or firm-level fixed effects because such time-invariant dummies would capture their variables of interest that are also mostly time-invariant. Instead they add industry dummies to control for industry effects on compensation.

2.5 Results

2.5.1 Results for Total Compensation

We first estimate equation (2.1) with total annual compensation including salary, cash bonus and long-term compensation on the left and one performance measure on the right. Then we combine all performance measures in one regression to see which measures have most explanatory power for total executive compensation in our two samples. Table 2.4 shows the results for the German sample. The first regression results show a (weakly) significant and negative relationship between a firm's stock return in year t and the total amount of compensation a firm manager receives at the end of year t. The next two regressions show that firm earnings (EBIT) and net income (EBIT reduced by interest and tax expenses), respectively, have a highly significant positive impact on total compensation. Sales growth is not a significant determinant of total compensation in German firms.

The combined regression with stock returns, EBIT and sales growth as explanatory performance measures[41] in the last column of Table 2.4 confirms these results. However, whereas the estimated coefficient of EBIT is about the same size as in the regression with EBIT as the only performance measure, the coefficient of stock returns is almost twice as large in absolute terms (more negative) as before. Sales growth is again insignificant. The positive and significant coefficient of the CEO dummy shows that CEOs earn significantly more than other executive board members. All specifications in Table 2.4 include year dummies for the years 2006-2009 to account for time effects (with 2005 serving as the base year). The coefficients are significant and positive throughout the years. This means that with respect to the reference year 2005, average compensation was significantly higher in each of the following years. Moreover, the coefficient size of the year dummies shows a peak in 2007 and lower levels for 2008 and 2009. This suggests that total compensation in the crisis years 2008 and 2009 was significantly higher than in 2005 but lower than it was during the peak in 2007.

Note that although the correlation between the performance measures in the last column of Table 2.4 is small, there may still be some degree of multicollinearity

[41] The results do not change when we replace EBIT with net income. We do not combine EBIT and net income in one regression because these two variables are highly correlated (correlation of 0.9). Correlation between the other performance measures is very small.

in our specification. EBIT and net income are correlated with firm size measured by total assets (the correlation is around 0.7), because in the cross section larger firms generate higher earnings and income than smaller firms. Multicollinearity inflates the standard errors of the regression coefficients and thus causes downward-biased t-statistics. In our specification, however, multicollinearity is not the reason why total assets is mostly insignificant in Table 2.4. There is not much variation in total assets over time during the five-year sample period and variation in the cross section is taken by the fixed effects[42]. A straight-forward approach to avoid multicollinearity would be to drop firm size from the regression. However, this changes the specification and may cause an omitted-variable problem which is not preferable over some degree of multicollinearity. Another approach in the literature is orthogonalization of correlated variables. Specifically, this would imply to first regress EBIT or net income, respectively, on total assets and then use the residual of this regression as a performance measure in equation (2.1) instead. However, as Kennedy (1982) and Pearce and Reiter (1985) show, the estimated coefficient of the residual would be the same as the coefficient of EBIT or net income in the original specification without orthogonalization (also the standard error of the coefficient would not change). Thus the interpretation of the effect of EBIT or net income on compensation would not change. Only the estimated coefficient of total assets would change such that this coefficient shows the effect of total assets on compensation as if there was no EBIT or net income in the regression[43] and thus from a different specification without firm performance[44]. Since we do not interpret the effect of firm size on compensation because it is largely captured by the fixed effects, we prefer to keep our original specification with EBIT or net income, respectively, and total assets as a control variable[45].

[42]It is a well established result that in the cross section firm size is a strong predictor for executive compensation. Larger firms pay higher compensation also in Germany; see for example Haid and Yurtoglu (2006). However, executive fixed effects capture this firm size effect. The variation in total assets for a given firm during our five-year sample period is not a strong predictor for changes in compensation in that firm. When we estimate the specifications in Table 2.4 without executive fixed effects, our results remain qualitatively the same but total assets have significant explanatory power for executive compensation.

[43]See the critique on this issue in Clarke and Stone (2008).

[44]The coefficient would be estimated from a misspecified model, because we do not believe that executives are paid according to firm size alone and not for performance at all.

[45]Yet another alternative would be to use as a regressor in equation (2.1) the ratio of EBIT divided by total assets. In a robustness test we find that this ratio is positive and significant and all other results remain qualitatively unchanged. However, anecdotal evidence from German annual reports suggests that executive compensation is rather based on EBIT than on return on assets measured by EBIT over total assets. Hence we prefer to use EBIT as a performance measure

Table 2.5 shows the corresponding results for the U.S. dataset. Unlike for the German data, we find no relationship between stock returns and total executive compensation. EBIT, net income and also sales growth are highly significant when taken separately as performance measures. When we combine stock returns, EBIT and sales growth in one regression (last column of Table 2.5) we find that both EBIT and sales growth remain significant. The CEO dummy is highly significant, as in the German sample, which indicates that CEOs receive higher total compensation than the other executive board members. As noted before, we do not interpret the coefficient of total assets although it is significant in some specifications in Table 2.5[46]. The time dummy variables show a similar pattern as in the regressions for Germany, but the coefficients indicate that U.S. executives reached the peak in average total compensation levels in 2008 and not already in 2007 as their German peers did.

Note that the coefficients in Tables 2.4 and 2.5 are not only statistically significant, but also economically meaningful. The dependent variable, total compensation, is denoted in thousands of Euros (U.S. Dollar) in the German (U.S.) sample, whereas EBIT is measured in millions of Euros (U.S. Dollar). Hence, for generating 1 million Euro (U.S. Dollar) in EBIT, the average German (U.S.) executive in our sample receives 164 Euro (223 U.S. Dollar) in total compensation. The significant coefficient of sales growth in the U.S. sample suggests that the average U.S. executive receives 454,000 U.S. Dollar for a 1 percent increase in sales[47]. The interpretation of the significant but negative stock return coefficient in the German sample is less intuitive. It suggests that on average a German executive in our sample receives 52,950 Euro after a negative 1 percent stock return.

This unexpected result calls for further investigation of the relationship between stock market performance and executive compensation. We split the sample period in pre-crisis and crisis years to analyze whether there are differences between these sub-periods. Matolcsy (2000), for example, identifies an impact of economic growth on the pay-performance relation of executive compensation. He finds a positive

and control for firm size by including total assets as a separate control variable.

[46]Once again, when we estimate the specifications in Table 2.5 without executive fixed effects, all results remain qualitatively the same but total assets are highly significant in all regressions.

[47]This number seems high at first sight. However, the average (median) sales in the U.S. sample are 5,906 million (1,679 million) U.S. Dollar. Thus a 1 percent increase in sales means additional 59.1 (16.8) million U.S. Dollar in revenues for the average (median) firm in our sample.

relation between executive cash compensation in Australian firms and accounting performance in periods of economic growth, but no significant relation during economic downturn.

In particular, we analyze executive compensation in two sub-periods, 2005-2007 as a pre-crisis period, and 2007-2009 as the period containing the financial crisis. We include the year 2007 in both sub-periods because, first, it is not clear whether to call 2007 already a crisis year or not, and, second, to have enough years in both regressions for our fixed-effects specification to be meaningful[48].

Table 2.6 shows that the negative stock return coefficient in the Germans sample is no longer significant in the two sub-periods and thus does not survive this first robustness check. The EBIT coefficient is significant in both sub-periods and of similar size as in the full sample. With coefficients of 0.1841 in 2005-2007 and 0.1317 in 2007-2009, the pay-performance sensitivity based on EBIT is somewhat larger during the pre-crisis period. Sales growth is again not significant for total compensation of German executives. For U.S. executives, we find more pronounced differences between the sub-period results in Table 2.6. Whereas there was no significant impact of stock returns on U.S. compensation in the full sample period, stock returns have a positive impact on total compensation in the pre-crisis period 2005-2007, but a negative impact during 2007-2009. The EBIT coefficient is positive and significant in both sub-periods, and with 0.4144 in 2005-2007 twice as large as the 0.1963 in 2007-2009. Sales growth was significant in the full sample period, but is only significant during sub-period 2007-2009.

To sum up, for both German and U.S. firms we find that firm earnings measured by EBIT and, in the case of U.S. executives, also sales growth have a significantly positive impact on total compensation. This holds for the full sample but also in each sub-period in which pay-performance sensitivities based on EBIT are lower during the crisis period in both samples. The latter result is not as strong as Matolcsy's (2000) finding of no pay-performance link during years of economic downturn, but it goes into the same direction. Moreover, with respect to EBIT we find somewhat higher pay-performance sensitivities in the U.S. than in German firms. We test the significance of these differences in section 2.5.4.

[48]Our main results do not change qualitatively though when we look at the two-year period 2008-2009 separately in a specification without individual but industry fixed effects.

The sub-period analysis confirms to some extent our expectation that stock market performance is a more important determinant in the U.S. than in Germany, because it has a significant (and positive) impact on total compensation of U.S. executives during 2005-2007. However, it seems to be negatively related to total U.S. compensation during the 2007-2009 period. In the following sections we identify which component of total compensation is negatively related to stock market performance in the U.S. More broadly, we now analyze whether the results for total compensation hold true for individual compensation components such as cash bonuses and long-term oriented compensation.

2.5.2 Results for Cash Bonuses

In this section we replace total compensation, w_{ijt}, in equation (2.1) with short-term variable compensation (cash bonuses). Again we analyze the full sample and the two sub-periods 2005-2007 and 2007-2009, separately. Matolcsy's (2000) finding of a significant pay-performance link in Australian firms only during periods of economic growth was based on cash compensation alone and explained with lower performance targets for cash bonuses in times of recession. If his finding also holds for the U.S. or Germany, it should be identified in this section based on cash bonus compensation.

Table 2.7 summarizes the results. The coefficient estimates in the first column show that, based on the full sample 2005-2009, cash bonuses of German executives are determined by EBIT and sales growth, but not by stock market performance. During the pre-crisis period 2005-2007, stock returns, and also EBIT, have positive explanatory power for German cash bonuses (column 3). This does not hold for the crisis period 2007-2009, in which once again only EBIT and sales growth are significant (column 5). Thus we find that only EBIT is a consistently significant determinant of cash bonuses in German firms. Based on the whole sample period, the estimated coefficients imply that German executives receive on average 162 Euro in cash bonuses for generating 1 million Euro in EBIT. This estimate is almost as large as the 164 Euro from the specification with total compensation in Table 2.4. Hence for German executives the pay-performance sensitivity of total compensation to EBIT comes mainly from cash bonuses. With 185 and 126 Euro, respectively, EBIT sensitivity of cash bonuses is somewhat higher in the pre-crisis period but lower during the crisis. For the sub-periods these numbers are also similar to the pay-performance sensitivities of total compensation in Table 2.6.

Estimates for U.S. executives, shown in columns two, four and six of Table 2.7, are more consistent across different time periods. Cash bonuses are significantly and positively related to stock returns, EBIT and sales growth in all regressions. Thus the negative relation between stock returns and total compensation in 2007-2009 (last column of Table 2.6) is not driven by cash bonuses. Based on the full sample period, the coefficient of stock return implies that U.S. executives receive on average a cash bonus of 135,000 U.S. Dollar for a 1 percent stock return. This estimate is somewhat higher for 2005-2007 and lower for 2007-2009. The EBIT coefficient based on 2005-2009 implies a 191 U.S. Dollar cash bonus for generating 1 million U.S. Dollar in EBIT. Again, this estimate is higher for the pre-crisis period and lower during the crisis period. It also shows that cash bonuses account for a large part of the estimated 223 U.S. Dollar EBIT sensitivity of total compensation in Table 2.5, but less so than for German executives. The coefficient of sales growth from the regression for 2005-2009 implies that U.S. executives receive on average a cash bonus of 373,000 U.S. Dollar for a 1 percent increase in sales. This estimate is lower in the pre-crisis period and higher in the crisis period.

The results in this section show that EBIT is an important determinant for cash bonuses of German and U.S. executives in both sub-periods. Stock returns are significant for cash bonuses throughout the sample period only for U.S. executives, but not for German executives during the crisis period. Our results explain why German and U.S. executives received bonuses during the crisis. As long as firms generate positive EBIT, managers may receive a bonus even though the stock return was negative. Although the estimated pay-performance sensitivities based on EBIT and stock returns are consistently smaller during the crisis period, our results differ from Matolcsy's (2000) finding of no pay-performance relation in crisis years for Australian firms. However, our findings for cash bonuses are in line with other results in the literature. The focus on earnings rather than stock return in German executive compensation was also identified by Schwalbach and Graßhoff (1997) and Haid and Yurtoglu (2006). Stock returns have always been identified as relevant for U.S. executive compensation, for example in Jensen and Murphy (1990), Hall and Liebman (1998) or Aggarwal and Samwick (1999).

Our results are supportive to the hypothesis that the institutional background has an impact on the compensation structure. On U.S. boards shareholders have more influence than shareholders on German supervisory boards. This may explain

why in U.S. firms stock performance is a significant determinant for cash bonuses throughout the sample period, whereas in German firms only accounting measures are consistently significant for cash bonuses. We may also interpret this finding in the spirit of Kaplan (1994) who argues that executive compensation in the U.S. is more related to stock returns than in Japan because of the market-oriented U.S. economy. In Japan, earnings determine executive compensation because, similar to Germany, the Japanese economy is rather bank-oriented than stock-market oriented.

Cash Bonuses and Firm Size

It is known from previous studies that some firm characteristics have an impact on the link between firm performance and executive compensation. For example, firm size is an important control variable because it is a robust finding that executives earn more in larger firms. In all our regressions we have included total assets as a control variable for firm size, which turned out to be insignificant in most regressions because of the fixed effects. However, Cichello (2005) also finds that not only pay levels but also pay-performance sensitivities vary with firm size. To analyze whether firm size has an impact on pay-performance sensitivities in our two samples, we proceed as follows. First, we look for a linear relation by including in our regression an interaction term between each performance measure and a rank measure of firm size. This rank measure is constructed by ranking all firms with respect to total assets and dividing by the number of observations[49]. Second, if the interaction term is not significant, we look for a potential non-linear relation. We create a dummy variable ('LARGE') which is one if the firm belongs to the upper half of the size distribution and zero else. Again we interact this dummy variable with each performance measure.

We expect different coefficient signs for these interaction terms. The interaction term between firm size and EBIT should be negative, while the interaction terms between firm size and stock return or sales growth, respectively, should be positive. To see why, consider one small and one large firm. Generating 10 million Euro in EBIT may be a good result for the small firm, but a very poor result for the large firm. This should be reflected in cash bonuses in the two firms. Hence in the cross section pay-performance sensitivity based on EBIT should be lower in larger firms.

[49]This rank measure has thus a value of one (zero) for the largest (smallest) firm in the sample.

The expectation differs when we consider stock return and sales growth as performance measures. The reason is that these measures already indicate performance relative to firm size, and not absolute values. Generating a 1 percent stock return or a 1 percent increase in sales creates more additional value in firms with large market value and sales numbers than in smaller firms. If this is reflected in bonus payments, we should expect higher pay-performance sensitivity based on stock return and sales growth for larger firms in our sample.

For German cash bonuses only EBIT and sales growth were significant in Table 2.7. We do not find a significant relation between firm size and pay-performance sensitivities when we interact the two performance measures with the ranked size measure (results not shown). However, our results indicate a non-linear relation between size and EBIT pay-performance sensitivity. The first column of Table 2.8 shows that the coefficient of the interaction term with EBIT ('EBIT x LARGE') is significant and has the expected negative sign, whereas the interaction term with sales growth is not significant. The estimated coefficients imply that an executive of a firm that belongs to the lower (upper) half of the size distribution receives 3,436 (165) Euro for generating 1 million Euro EBIT.

The second column of Table 2.8 shows the results for U.S. cash bonuses. EBIT pay-performance sensitivity decreases linearly as we move from smaller to larger firms, whereas pay-performance sensitivities based on stock return and sales growth increase. In this specification the pay-performance sensitivity can be calculated by adding the rank of firm size times the coefficient of the interaction term to the coefficient of EBIT. For example, the pay-performance sensitivity in the firm with median size in the U.S. sample is $1.1541 - 0.5 * 1.0456 = 0.6313$, whereas the pay-performance sensitivity is $1.1541 - 0 * 1.0456 = 1.1541$ in the smallest U.S. firm. Thus the estimated coefficients imply that the executive at the smallest (median) U.S. firm receives a cash bonus of 1,154 (631) U.S. Dollar for generating 1 million U.S. Dollar EBIT, 25,000 (145,000) U.S. Dollar for a 1 percent stock return, and 218,000 (305,000) U.S. Dollar for a 1 percent increase in sales.

The results for both samples confirm the hypothesis that EBIT pay-performances sensitivity is decreasing with firm size. Pay-performance sensitivities differ substantially between firms of different size. For the smallest (median size) firm in the U.S. sample, the sensitivity of cash bonus payments to EBIT is six (three) times the

average cash bonus sensitivity calculated from the specification in Table 2.7. In the German sample the difference is even more pronounced, probably because there is much more variation in firm size within the sample (see Table 2.3). The average EBIT pay-performance sensitivity at firms in the lower half of the size distribution is more than 20 times higher than at firms in the upper half of the size distribution. Firm size has a strong impact on pay-performance sensitivities based on stock return and sales growth only for U.S. cash bonuses. Compared to the smallest firm in the U.S. sample, we estimate that pay-performance sensitivities based on stock returns and sales growth at the median sized firm are larger by a factor of 5.8 and 1.4, respectively.

Cash Bonuses and Firm Risk

In this section we analyze the relation between pay-performance sensitivity and firm risk measured by performance volatility. Aggarwal and Samwick (1999) present empirical evidence that executive compensation is less related to firm performance in riskier firms (i.e. firms with higher performance volatility). The intuition behind this result is that performance-related compensation involves a risk transfer for which executives need to be compensated. Thus performance-related compensation is more costly for riskier firms. However, other studies such as Prendergast (2002) argue in favor of a positive relation between risk and performance-related compensation, because firms in risky environments are more likely to delegate decision responsibility to executives and link compensation to observed performance.

We measure firm risk by the variance of firm performance prior to the compensation event in year t. For monthly stock returns we calculate the variance over the three years preceding the beginning of fiscal year t[50]. Because EBIT and sales growth is annual data we use a time horizon of 10 years to calculate the variance prior to fiscal year t. We normalize the risk measure between zero and one by dividing its rank within the sample by the number of observations[51]. We include interaction terms between this risk measure and each performance measure that we identified as significant for cash bonuses in Table 2.7. If pay-performance sensitivity is decreasing (increasing) in firm risk, these interaction terms should have negative

[50] If compensation is paid for fiscal year 2008, beginning at 01/01/2008, the variance is calculated based on monthly returns from the period 01/01/2005 to 12/31/2007.

[51] This risk measure has thus a value of one (zero) for the most (least) risky firm in the sample.

(positive) coefficients.

The results are shown in the last two columns of Table 2.8. The sample size is now restricted to observations with a required data history of up to 10 years prior to the compensation event. The German sample is reduced by almost 40 percent, whereas the U.S. sample loses only 16 percent of its observations. In the reduced German sample (column 3 of Table 2.8), we find a negative relation between risk and EBIT pay-performance sensitivity of cash bonuses. The interaction term suggests that for given EBIT, executive compensation in riskier firms is less sensitive to EBIT than in less risky firms. The pay-performance sensitivity at the firm with median risk in our German sample is $0.8700 - 0.5 * 0.7844 = 0.4778$, whereas this sensitivity is 0.8700 and 0.0856, respectively, at the firms with minimum and maximum risk. This means that for 1 million Euro firm EBIT a manager at the firm with median (minimum) [maximum] risk in our sample receives 478 (870) [86] Euro.

In this specification, the coefficient of sales growth is negative when we control for risk and the interaction term. This is contrary to what we saw before. However, when we exclude the risk term from the regression, sales growth is, unlike in the full German sample before, not significant in this reduced sample. Since sales growth does not survive this critical robustness test, we do not interpret its negative coefficient in Table 2.8.

The last column of Table 2.8 shows the results with firm risk for the U.S. sample. In the base specification in Table 2.7 we found significant explanatory power of EBIT, sales growth and stock returns. When we add a risk measure for each performance measure to our base regression, we see that all performance measures remain highly significant and that the interaction terms are all significant with negative coefficients. The estimates of the coefficients imply that a manager at the firm with median (minimum) [maximum] risk in the U.S. sample receives 551 (981) [121] U.S. Dollar for 1 million U.S. Dollar in firm EBIT. For a 1 percent stock return or sales growth the manager at the firm with median risk receives 177,000 or 270,000 U.S. Dollar, respectively. Hence we find that pay-performance sensitivities vary substantially with firm risk in the two samples. For example, compared to the estimates in our base specification in Table 2.7, the EBIT pay-performance sensitivity at the firm with the median (lowest) risk is about three (five) times higher in both samples.

A final test on the impact of firm risk (performance volatility) on pay-performance

sensitivity pertains a central result from the accounting literature. As discussed in the literature section, accounting studies such as Lambert and Larcker (1987) or Sloan (1993) analyze the choice of performance measures in executive compensation and find that firms place relatively more weight on performance measures which are less noisy or volatile. This indicates, for example, that the observed EBIT pay-performance sensitivity is not only affected by EBIT volatility, but also by the volatility of other performance measures. We test for this cross-dependence by dividing the U.S. sample into four subsamples[52] of firms with (1) stock return volatility below the sample median and EBIT volatility below the sample median, (2) stock return volatility below, but EBIT volatility above the median, (3) stock return volatility above, but EBIT volatility below the median, and (4) both volatility measures above the respective median values. Volatility is measured by the 3-year stock return variance and the 10-year EBIT variance as described above.

Table 2.9 shows the results. The coefficient of stock return is substantially larger for firms with low stock return volatility (columns 1 and 2 of Table 2.9) than for firms with high stock return volatility (columns 3 and 4). Analogously the EBIT coefficient is larger for firms with lower EBIT volatility (columns 1 and 3). This is consistent with the negative relationship between volatility and pay-performance sensitivity (Table 2.8). Furthermore, Table 2.9 shows a positive impact of the volatility of one performance measure on the pay-performance sensitivity of the other performance measure. For example, firms with low stock return volatility not only have a larger EBIT pay-performance sensitivity when EBIT volatility is lower, they also have lower stock return pay-performance sensitivity (compare columns 1 and 2). This implies that firms with higher EBIT volatility substitute EBIT with stock returns as a performance measure. As suggested by the accounting literature, we not only find a direct effect of EBIT volatility on EBIT pay-performance sensitivity, but also an indirect effect from stock market volatility, and vice versa.

2.5.3 Results for Long-Term Compensation

We finally analyze long-term oriented compensation. In the German sample we face the problem that about half of the executives receive no long-term compensation components. To include all the information in the data we estimate a Tobit model

[52]We cannot perform the same test for German data because the German subsamples become too small for meaningful fixed-effects regressions.

for the German sample. In the U.S. sample only 4 percent of the observations show zero long-term compensation. Since this is a small fraction of the data, we continue to use a panel specification.

Column 1 of Table 2.10 shows the results for the German executives when we only include firm performance from the previous fiscal year as explanatory variables. Only stock returns have significant explanatory power for long-term compensation for the period 2005-2009. The negative sign suggests that the lower the stock return in the fiscal year, the higher was the amount of long-term compensation executives received. For U.S. executives (column 3 of Table 2.10) we find very similar results. Stock returns have a significantly negative impact on long-term compensation, but there is no explanatory power of other performance measures. This negative relation between stock returns and long-term compensation explains the negative stock return coefficients we found for total compensation (Tables 2.4, 2.5 and 2.6).

Although a negative relation between stock returns and long-term compensation seems strange at first, we explain this as follows. When the stock of a company declined during a fiscal year, companies may want to motivate executives to increase the stock price in subsequent years. Granting more long-term compensation can provide additional incentives for executives to generate positive stock returns. This may lead firms to grant more long-term compensation as an incentive to increase the stock price after a year with a declining stock price.

Whereas in most annual reports it is explicitly stated that cash bonuses are paid for performance in the preceding fiscal year, this is not true for long-term compensation. We now include lags of our performance measures to see whether long-term compensation is determined by performance over a longer time horizon.

Columns 2 and 4 of Table 2.10 show the results for German and U.S. executives, respectively. Stock returns in the previous fiscal year have no explanatory power for long-term compensation in both samples. Stock returns in the four preceding fiscal years have a significantly positive impact on long-term compensation for U.S. executives, whereas in the German sample this only holds for the stock return up to three years ago. EBIT is insignificant in both samples[53]. Lagged sales growth has a weakly significant and negative impact on long-term compensation in the U.S.

[53]EBIT is correlated over time. Dividing EBIT by total assets decreases this correlation considerably, but does not change our results.

sample and a weakly significant positive impact in the German sample.

We tried to confirm these results for our two sub-periods (not shown). For the German sample the negative coefficient of stock returns is significant in the 2007-2009 period, whereas it is still not significant in the 2005-2007 period. Lagged stock returns cannot explain long-term compensation in the pre-crisis period, but are significant in the crisis period for up to two years. For the U.S. sample the coefficient of stock returns in the previous fiscal year is positive and significant in the pre-crisis period and negative and significant in the crisis-period. Results for the lagged stock returns remain unchanged for the pre-crisis period. In the crisis period only stock returns from one and four years ago have significant explanatory power.

Hence there is no consistent explanation for long-term compensation in either country. Our results suggest that long-term compensation grants are subject to discretion rather than purely performance-oriented. One possible explanation for this finding is the following. We have anecdotal evidence from German firm's annual reports that they grant a particular value of long-term compensation every year. This would also explain that there is no pay-performance relation in the crisis. Another possibility to design long-term compensation is to grant a particular number of stocks or options every year[54]. This would imply that the value of long-term compensation is positively related to prior firm performance and explain the positive pay-performance relation between long-term compensation and (lagged) stock returns in the U.S. sample before the crisis. When firms grant more long-term compensation after years with negative stock returns, as explained above, the pay-performance relation would be negative. This could explain the negative impact of stock returns on long-term compensation in both samples during the crisis.

2.5.4 Differences in Pay-Performance Sensitivities

In this section we test whether the differences in pay-performance sensitivities in the two countries are significant. The simplest approach is to pool the two datasets and run a joint regression. However, the two samples differ not only in the total number of observations (2,404 hand-collected German observations versus 25,515 U.S. observations), but also in various characteristics such as industry composition, average

[54]See the discussion in Murphy (2013).

firm size and number of observations per year (see Table 2.2). These differences potentially bias the results when we pool the two datasets.

To circumvent this problem we use a propensity-score matching approach as in Conyon et al. (2011) to create a subsample of U.S. firms with similar characteristics as the firms in the German sample. Since we are ultimately interested in how executives are paid in German and U.S. firms we not only match the samples in terms of average firm size, industry and number of observations per year, but also with respect to our firm performance measures. We want to compare two samples of firms which differ only in their nationality. In particular, we create a U.S. subsample which is comparable to our German sample with respect to (1) number of observations per year, (2) industry composition (measured by the two-digit supersector Industry Classification Code (ICB)), (3) average firm size, and (4) firm performance. For each German firm we look in the sample of U.S. firms for the closest match in terms of these criteria.

We start the matching procedure with pooling the two samples to estimate for each year in a Logit regression the probability that a firm is German as a function of firm size, stock return, EBIT, sales growth and industry indicators[55]. Table 2.11 shows the results. The dependent variable in the Logit regression is a German indicator variable which equals one if the firm is German and zero otherwise. The coefficients indicate that on average German firms show significantly higher EBIT, but lower total assets than U.S. firms throughout the period 2005-2009. Stock returns were significantly higher for German firms from 2005 to 2007 and significantly lower than for U.S. firms in 2008. Sales growth was significantly lower in the German sample in 2005 and 2007.

Based on the Logit regressions we calculate propensity scores, look for the best match for each German firm in 2005, and include all available observations of this match in the U.S. subsample[56]. In each of the subsequent years 2006-2009 we only search for a match for all German firms that were not matched in previous years and include all observations of the U.S. matches[57]. Our matching procedure delivers

[55]Here we include only one observation per firm in every year. Moreover, for our matching procedure we converted all U.S. Dollar values into Euro values at historical exchange rates before combining them in the Logit regression.

[56]The results of our analysis with matched samples hold true when we consider only the CEOs of our matched firms.

[57]Note that we include all available observations 2005-2009 of matched U.S. firms irrespectively of

a U.S. sample that is indeed similar to the German sample with respect to average firm size, industry composition and firm performance. Table 2.12 presents summary statistics for executive compensation in the matched U.S. sample. Compared to the full U.S. sample in Table 2.1, total compensation of executives in the subsample is lower (1.8 million U.S. Dollar instead of 2.2 million U.S. Dollar in the full sample), and the average share of fixed compensation is slightly higher (37 instead of 33 percent) while the long-term share is lower. The structure of executive compensation in the matched U.S. subsample is still significantly different from the German sample whereas the two samples are very similar in terms of firm structure.

The first two columns of Table 2.13 show regression results based on the matched U.S. sample with 3,665 observations. When we compare the results for total compensation as the dependent variable (first column of Table 2.13) with those based on the full U.S. sample (last column of Table 2.5), we find again that EBIT has a significant positive impact on total compensation. The estimated coefficient is smaller though and suggests for executives in the subsample an increase in compensation of 167 U.S. Dollar for 1 million U.S. Dollar generated EBIT instead of the 223 U.S. Dollar estimated in the full U.S. sample. Stock returns are again not significant in the subsample and sales growth is not significant either although it was significant for the full U.S. sample.

Column 2 of Table 2.13 shows the regression results for the matched U.S. sample with cash bonuses as the dependent variable. Stock returns, EBIT and sales growth are significant which was also found in the full U.S. sample in Table 2.7. The coefficient estimates for EBIT and stock returns and sales growth are again smaller than those from the regression based on the full U.S. sample. For example, we now estimate that on average U.S. executives receive a cash bonus of 179 U.S. Dollar for 1 million U.S. Dollar generated EBIT, which is slightly less than the 190 U.S. Dollar estimate based on the full U.S. sample, but still larger than the estimated 162 Euro bonus German executives receive for 1 million Euro in EBIT. The following pooled regression allows us to investigate whether this difference is statistically significant.

The last two columns of Table 2.13 show the estimates for the pooled sample. We combine the German sample with the U.S. subsample and add to equation (2.1)

the number of available observations for German firms. This explains why our matching procedure leads to a U.S. subsample which is much smaller than the full U.S. sample but still larger than the German sample.

interaction terms of our performance measures and a dummy variable which is one for executives employed by U.S. firms. Columns 3 and 4 of Table 2.13 show the results with total compensation and cash bonuses as dependent variables[58]. We first observe that in both joint regressions only those performance measures are significant that were also significant in the separate regressions for the German and U.S. samples. Moreover, the interaction terms between stock return as well as sales growth and the U.S. dummy variable are significant and positive[59]. This confirms the higher pay-performance sensitivity for U.S. executives relative to their German peers for these two performance measures. We find no significant difference in the sensitivity of compensation to EBIT. The estimated coefficients are very similar to the ones estimated from separate regressions. For example, in the joint regression the EBIT coefficient is 0.171 (last column of Table 2.13) which is between the 0.179 (column 2 of Table 2.13) for the matched U.S. sample and the 0.162 for the German sample (column 1 of Table 2.7). Similarly the coefficient of sales growth is 42.7 for German executives and $42.7 + 206.9 = 249.6$ for U.S. executives. These numbers are similar to the estimated 62.0 for German executives (column 1 of Table 2.7) and 231.3 for U.S. executives (column 2 of Table 2.13).

The analysis in this section shows that pay-performance sensitivities are significantly higher in the U.S. than in German only for performance measured by stock returns and sales growth. Pay-performance sensitivities with respect to firm earnings are not significantly different between the two countries. U.S. executives face incentives related to stock performance in addition to earnings-based incentives, which indicates that executives in the U.S. face overall stronger financial incentives than their German peers. German shareholders seem to rely more on direct control through the institutionalized supervisory body.

We argue that shareholders of German firms cannot enforce a link between executive compensation and shareholder value, because they share the control function on the supervisory board with employee representatives. In unreported regressions we find that, unlike in the full German sample, executive compensation is significantly related to stock returns in a German subsample of firms in which shareholders hold

[58]Note that our results do not depend on whether or not we convert Euro values into U.S. Dollar before estimating the two samples jointly because for each observation we have the same currency on both sides of equation (2.1). Converting all values into a single currency only affects the year dummy variables and the CEO dummy, but we do not interpret these coefficients.

[59]We do not show a coefficient estimate for the U.S. dummy itself because the dummy is captured by the executive fixed effects.

the majority of the supervisory board seats (firms with less than 2000 employees)[60]. Compared to a matched U.S. subsample, stock return pay-performance sensitivity is still significantly lower for the firms in the German subsample. Since earnings pay-performance sensitivities do not differ significantly between the two samples, we still find overall lower pay-performance sensitivity for German firms.

2.6 Robustness

We perform several robustness checks. All results remain qualitatively the same with industry or firm-level fixed effects instead of individual fixed effects. Stock returns remain insignificant for explaining total executive compensation also when we measure stock returns relative to index returns to see whether shareholders look at relative instead of absolute stock market performance. Our risk measure was based on monthly data over a three-year horizon. Results do not change when we use weekly data or a four-year horizon. In all regressions we exclude firms from the financial industry because performance measures such as sales growth or earnings are hardly comparable between financial and non-financial firms. Other studies in the literature also exclude firms in the utilities sector because both the financial and the utilities sectors differ from other sectors in that they are highly regulated. In a robustness check we find no substantial changes in our results when we exclude utilities.

At least 10 percent of firms in both the German and the U.S. sample report a negative EBIT. We test the robustness of our results by including a dummy variable which is one for a negative EBIT and zero otherwise, and also an interaction term of this dummy with EBIT. The dummy is significantly negative but the interaction term is not significant (results not reported). Since the EBIT coefficient remains very similar to the one in our original specification without the dummy variable, we conclude that executive compensation in firms reporting a negative EBIT is generally lower but the pay-performance sensitivity is not significantly different from the average sensitivity of other firms in the sample[61].

[60]Executive compensation is unrelated to stock returns in a German subsample of firms with more than 2000 employees. This difference between firms with and without a shareholder majority on the supervisory board was also observed by Heimes and Seemann (2011).

[61]In a similar robustness test a dummy for negative stock returns is not significant and does not change our results for stock returns.

Although we exclude the upper and lower 0.5 percent of the total compensation distribution, our results may be driven by outliers or the typical skewness of an income distribution. As a robustness test we repeat our analysis with median regression instead of fixed-effects panel regression (not reported). For the U.S. sample, all results for total compensation and cash bonuses and in all sub-periods do not change[62]. For the German sample there are two minor changes. First, based on the full sample period, total compensation is still driven by EBIT but we lose the significance of the unintuitive negative stock return coefficient in Table 2.4. Second, for cash bonuses during 2005-2009 not only EBIT but also stock returns are significant (though on a weak level), similar to what we found for the sub-period 2005-2007 in Table 2.7. However, since stock returns are highly significant with a larger coefficient in all sub-periods for the U.S. sample, we still argue that stock market performance plays a more pronounced role in U.S. cash compensation than in Germany.

2.7 Concluding Remarks

This paper provides evidence about executive compensation in Germany and the United States during the period 2005-2009. We find that the compensation structure of German and U.S. executives differs in that U.S. firms grant a much higher share of compensation as long-term oriented compensation (e.g. company stock and managerial stock options). For German executives short-term oriented cash bonuses account for a higher fraction of compensation. We find that total compensation of both German and U.S. executives is determined by firm earnings during our sample period 2005-2009 and also in two sub-periods with and without the financial crisis. We find no robust relation between stock market performance and total executive compensation in either country. For example, stock returns and total compensation of U.S. executives are positively related in the sub-period excluding the crisis years 2008 and 2009, but negatively related in the period 2007-2009.

We analyze the pay-performance link for individual compensation components separately and investigate whether the different institutional settings influence the

[62]Of course, median pay-performance sensitivities are not identical to average pay-performance sensitivities from regressions accounting for individual fixed effects, but they are of similar order of magnitude. This was also found by other authors using both median regression and OLS with executive fixed effects, e.g. Aggarwal and Samwick (1999) or Cichello (2005).

choice of performance measures. We find that yearly cash bonuses of German executives are determined by firm earnings throughout all sub-periods, whereas stock returns have some impact only in the pre-crisis period 2005-2007. Thus positive accounting performance may explain why German executives received cash bonus payments even during the recent crisis when shareholder returns were often negative. For U.S. executives we find that firm earnings, sales growth and stock returns explain cash bonuses in all periods. Our results suggest that the sensitivity of bonuses to stock returns is larger in the U.S. than in Germany, whereas the earnings pay-performance sensitivity is not significantly different. We also provide evidence that pay-performance sensitivities of cash bonuses differ with firm risk and firm size. Finally, in line with the accounting literature on executive compensation, we find evidence for firms choosing performance measures in cash bonus compensation that are relatively less volatile than other measures. For example, firms in the upper part of the stock return volatility distribution tend to rely more on EBIT than on stock return as a performance measure for cash bonuses, and vice versa.

We argue that the focus on accounting performance in Germany and the additional provision of stock performance incentives in the U.S. are due to different models of corporate control. Whereas in Germany corporate control is organized in a two-tier board structure with an institutionalized supervisory board, U.S. corporate control relies on compensation-based incentives. Executives in the U.S. face accounting pay-performance sensitivities of similar magnitude as their German peers, but they face additional incentives through the link between bonuses and stock performance.

Our results suggest that employee representatives on the supervisory board oppose the use of stock-related incentives. There is no link between stock performance and executive compensation in German firms with equal fractions of employee representatives and shareholder representatives on the supervisory board. When shareholder representatives hold the majority on the supervisory board, we find that German firms tie compensation to stock performance. Although the stock pay-performance sensitivity is positive in these German firms, it is still significantly lower than in comparable U.S. firms. Taken together we interpret this as evidence that compared to U.S. firms, the separate supervisory body leads to lower incentives in German firms and the presence of employee representatives prevents the use of stock-based incentives.

It is not clear what determines long-term compensation in either country. We find weak evidence for a negative relation between stock returns and long-term compensation. An explanation for this unintuitive finding could be that long-term compensation such as company stock or options serve as discretionary grants providing extra incentives to increase firm value after years of weak performance. However, we do not find evidence for any pay-performance relation in the pre-crisis period. There is anecdotal evidence from annual reports that many German firms grant long-term compensation independent of past firm performance. Instead they set up long-term incentive plans and grant options, company stock, phantom stock etc. over several years to provide executives with incentives to increase firm performance.

For long-term compensation of U.S. executives we find weak explanatory power of lagged stock market performance. Stock returns up to four years before the compensation year have some explanatory power in the U.S. sample, but this relation is weaker in the crisis period. Thus we are not very confident that lagged stock performance explains company stock and option grants, and thus cannot provide a robust explanation for what determines long-term oriented compensation. This not only sets an agenda for future research, it also shows where firms and regulators can help to improve transparency and thus our understanding of executive compensation.

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Appendix

Table 2.1: Compensation Components of German and U.S. Executives, 2005-2009

	German Executives [N=2,404]				U.S. Executives [N=25,515]			
	Mean	Median	Minimum	Maximum	Mean	Median	Minimum	Maximum
Total	1,026	605	55	6,681	2,197	1,300	174	22,550
Fixed	389	302	38	2,584	439	370	0	7,418
Short Term	446	210	0	4,575	551	278	0	22,415
Long Term	192	0	0	4,859	1,209	550	0	21,594
Share Fixed	0.53	0.50	0.06	1	0.33	0.29	0	1
Share Short Term	0.35	0.36	0	0.94	0.24	0.22	0	1
Share Long Term	0.12	0.00	0	0.90	0.43	0.45	0	1

All numbers in the first four lines are in thousands of 2005 Euros (U.S. Dollars) for German (U.S.) executives. Fixed compensation is not performance related, e.g. base salary, company cars, etc. Short-term compensation are annual cash bonuses. Long-term compensation is the value of shares, options and compensation based on incentive plans. The last three lines show the respective shares of total compensation.

Table 2.2: Development of Compensation Components 2005-2009

	German Executives					U.S. Executives				
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
Total Compensation	1,068	1,117	1,073	962	939	2,189	2,340	2,214	2,159	2,085
	(605)	(699)	(645)	(575)	(544)	(1,308)	(1,343)	(1,306)	(1,280)	(1,275)
Share Fixed	0.56	0.50	0.51	0.53	0.58	0.34	0.32	0.33	0.33	0.33
	(0.51)	(0.47)	(0.46)	(0.50)	(0.55)	(0.30)	(0.27)	(0.28)	(0.29)	(0.29)
Share Short Term	0.33	0.37	0.37	0.36	0.32	0.23	0.26	0.25	0.22	0.23
	(0.37)	(0.37)	(0.38)	(0.37)	(0.32)	(0.21)	(0.24)	(0.23)	(0.20)	(0.22)
Share Long Term	0.12	0.13	0.12	0.11	0.11	0.44	0.42	0.43	0.45	0.44
	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.45)	(0.45)	(0.45)	(0.47)	(0.45)
Number of Executives	266	490	552	574	522	4,542	5,057	5,485	5,445	4,986
Number of Firms	86	156	182	189	178	922	1,038	1,092	1,075	976
Average Firm Size	10,120	9,719	7,423	6,689	6,260	7,384	6,740	6,160	6,269	7,160
Median Firm Size	335	323	300	247	248	1,930	1,857	1,688	1,673	1,912

The first line shows average total compensation per executive (median values in brackets) in thousands of 2005 Euros for German executives and thousands of 2005 U.S. Dollars for U.S. executives. The average shares (median shares in brackets) of fixed, short-term and long-term compensation are given with respect to total compensation. Fixed compensation is not performance related, e.g. base salary, company cars, etc. Short-term compensation are annual cash bonuses. Long-term compensation is the value of shares, options and compensation based on incentive plans. Firm size is measured by total assets in millions of 2005 Euros and millions of 2005 U.S. Dollars for German and U.S. firms, respectively.

Table 2.3: Distribution of Performance Measures, 2005-2009

Percentile	Stock Return	EBIT	Net Income	Sales Growth	Total Assets
German Sample [N=791]					
0	-0.7767	-651	-1,067	-0.6852	3
10	-0.5227	-6	-13	-0.1633	36
20	-0.3755	1	-1	-0.0640	54
30	-0.1990	4	2	-0.0185	90
40	-0.0479	7	4	0.0189	166
50	0.0496	17	8	0.0489	282
60	0.1504	33	17	0.0848	604
70	0.2848	88	45	0.1279	1,470
80	0.4855	196	111	0.2025	3,160
90	0.7432	1,043	524	0.3488	14,551
100	4.2877	7,406	5,022	2.2281	249,017
Mean	0.1240	378	196	0.0819	7,732
U.S. Sample [N=5,103]					
0	-0.8027	-1,781	-2,201	-0.5280	44
10	-0.4231	6	-5	-0.1318	310
20	-0.2774	35	18	-0.0329	559
30	-0.1619	64	35	0.0172	840
40	-0.0729	102	58	0.0534	1,247
50	0.0063	159	89	0.0800	1,810
60	0.0977	241	137	0.1127	2,683
70	0.2010	390	224	0.1491	4,907
80	0.3358	692	404	0.2022	7,409
90	0.6177	1,673	1,002	0.3116	18,690
100	2.5366	17,180	11,612	1.0327	264,747
Mean	0.0709	637	385	0.0899	6,714

All performance measures are taken from Thomson Reuters' Datastream database and adjusted for inflation. EBIT, Net Income and Total Assets are in millions of 2005 Euros (U.S. Dollars) for German (U.S.) firms.

Table 2.4: Determinants of Executive Compensation in German Corporations, 2005-2009

Dependent Variable	Total Compensation				
Stock Return	-28.62*	-	-	-	-52.95***
	(-1.96)				(-3.27)
EBIT	-	0.1564***	-	-	0.1641***
		(5.94)			(6.30)
Net Income	-	-	0.1587***	-	-
			(5.09)		
Sales Growth	-	-	-	34.36	47.02
				(0.85)	(1.13)
Total Assets	0.0013	0.0001	0.0012	0.0013	-0.0005
	(0.31)	(0.03)	(0.26)	(0.32)	(-0.01)
CEO	414.91***	399.29***	422.78***	414.09***	399.52***
	(3.26)	(3.39)	(3.45)	(3.25)	(3.40)
2006	162.29***	155.24***	138.96***	165.31***	144.79***
	(6.11)	(5.86)	(5.41)	(6.27)	(5.42)
2007	259.09***	243.49***	236.83***	266.09***	231.40***
	(8.27)	(8.00)	(7.91)	(8.56)	(7.58)
2008	195.47***	208.27***	204.00***	218.20***	167.52***
	(4.85)	(5.40)	(5.33)	(5.54)	(4.27)
2009	197.46***	219.01***	203.87***	205.12***	228.61***
	(4.69)	(5.21)	(4.89)	(4.56)	(5.10)
Individual Effects	yes	yes	yes	yes	yes
Observations	2,404	2,404	2,404	2,404	2,404

Estimates are based on a panel regression with executive fixed effects and year dummies controlling for time effects. The dependent variable is total annual compensation paid at the end of fiscal year t and measured in thousands of 2005 Euros. Stock returns are calculated as the stock market value at the end of the fiscal year divided by the stock market value at the beginning of the fiscal year. EBIT are total firm earnings before interest and taxes in millions of 2005 Euros. Net income is EBIT subtracted by interest and tax expenses. Sales growth is calculated as sales at the end of the fiscal year divided by sales of the preceding fiscal year. Total assets are total firm assets in millions of 2005 Euros. CEO is a dummy variable to identify executives serving as CEOs during year t. All numbers are adjusted for inflation. For each estimate t-values are given in parentheses. Standard errors are corrected for heteroscedasticity and clustering at the executive level. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 2.5: Determinants of Executive Compensation in U.S. Corporations, 2005-2009

Dependent Variable	Total Compensation				
Stock Return	4.97	-	-	-	-18.86
	(0.19)				(-0.71)
EBIT	-	0.2445***	-	-	0.2234***
		(4.49)			(5.03)
Net Income	-	-	0.2537***	-	-
			(4.99)		
Sales Growth	-	-	-	544.55***	453.59***
				(6.43)	(5.45)
Total Assets	0.0232***	0.0098	0.0137	0.0224***	0.0103
	(2.69)	(1.02)	(1.46)	(2.61)	(1.08)
CEO	1333.09***	1349.25***	1344.05***	1327.18***	1343.00***
	(9.20)	(9.31)	(9.27)	(9.15)	(9.26)
2006	241.72***	236.46***	236.46***	255.33***	248.05***
	(7.25)	(7.09)	(7.08)	(7.70)	(7.47)
2007	300.81***	285.47***	289.96***	326.06***	305.95***
	(9.05)	(8.60)	(8.75)	(9.88)	(9.17)
2008	315.94***	322.44***	324.42***	350.39***	343.35***
	(8.56)	(9.06)	(9.11)	(9.97)	(9.45)
2009	163.67***	195.31***	187.41***	301.96***	309.89***
	(4.37)	(5.29)	(5.08)	(7.70)	(7.93)
Individual Effects	yes	yes	yes	yes	yes
Observations	25,515	25,515	25,515	25,515	25,515

Estimates are based on a panel regression with executive fixed effects and year dummies controlling for time effects. The dependent variable is total annual compensation paid at the end of fiscal year t and measured in thousands of 2005 U.S. Dollars. Stock returns are calculated as the stock market value at the end of the fiscal year divided by the stock market value at the beginning of the fiscal year. EBIT are total firm earnings before interest and taxes in millions of 2005 U.S. Dollars. Net income is EBIT subtracted by interest and tax expenses. Sales growth is calculated as sales at the end of the fiscal year divided by sales of the preceding fiscal year. Total assets are total firm assets in millions of 2005 U.S. Dollars. CEO is a dummy variable to identify executives serving as CEOs during year t. All numbers are adjusted for inflation. For each estimate t-values are given in parentheses. Standard errors are corrected for heteroscedasticity and clustering at the executive level. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 2.6: Determinants of Executive Compensation in Sub-Periods

Dependent Variable	Total Compensation			
	2005-2007		2007-2009	
	Germany	U.S.	Germany	U.S.
Stock Return	-7.32	198.77***	-2.60	-85.40***
	(-0.28)	(3.96)	(-0.12)	(-2.97)
EBIT	0.1841***	0.4144***	0.1317***	0.1963***
	(3.97)	(5.09)	(2.94)	(5.12)
Sales Growth	54.12	120.75	5.1239	498.59***
	(1.16)	(0.87)	(0.12)	(5.02)
Total Assets	0.0139***	-0.0055	-0.0002	-0.0008
	(3.46)	(-0.35)	(-0.08)	(-0.08)
CEO	378.77**	1531.95***	244.93***	1031.01***
	(2.19)	(5.97)	(2.64)	(5.57)
Year Effects	yes	yes	yes	yes
Individual Effects	yes	yes	yes	yes
Observations	1,301	14,967	1,662	16,020

Estimates are based on a panel regression with fixed effects and year dummies controlling for time effects. The dependent variables is total executive compensation paid at the end of fiscal year t and measured in thousands of 2005 Euros (U.S. Dollars) for German (U.S.) executives. Stock returns are calculated as the stock market value at the end of the fiscal year divided by the stock market value at the beginning of the fiscal year. EBIT are total firm earnings before interest and taxes in fiscal year t. Sales growth is calculated as sales at the end of the fiscal year divided by sales of the preceding fiscal year. Total assets are total firm assets in millions of 2005 Euros (U.S. Dollars). CEO is a dummy variable to identify executives serving as CEOs during year t. All numbers are adjusted for inflation. For each estimate t-values are given in parentheses. Standard errors are corrected for heteroscedasticity and clustering at the executive level. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 2.7: Determinants of Cash Bonuses in German and U.S. Corporations

Dependent Variable	Cash Bonus					
	2005-2009		2005-2007		2007-2009	
	Germany	U.S.	Germany	U.S.	Germany	U.S.
Stock Return	-9.27	135.31***	20.22**	180.51***	4.17	140.38***
	(-0.90)	(12.87)	(2.06)	(10.97)	(0.25)	(11.54)
EBIT	0.1616***	0.1905***	0.1853***	0.2526***	0.1258***	0.1501***
	(8.01)	(7.75)	(4.50)	(6.05)	(3.40)	(7.65)
Sales Growth	62.04***	372.94***	-14.17	127.17***	75.65***	426.44***
	(2.93)	(11.11)	(-0.35)	(2.95)	(3.84)	(11.43)
Total Assets	0.0015	-0.0028	0.0041	-0.0036	0.0007	-0.0084
	(0.50)	(-0.50)	(1.39)	(-0.28)	(0.63)	(-1.29)
CEO	234.98**	359.07***	221.50	390.84***	151.11**	252.75***
	(2.58)	(8.56)	(1.63)	(7.13)	(2.02)	(5.28)
Year Effects	yes	yes	yes	yes	yes	yes
Individual Effects	yes	yes	yes	yes	yes	yes
Observations	2,404	25,515	1,301	14,967	1,662	16,020

Estimates are based on a panel regression with fixed effects and year dummies controlling for time effects. The dependent variables is short-term cash bonuses paid at the end of fiscal year t and measured in thousands of 2005 Euros (U.S. Dollars) for German (U.S.) executives. Stock returns are calculated as the stock market value at the end of the fiscal year divided by the stock market value at the beginning of the fiscal year. EBIT are total firm earnings before interest and taxes in fiscal year t. Sales growth is calculated as sales at the end of the fiscal year divided by sales of the preceding fiscal year. Total assets are total firm assets in millions of 2005 Euros (U.S. Dollars). CEO is a dummy variable to identify executives serving as CEOs during year t. All numbers are adjusted for inflation. For each estimate t-values are given in parentheses. Standard errors are corrected for heteroscedasticity and clustering at the executive level. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 2.8: Cash Bonuses and Firm Characteristics, 2005-2009

Dependent Variable	Cash Bonus			
	Firm Size		Firm Risk	
	Germany	U.S.	Germany	U.S.
Stock Return	-12.19	25.43*	4.26	282.15***
	(-1.08)	(1.85)	(0.23)	(8.87)
Stock Return x Rank(·)	-	240.01***	-	-209.39***
		(6.11)		(-4.86)
Rank(·)	-	-	-	51.66
				(1.08)
EBIT	3.44***	1.1541***	0.8700***	0.9806***
	(3.72)	(6.83)	(3.40)	(7.26)
EBIT x Rank(·)	-	-1.0456***	-0.7844***	-0.8599***
		(-5.67)	(-2.73)	(-5.85)
Rank(·)	-	-	589.50	88.27
			(1.10)	(0.92)
EBIT x LARGE	-3.27***	-	-	-
	(-3.54)			
Sales Growth	31.73*	218.10***	-519.52**	530.16***
	(1.94)	(4.93)	(-2.40)	(5.33)
Sales Growth x Rank(·)	-	173.83*	728.55***	-519.55*
		(1.67)	(2.69)	(-1.78)
Rank(·)	-	505.41***	-243.19*	113.88
		(5.12)	(-1.90)	(1.00)
Sales Growth x LARGE	52.70	-	-	-
	(0.99)			
LARGE	73.19	-	-	-
	(1.59)			
CEO	225.43**	369.92***	450.17***	420.79***
	(2.54)	(8.92)	(2.83)	(8.33)
Total Assets	-	-	0.0012	-0.0010
			(0.91)	(-0.18)
Year Effects	yes	yes	yes	yes
Individual Effects	yes	yes	yes	yes
Observations	2,404	25,515	1,458	21,130

Estimates are based on a panel regression with executive fixed effects and year dummies. The dependent variable is cash bonuses paid at the end of fiscal year t and measured in thousands of 2005 Euros (U.S. Dollars) for German (U.S.) firms. Stock returns are calculated as the stock market value at the end of the fiscal year divided by the stock market value at the beginning of the fiscal year. EBIT are total firm earnings before interest and taxes in millions of 2005 Euros (U.S. Dollars). Sales growth is calculated as sales at the end of the fiscal year divided by sales of the preceding fiscal year. LARGE is a dummy variable equal to one if a firm is in the upper half of the firm size distribution. In column 2, Rank(·) is the rank of firm size (measured by total assets) divided by the number of observations. In columns 3 and 4, Rank(·) is the rank of the stock return variance, EBIT variance or sales growth variance, respectively, divided by the number of observations. The variance of EBIT and sales growth is calculated based on annual data over ten years preceding the beginning of fiscal year t. The variance of stock returns is calculated based on monthly data over three years preceding the beginning of fiscal year t. All numbers are adjusted for inflation. T-values are given in parentheses. Standard errors are corrected for heteroscedasticity and clustering at the executive level. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 2.9: Cash Bonuses and Performance Volatility in U.S. Corporations, 2005-2009

Dependent Variable	Cash Bonuses			
	Low Stock Volatility		High Stock Volatility	
EBIT Volatility	Low	High	Low	High
Stock Return	149.22***	338.97***	82.63***	153.26***
	(7.16)	(7.67)	(8.88)	(3.64)
EBIT	0.5060***	0.1565***	0.4029***	0.2900***
	(4.22)	(5.73)	(4.43)	(4.82)
Sales Growth	206.03***	359.32***	112.37***	801.69***
	(3.17)	(3.01)	(3.52)	(6.68)
Total Assets	0.0491***	-0.0005	0.0661***	-0.0178
	(3.87)	(-0.09)	(4.44)	(-0.91)
CEO	280.77***	593.02***	173.38***	631.69***
	(3.23)	(6.36)	(3.74)	(3.38)
Year Effects	yes	yes	yes	yes
Individual Effects	yes	yes	yes	yes
Observations	4,380	6,408	5,917	4,425

This table shows regression estimates based on four U.S. subsamples created with respect to performance volatility. Columns 1 and 2 contain U.S. firms with stock return volatility below the sample median, and EBIT volatility below and above the median, respectively. Columns 3 and 4 contain U.S. firms with stock return volatility above the sample median, and EBIT volatility below and above the median, respectively. Stock return (EBIT) volatility is measured by the Rank$(\cdot)$ measure as defined in Table (2.8). In all regressions the dependent variables is short-term cash bonuses paid at the end of fiscal year t and measured in thousands of 2005 U.S. Dollars. All regressions include individual fixed effects and year dummies controlling for time effects. Stock returns are calculated as the stock market value at the end of the fiscal year divided by the stock market value at the beginning of the fiscal year. EBIT are total firm earnings before interest and taxes in fiscal year t. Sales growth is calculated as sales at the end of the fiscal year divided by sales of the preceding fiscal year. Total assets are total firm assets in millions of 2005 U.S. Dollars. CEO is a dummy variable to identify executives serving as CEOs during year t. All numbers are adjusted for inflation. For each estimate t-values are given in parentheses. Standard errors are corrected for heteroscedasticity and clustering at the executive level. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 2.10: Determinants of Long-Term Compensation, 2005-2009

Dependent Variable	Long-Term Compensation			
	Germany		U.S.	
Stock Return	-101.39***	-26.18	-147.48***	-17.76
	(-4.78)	(-1.02)	(-5.87)	(-0.65)
Stock Return$_{t-1}$	-	67.13*	-	250.64***
		(1.96)		(5.61)
Stock Return$_{t-2}$	-	134.75***	-	183.81***
		(4.10)		(5.82)
Stock Return$_{t-3}$	-	39.79*	-	86.40***
		(1.78)		(2.79)
Stock Return$_{t-4}$	-	10.29	-	64.72***
		(0.50)		(2.89)
EBIT	0.0128	0.0114	0.0335	-0.0115
	(0.92)	(0.66)	(0.99)	(-0.34)
EBIT$_{t-1}$	-	-0.0825***	-	-0.0286
		(-3.31)		(-0.66)
Sales Growth	-8.8345	36.65	77.84	0.33
	(-0.21)	(0.65)	(1.07)	(0.00)
Sales Growth$_{t-1}$	-	71.47**	-	-131.92*
		(2.06)		(-1.74)
Total Assets	-0.0015**	0.0023	0.0113	0.006
	(-2.07)	(0.70)	(1.36)	(0.67)
CEO	94.10	83.79	843.97***	877.41***
	(1.26)	(1.03)	(6.51)	(6.25)
Year Effects	yes	yes	yes	yes
Individual Effects	yes	yes	yes	yes
Observations	2,404	1,940	23,515	23,188

The dependent variable is long-term variable compensation granted at the end of fiscal year t and measured in thousands of 2005 Euros (U.S. Dollars) for German (U.S.) executives. Estimates in columns 1 and 2 are based on a Tobit specification because 52 percent of German observations receive zero long-term compensation. All specifications include individual fixed effects and year dummies controlling for time effects. Stock returns are calculated as the stock market value at the end of the fiscal year divided by the stock market value at the beginning of the fiscal year. EBIT is total firm earnings before interest and taxes in fiscal year t. Sales growth is calculated as sales at the end of the fiscal year divided by sales of the preceding fiscal year. The subscript $t-i$ indicates a variable that is lagged i periods. CEO is a dummy variable to identify executives serving as CEOs during year t. All numbers are adjusted for inflation. For each estimate t-values are given in parentheses. Standard errors are corrected for heteroscedasticity and clustering at the executive level. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 2.11: Logit Model for Propensity Score Matching (Germany=1)

Year	2005	2006	2007	2008	2009
EBIT	3.61***	5.18***	4.71***	6.49***	4.19***
	(3.87)	(5.09)	(4.73)	(6.12)	(3.89)
Stock Return	1.67***	0.6072**	0.5106*	-1.26***	0.2042
	(5.66)	(2.50)	(2.24)	(-3.52)	(1.29)
Sales Growth	-3.18***	-0.6969	-1.53***	-0.0175	0.3423
	(-3.78)	(-1.28)	(-2.67)	(-0.04)	(0.66)
Total Assets	-1.24***	-1.49***	-1.31***	-1.57***	-1.22***
	(-5.46)	(-8.24)	(-7.62)	(-9.34)	(-7.64)
Industry Dummies	yes	yes	yes	yes	yes
Observations	949	1,084	1,197	1,204	1,110

The Logit regression models the probability that a firm is German as a function of earnings before interest and taxes (EBIT), stock return, sales growth, total assets of the respective firm-year and industry dummies. We only include industries for which there are firms in Germany and the U.S., since we demand the matched pairs to come from the same industry. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 2.12: Compensation Components in Matched U.S. Sample, 2005-2009

	Matched U.S. Sample [N=3,665]			
	Mean	Median	Minimum	Maximum
Total	1,801	936	174	22,509
Fixed	379	316	12	1,649
Short Term	463	180	0	22,415
Long Term	960	382	0	19,502
Share Fixed	0.37	0.33	0.01	1
Share Short Term	0.21	0.19	0	1
Share Long Term	0.42	0.43	0	0.98

All numbers in the first four lines are in thousands of 2005 U.S. Dollars. Fixed compensation is not performance related, e.g. base salary, company cars, etc. Short-term compensation are annual cash bonuses. Long-term compensation is the value of shares, options and compensation based on incentive plans. The last three lines show the respective shares of total compensation.

Table 2.13: Determinants of Executive Compensation in Matched Sample, 2005-2009

	U.S. Executives		All Executives	
Dependent Variable	Total	Cash Bonus	Total	Cash Bonus
Stock Return	17.22	109.81***	-11.83	8.74
	(0.44)	(5.59)	(-0.56)	(0.65)
Stock Return x U.S.	-	-	5.91	87.66***
			(0.16)	(4.59)
EBIT	0.1673*	0.1790***	0.1433***	0.1713***
	(1.72)	(2.63)	(5.29)	(7.39)
EBIT x U.S.	-	-	0.0020	-0.0873
			(0.02)	(-1.56)
Sales Growth	220.82	231.28***	-23.79	42.71**
	(1.48)	(3.11)	(-0.59)	(2.01)
Sales Growth x U.S.	-	-	328.46**	206.87***
			(2.23)	(2.82)
Total Assets	-0.0073	-0.0369***	-0.0017	-0.0088*
	(-0.58)	(-3.58)	(-0.41)	(-1.83)
CEO	783.65***	233.05**	574.03***	215.74***
	(2.67)	(2.59)	(3.84)	(3.16)
Year Effects	yes	yes	yes	yes
Individual Effects	yes	yes	yes	yes
Observations	3,665	3,665	6,069	6,069

Estimates are based on a panel regression with individual and year effects. The dependent variables are total compensation or short-term cash bonuses granted at the end of fiscal year t. Stock returns are calculated as the stock market value at the end of the fiscal year divided by the stock market value at the beginning of the fiscal year. EBIT are total firm earnings before interest and taxes in fiscal year t. Sales growth is calculated as sales at the end of the fiscal year divided by sales of the preceding fiscal year. Total assets are total assets in fiscal year t. CEO is a dummy variable to identify executives serving as CEOs during year t. U.S. is a dummy variable to identify executives employed by U.S. firms. All numbers are adjusted for inflation. For each estimate t-values are given in parentheses. Standard errors are corrected for heteroscedasticity and clustering at the executive level. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Chapter 3

Profit Sharing with Executives

3.1 Introduction

Firms earn cash and use part of these earnings to pay the top management for running the firm. Bebchuk and Grinstein (2005) observe that not only compensation levels, but also the ratio of top management compensation to firm earnings increased in U.S. firms from five percent in the mid-1990s to about ten percent in 2001-2003. In this paper we present evidence that such a ratio varies substantially between firms and industries. So far the literature offers no explanation for this cross-sectional variation. None of the studies that analyze relative compensation expenses[1] attempts to explain differences between firms. Our study contributes to the literature by identifying firm characteristics and measures of managerial power as explanatory factors for the observed cross-sectional variation in the fraction of earnings U.S. firms spent on executive compensation.

We measure firm earnings and executive compensation based on actual cash flows for a sample of U.S. firms during 2005-2009. In particular, we analyze which fraction of the cash flow generated from operating activities firms allocate as cash payments to the five executives of the top management[2]. We construct two measures: The

[1] Apart from Bebchuk and Grinstein (2005), we are aware of Haid and Yurtoglu (2006) who calculate a ratio of executive compensation to earnings of eight percent for German firms during 1987-2003, and Thanassoulis (2012) who analyzes the ratio of total employee compensation to shareholders' equity, and finds a median ratio of 18 percent for the U.S. industry and 20 percent for U.S. banks in 2007.

[2] U.S. public firms disclose individualized compensation data for the top five executive board members including the CEO. We use this data and thus refer to this group of executives whenever we speak about the top management.

cash ratio, defined as the fraction of operating cash flow spent on salaries and variable cash bonuses for the top management, and the bonus ratio, defined as the corresponding fraction based on bonus payments alone. In our sample the average cash ratio varies by industry between one and four percent. In some industries there are firms with a cash ratio of more than 80 percent, whereas in other industries the cash ratio never exceeds 12 percent in any firm. The average cash ratio is highest in firms of the Technology sector and lowest in the Utilities sector[3].

To explain the observed cross-sectional variation, we derive hypotheses about potential explanatory factors based on related literature. For example, studies on profit sharing with employees, see e.g. Weitzman and Kruse (1990), suggest that the participation rate in firm earnings may differ between firms because of other incentives provided through stock and option grants. Studies on cross-sectional differences in corporate policy decisions such as Smith and Watts (1992), Gaver and Gaver (1993) or Ryan Jr and Wiggins III (2002), offer firm-specific investment opportunities or growth options as explanatory variables for corporate decisions on executive compensation. They also suggest that compensation policy is related to corporate financing policy and dividend policy. A recent announcement by the largest German bank confirms that corporate decisions on executive compensation and dividend policy are related. In July 2012, the bank announced to adjust its executive compensation policy to address "the relative balance between rewards for shareholders and those for employees" (Deutsche Bank, 2012). Hence we consider the relative balance between executive compensation and dividend expenses as a relevant factor in corporate policy decisions.

The main findings from our empirical analysis are as follows. First, the cash ratio and the bonus ratio are lower in firms with higher investments (relative to firm size). Firms with a more capital-intense production technology allocate a lower fraction of cash to the top management. Second, the cash ratio and the bonus ratio are also lower in firms which spent more on interest to creditors and dividends for shareholders (again relative to firm size). Interestingly, the two cash-flow shares are positively related to the dividend payout ratio, defined as the fraction of operating cash flow shareholders receive as dividends. We interpret this as a consistent cash-flow policy toward shareholders and managers: Firms which allocate a lower fraction of cash to shareholders also allocate a lower fraction to the top management.

[3]Industries classified according to the two-digit supersector Industry Classification Code (ICB).

Third, the cash ratio and the bonus ratio are lower in larger firms. It is quite intuitive that executives in larger firms do not receive the same share in operating cash flow as their peers in smaller firms[4]. Fourth, both ratios are positively related to firm performance measured by stock return, but the relation is stronger for the bonus ratio, probably because the cash ratio contains fixed salaries which are typically related to firm size but not firm performance. Only the cash ratio is negatively related to profitability. This indicates that more profitable firms dedicate a lower fraction of cash to the top management, but this does not hold for bonus payments alone.

Fifth, the top management's cash-flow share is negatively related to the fraction of total compensation that is granted as non-cash compensation in the form of company stock, options or long-term incentive (LTI) plans. This finding provides evidence for the hypothesis that cash-based participation in firm earnings and ownership-providing LTI compensation are substitutes to align the interests of shareholders and managers.

Finally, we investigate whether two measures of managerial power are related to the top management's cash-flow share. The cash ratio is not related to such measures, but the bonus ratio is positively related to a measure of managerial entrenchment, the E-index developed by Bebchuk et al. (2009), and a measure of CEO power, the CEO pay slice (CPS) developed by Bebchuk et al. (2011). Thus more managerial power vis-à-vis shareholders and a powerful CEO implies that the top management receives a larger share of available cash as bonuses. Bebchuk et al. (2011) find evidence that powerful CEOs are associated with agency problems and lower firm value. Hence a large fraction of cash being captured by the top management may be another sign for agency problems and managerial rent extraction.

The remaining part of this paper is organized as follows. In section 3.2, we summarize the related literature. In section 3.3, we define our variables of interest and develop our hypotheses. We present the data in section 3.4 and show results in section 3.5. Section 3.6 provides several robustness checks before we conclude in section 3.7.

[4]Cash compensation of executives in larger firms is higher than in smaller firms, but the relation between compensation and firm size is not linear.

3.2 Related Literature

Our work is primarily motivated by Bebchuk and Grinstein (2005) who analyze the growth of U.S. executive pay and find that not only compensation levels have increased substantially, but also the ratio of top management compensation to firm earnings (measured by net income). They find an increase from 5.2 percent in 1993-1997 to 9.8 percent in 2001-2003. Another study that calculates the top management's share in firm earnings is Haid and Yurtoglu (2006). They calculate for the top management of German firms a compensation-to-earnings ratio of 7.7 percent for an average board size of 3.7 executives during 1987-2003[5]. Thanassoulis (2012) also analyzes relative compensation expenses, but as a ratio to the book value of shareholder equity. He investigates bank default risk stemming from high compensation expenses to employees. He finds that median employee compensation at U.S. banks accounted for 20 percent of shareholder equity during the period 1998-2009, but for 10 percent of the sample the compensation-to-equity ratio was beyond 80 percent. Thanassoulis (2012) concludes that the compensation bill represents a substantial expense and is thus a relevant factor for default risk. In an online appendix[6], he compares the ratio of compensation expenses to shareholder equity between banks and the whole cross-section of U.S. firms in 2007. He finds that median employee compensation accounted for 18 percent of shareholder equity in the cross section, and outliers drive the mean ratio to 45 percent. Hence the ratio of compensation to shareholder equity is a little higher for banks, but also quite substantial for non-financial firms.

Second, since we analyze differences in the top management's cash-flow share between firms, our work contributes to the literature examining cross-sectional variation in corporate policy on executive compensation, financing and dividend decisions. These corporate policy decisions are related. For example, the decision to pay a dividend lowers the amount of cash that can be retained for investments in the future. Firm earnings may not only be paid as dividends to shareholders or retained for investment, but may also be paid as bonuses to the management (or to employees below the management level) as an incentive reward. Hence, allocating

[5] In both studies it remains unclear whether or not executive compensation is already deducted from firm earnings. In our study, we explicitly add back compensation expenses and then calculate a cash-flow share with respect to this adjusted number.

[6] Available on the journal website at `http://www.afajof.org/details/page/3626901/Supplements.html`.

firm earnings to investments, creditors, shareholders and managers may be part of the firm's overall corporate finance strategy.

One study on the relation between executive compensation, financing and dividend policy is Bhattacharyya et al. (2008b). For U.S. firms they find that the dividend payout ratio (the fraction of income paid out as dividends) is negatively related to total CEO compensation, the cash bonus and the value of stock options granted to the CEO. They argue that managers of high quality earn higher compensation in competitive labor markets, but also find better investment opportunities, hence the lower dividend payout ratio. Bhattacharyya et al. (2008a) confirm this finding for a sample of Canadian firms. Healy (1985) studies bonus plans of U.S. firms and observes a link between dividend payments and the size of the cash pool available for bonus payments. In particular, he finds that shareholders put an upper limit on bonus pools which is based on dividend payments. This creates incentives to pay dividends and counteracts the manager's incentive to retain earnings in the firm which comes from dividend payouts reducing the cash flow coverage of the manager's salary claim (Smith and Watts, 1982). The discussion in Holthausen et al. (1995) also provides examples of firms using a funding formula for bonus pools that is based on dividend payments (p. 33).

Another study is Smith and Watts (1992). Based on industry-level data, they find that U.S. firms in industries with more growth options (indicated by a lower book-to-market value[7]) have lower leverage and lower dividend yields, but pay higher executive compensation and more often use stock option plans. Dividend yields and executive compensation levels are also positively related to the average firm size of an industry. Moreover, Smith and Watts (1992) document a positive relation between leverage and dividend yields, and a negative relation between leverage and compensation levels. They conclude that there are robust empirical relations among corporate policy choices on leverage, executive compensation and dividend policy, and various firm characteristics such as investment opportunities and firm size.

Similar findings are documented by Gaver and Gaver (1993). They find that firms with superior investment opportunities (labeled "growth firms")[8] have lower

[7]The market value of the firm is calculated as the market value of equity plus the book value of assets minus the book value of equity.

[8]They construct an index of investment opportunities which is based on the market-to-book value, R&D expenditures, the earnings/price ratio, the variance of total returns, and the frequency

debt/equity ratios, lower dividend yields, but pay higher cash compensation to executives and are more likely to use stock option plans than "non-growth firms" with less promising investment opportunities. Ryan Jr and Wiggins III (2002) investigate the relation between corporate compensation policy, R&D investments, industry- and firm-specific characteristics. They find that firms with superior growth opportunities[9] exhibit a higher ratio of R&D expenditures to total assets. Executive compensation in firms with a higher R&D ratio consists to a larger part of stock options and less of cash bonuses and company stock compared to executive compensation in firms with inferior growth opportunities.

Third, our work is related to the literature on profit sharing. This literature typically investigates how and why firms let employees participate in firm profits and whether profit sharing has an impact on firm performance. The focus of this literature is on profit sharing with employees below the top management. However, findings in this literature may help to understand why also profit sharing with executives differs across industries and firms. For example, Kruse (1996) examines firms with profit-sharing plans and finds that profit sharing is more likely in firms with high R&D expenditures and higher volatility in profits. He argues that profit-sharing arrangements help to motivate interdependent and complex R&D work in firms with constantly developing technology. Moreover, profit sharing helps firms experiencing high volatility in company performance as an insurance mechanism to share uncertainty with employees. Risk-averse employees may be compensated for taking financial risk with higher overall compensation levels. Support for the latter is provided by Hart and Hübler (1991). They find that employees participating in profit sharing arrangements receive higher salaries (excluding the bonus from the profit-sharing arrangement), and that the shared amount of profit is increasing in salary levels. Moreover, profit sharing is more likely in larger firms.

In a meta study that combines evidence from the profit-sharing literature, Weitzman and Kruse (1990) conclude that profit sharing has a more significant effect on productivity than employee ownership. This finding may explain why many firms choose to provide managerial incentives in the form of profit-based cash bonus pay-

of the firm being included in growth-oriented mutual funds. They define "growth firms" and "nongrowth firms", respectively, as firms ranked in the top and bottom quartile of this index.

[9]Growth opportunities are measured by the market-to-book value of assets, calculated as the market value of equity plus the book value of debt, divided by the sum of book values of equity and debt.

ments rather than equity ownership. The authors also find that although the empirical evidence on the link between profit sharing and productivity is mixed, there is more support for a positive impact of profit sharing on productivity.

Fourth, our study is related to the literature on managerial power and entrenchment, because we analyze whether the top management's cash-flow share is related to managerial power. There is some discussion whether a more powerful management or a powerful CEO[10] is good or bad for shareholders. Larcker and Tayan (2012) summarize some of the arguments. Shareholders may benefit from powerful CEOs because there is greater upward potential for firm performance. On the other hand, powerful CEOs receive higher compensation and may cause higher turnover in senior management. Morse et al. (2011) find that compensation of powerful CEOs[11] is generally higher, and sensitive to either stock returns or returns on assets, whichever measure is performing better in a given period. They find a negative effect of CEO power on firm value and operating firm performance.

Bebchuk et al. (2011) measure CEO power by the "CEO Pay Slice" (CPS), defined as the fraction of top management compensation captured by the CEO. They find evidence that higher CPS is associated with lower firm value and inferior firm performance[12]. The authors conclude that a high CPS indicates agency problems and managerial rent extraction, which has a negative impact on firm performance. Finally, Bebchuk et al. (2009) measure managerial entrenchment with an index ("E-index") based on six equally weighted corporate governance provisions which provide the top management with protection from being removed, or the consequences of removal, and thus limit the power of shareholders. These include staggered boards, limits to shareholder bylaw amendments, supermajority requirements for mergers and charter amendments, poison bills, and golden parachutes[13]. They find that higher index levels (more pronounced managerial entrenchment) are associated with lower firm value and negative abnormal returns.

[10] CEO power is often used as a proxy for management power.

[11] Defined as CEOs who are also board chairman, who are controlled by boards with few outside directors, and or boards with a higher fraction of board members appointed during the CEO's time in office.

[12] Specifically, they find that CPS is associated with lower firm value, lower accounting profitability, lower stock returns around acquisition announcements, lower performance sensitivity of CEO turnover and a higher likelihood of lucky managerial option grants at the lowest price of the month.

[13] We discuss the E-index in more detail in section 3.5.4.

3.3 Variable Definition and Hypothesis Development

In this section we define the main variables of interest and derive hypotheses about potential explanatory factors for the fraction of annual earnings firms use to pay the top management[14]. We measure the top management's share in firm earnings on a cash-flow basis. Firms generate cash from operations and allocate it among investments, interest to creditors, dividends for shareholders, taxes and retained earnings for future investment.We may write the following cash flow identity:

$$\begin{aligned}\text{OCF} &= \text{EBIT} + \text{Investments} + \text{Depreciation} \\ &= \text{Net Income} + \text{Interest} + \text{Taxes} + \text{Investments} + \text{Depreciation},\end{aligned}$$

where OCF is net operating cash flow, defined as the difference between cash inflows and outflows from operating activities, and EBIT are Earnings Before Interest and Taxes. Net Income is eventually allocated as dividends to shareholders or retained for future investments. Rearranging terms yields:

$$\begin{aligned}\text{OCF} = \\ \text{Investments} + \text{Depreciation} + \text{Retained Earnings} + \text{Interest} + \text{Dividends} + \text{Taxes},\end{aligned}$$

which shows the alternative uses of cash for investment (today and in the future), interest, dividends and taxes.

Because OCF is net of expenses for top management compensation and we are interested in the fraction of OCF spent on top management compensation, we define "net operating cash flow before cash compensation" (OCFBC) as net cash flows from operating activities plus cash payments (C) to the top management[15]:

$$\text{OCFBC} = \text{OCF} + \text{C}$$

OCF is available from the Datastream database[16]. Total top management com-

[14]The exact definitions of the explanatory variables used in this study are discussed in the data section 4.

[15]We first analyze cash payments to the top management as a fraction of OCFBC, but later narrow our analysis to cash bonus payments only.

[16]Datastream's "net cash flows from operating activities" contain net cash receipts and disbursements resulting from the operations of the company, including funds from operations and

pensation as stated in SEC reports[17] typically comprises both cash and non-cash compensation. Cash compensation consists of the base salary and cash bonus payments, usually granted for meeting short-term financial performance goals. Non-cash compensation comprises company stock, options and company-specific long-term incentive (LTI) plans with payout structures related to future stock price developments. In SEC reports, U.S. companies have to specify a grant-date value of company stock, options and LTIs, but this value is typically not related to immediate cash payments.

We construct the following measure, denoted "cash ratio" (CR), to analyze what fraction of OCFBC is dedicated to the top management as cash payments:

$$CR_{it} = \frac{C_{it}}{OCFBC_{it}}, \tag{3.1}$$

where C_{it} comprises cash payments (salaries and bonuses) to firm i's top five executives for fiscal year t, and $OCFBC_{it}$ is defined as above for firm i and fiscal year t.

In a second step, we reformulate equation (3.1) such that we exclude fixed salaries from the top management's cash compensation and focus on cash bonuses only. We construct the "bonus ratio" (BR) as:

$$BR_{it} = \frac{B_{it}}{OCFBB_{it}}, \tag{3.2}$$

where $OCFBB_{it} = OCF_{it} + B_{it}$, and B_{it} denoting cash bonus payments to firm i's top five executives for fiscal year t.

The objective of our study is to find explanatory factors for CR_{it} and BR_{it} in the cross section. We now derive hypotheses for potential explanatory variables, partly motivated by the literature we discussed in the previous section. Our first set of explanatory factors (Hypotheses 1a-1c) stems from the accounting identity described in the OCF equation above:

funds from other operating activities. In the robustness section, we discuss the use of alternative measures, e.g. operating income or net income.

[17] Our compensation data comes from company filings with the Securities and Exchange Commission (SEC), as will be discussed in the data section 4. In SEC reports, firms have to publish compensation data for the five best paid executive officers. We refer to these five executives as the top management.

Investments. A firm with plenty productive investment opportunities may choose to retain cash for investment instead of allocating it to the top management, similar to the finding that firms with productive investment opportunities tend to pay lower dividends than their peers with fewer investment opportunities (see e.g. Fama and French (2001)). A firm with investment opportunities may grant the top management more non-cash compensation such as company stock or options instead, for which we control in our regressions.

Hypothesis 1a: Firms with productive investment opportunities pay a lower fraction of operating cash flow to the top management.

Interest to creditors. Firms with a higher leverage (debt-to-equity) ratio are expected to pay a higher fraction of generated cash flows as interest to creditors. Ceteris paribus, a lower fraction is left for the top management[18]. Hence we hypothesize:

Hypothesis 1b: The higher are interest payments to creditors, the lower is the top management's fraction of cash flows[19].

Dividend payments. Similar to interest payments, dividend payments reduce the available pool of cash that could be allocated to the top management. This calls again for a negative relation between dividend payments and the top management's share in cash flows.

Hypothesis 1c: The higher are dividend payments to shareholders, the lower is the top management's fraction of cash flows.

The next hypothesis is partly motivated by the discussed profit sharing literature:

Non-cash compensation. In a regression explaining cash compensation as a fraction of cash flows we should control for other, possibly non-cash compensation. Apart from the base salary and a cash bonus, most top executives in U.S. companies receive long-term incentive (LTI) compensation, such as company stock, options or other compensation based on firm-specific LTI plans. Different types of compensation may serve as substitutes. The top management of one firm may be paid a

[18]This ceteris paribus argument requires to control for cash flows to shareholders as well.

[19]Note that net cash flows from operating activities (our cash flow measure) are measured before interest payments.

lower share of the firm's cash flows than the top management of another firm, but may be paid with company stock or options instead. Moreover, LTI compensation such as stock and options provides managerial ownership. The profit sharing literature suggests that profit sharing and employee ownership are used as substitutes to align the interests of managers and shareholders. Hence, the profit sharing literature suggests a negative relation between the top management's cash-flow share and LTI compensation. Hence we hypothesize:

Hypothesis 2: The top management's share in cash flows is negatively related to non-cash compensation such as company stock and options.

We also argue that firm size is a crucial determinant of the top management's cash-flow share:

Firm size. Larger firms produce larger cash earnings than smaller firms. Although it is a well established finding that executives in larger firms earn more than their peers in smaller firms, it is unlikely that the same fraction of earnings goes to the top management as cash compensation[20]. Hence we hypothesize that:

Hypothesis 3: Larger firms pay a lower fraction of cash flows to the top management.

In section 5.4, we will investigate our final hypothesis about managerial power. Cross-sectional differences in corporate compensation policy may result from different "optimal", firm-value maximizing compensation rules, but also from different degrees of agency problems with managerial rent extraction at firm owners' expenses:

Managerial power. When we analyze the impact of managerial entrenchment and powerful CEOs on the cash-flow share captured by the top management, we expect that greater managerial bargaining power vis-à-vis firm owners is visible in a larger cash-flow share for the top management:

Hypothesis 4: Firms with a more powerful top management allocate a higher fraction of cash to the top management.

In the next section we discuss our data and define the explanatory variables we use to test our set of hypotheses.

[20]For example, consider two firms with earnings of 10 million and 1 billion U.S. Dollar, respectively. Typically the top management in the 1-billion-Dollar firm earns more than their peers in the 10-million-Dollar firm, but the difference is typically less than factor 100.

3.4 Data

Our data comes from two sources. Compensation data is retrieved from "DEF 14A" company filings with the Securities and Exchange Commission (SEC) in which listed U.S. companies disclose compensation of the CEO and the next four highest paid executive board members. SEC filings are available through the SEC's EDGAR database on `http://www.sec.gov/edgar/shtml`. We have compensation data for 3859 firm-years during the period 2005-2009. Firm data is taken from Thomson Reuters' Datastream database.

Table 3.1 in the appendix shows summary statistics for our two measures of the top management's cash-flow share. The cash ratio (CR_{it}), defined in equation (3.1) as the fraction of net operating cash flow paid as cash compensation (salaries plus bonuses) to the top management, is shown for individual industries in the left part of Table 3.1. The bonus ratio (BR_{it}), defined in equation (3.2) as the fraction of net operating cash flow paid as cash bonuses to the top management, is summarized in the right part of Table 3.1.

On average, across industries and over time, the cash ratio is 3.2 percent and the bonus ratio is 1.4 percent. The cash ratio varies over time with the highest average in 2006 (3.5 percent) and the lowest in 2009 (2.8 percent). A similar pattern holds for the bonus ratio. Note that the top management's cash-flow shares in our sample period 2005-2009 are substantially lower than the 8.1 percent reported by Bebchuk and Grinstein (2005) for the period 1999-2003. The difference is explained by the fact that our measure reflects cash compensation only, whereas Bebchuk and Grinstein (2005) refer to total compensation including the grant-date value of company stock, options etc. Moreover, we explicitly control for the fact that our operating cash flow measure already reflects compensation expenses and add them back before calculating the top management's share. In our dataset, the top management's share in operating cash flow based on total compensation including non-cash components is almost 6 percent (not reported), which is closer to the number reported by Bebchuk and Grinstein (2005).

Table 3.1 also reveals that the top management's cash-flow share differs across industries based on the two-digit supersector Industry Classification Code (ICB). On average, the top five executives receive the highest cash ratio in the Technology sector (4.1 percent), Personal & Household Goods (4.0 percent), and Health Care

(3.7 percent). The average cash ratio is lowest in Utilities (1.3 percent), Telecommunications (1.5 percent) and the Media sector (1.9 percent). This industrial pattern is similar for the bonus ratio.

Finally, Table 3.1 reveals that for individual firms the cash ratio can be as high as 88.1 percent (79.4 percent for the bonus ratio) in the Industrial Goods & Services sector, whereas no top-five executive team in the Telecommunications and Utilities sectors receives more than 11.7 and 17.4 percent, respectively, in any year (9.9 and 9.6 percent for the bonus ratio). Hence Table 3.1 suggests to control for industry and time effects in the regression analysis.

To test our set of hypotheses we use firm-level data from Datastream as explanatory variables. Table 3.2 in the appendix provides a summary of the variables used in this study. In all regressions we add year dummies and industry dummies based on the two-digit supersector Industry Classification Code (ICB), and adjust all monetary variables for inflation. We briefly describe the explanatory variables and discuss the expected relation with the top management's cash-flow share.

To test Hypothesis 1a, we measure investment activity and investment opportunities by the following variables:

Capital intensity. Firms with high capital expenditures (relative to firm size measured by total assets) are expected to run a more capital-intense business model. We use this measure to proxy investment activity. Hypothesis 1a implies a negative relation between capital intensity and the top management's cash-flow share[21] (cash ratio and bonus ratio).

R&D intensity. Another proxy for investment activity are expenditures for research and development (R&D) relative to firm size. We expect that firms with a high R&D intensity retain cash for investments and allocate a lower fraction of cash flows to the top management. Hypothesis 1a implies a negative relation between R&D intensity and the top management's cash ratio and bonus ratio. Contrary to Hypothesis 1a, however, the profit sharing literature suggests a positive relation between R&D intensity and the bonus ratio. The argument is that earnings participation of employees is more prevalent in firms with high R&D intensity, because R&D requires cooperation and interaction which is fostered by employee participa-

[21] We measure capital expenditures relative to firm size to ensure that the estimated relation to the top management's cash-flow share is not affected by a (negative) firm-size effect.

tion schemes.

Market-to-book ratio. The market-to-book ratio is often used as an indicator for investment opportunities (e.g. in Smith and Watts (1992), Gaver and Gaver (1993) or Ryan Jr and Wiggins III (2002)). Firms with a high market-to-book ratio trade at a surplus because they are expected to have productive investment opportunities that yield high earnings in the future. Typically such firms pay small dividends and keep profits as retained earnings for future investments. We hypothesize that firms with a high market-to-book ratio also pay a lower fraction of cash flows to the top management, because such firms allocate cash neither to shareholders nor to the top management, but retain it for future investment. Again Hypothesis 1a implies a negative relation between the market-to-book ratio and the fraction of cash paid to the top management.

Sales growth. An indirect measure for investment opportunities is sales growth. The top management's cash-flow share may be higher in growing firms, because such firms typically grant their managers more discretion in choosing investment projects. This is accompanied by higher compensation (Gaver and Gaver, 1993) and a tighter link between compensation and outcomes (Prendergast, 2002). Hence we expect that the top management's cash-flow ratio is higher in firms with higher sales growth.

Hypotheses 1b (interest to creditors) and 1c (dividends for shareholders) address the relation between the managerial fraction of cash flows and corporate financing. We use the following variables:

Interest payments. Hypothesis 1b implies a negative relation between interest payments (relative to firm size) and the managerial cash-flow share.

Leverage ratio. Interest payments are related to the level of indebtedness. Firms with a higher leverage (debt-to-equity) ratio are expected to pay a higher fraction of cash flows to creditors. Ceteris paribus, a lower fraction is left for the top management. This calls for a negative relation between leverage and the managerial cash-flow share.

Dividend payments. Hypothesis 1c implies a negative relation between dividend payments (relative to firm size) and the managerial cash-flow share.

Dividend payout ratio. Firms with a low dividend payout ratio (fraction of available cash paid to shareholders) typically retain cash for investment opportunities, and do not necessarily allocate more cash to the top management. Empirical studies show that dividend and compensation policies are related through a firm's investment opportunities (Smith and Watts, 1992). This calls for a positive relation between the dividend payout ratio and the top management's cash-flow share. We calculate the dividend payout ratio (DPR) as the fraction of $OCFBC_{it}$ ($OCFBB_{it}$ in regressions for the bonus ratio) dedicated to shareholders as dividend payments: $DPR_{it} = \frac{DIV_{it}}{OCFBC_{it}}$, where DIV_{it} is the total amount paid as dividends to common shareholders of firm i in fiscal year t[22].

To test Hypothesis 2, we measure non-cash compensation as follows:

Long-term incentives. Firms with plenty productive investment opportunities may choose to grant the top management non-cash compensation and retain cash for investment. Non-cash compensation consists of long-term incentive (LTI) compensation such as company stock, options or firm-specific LTI plans. We measure long-term incentives as the grant-date value of non-cash compensation divided by total compensation[23]. Hypothesis 2 calls for a negative relation between long-term incentives and the top management's cash-flow share.

To test Hypothesis 3, we add the following variable:

Firm size. We measure firm size by total assets at the end of the fiscal year. Hypothesis 3 suggests a negative relation between firm size and the managerial cash-flow share.

To test Hypothesis 4, we later add two measures of managerial power:

E-index. The E-index is the entrenchment index developed by Bebchuk et al. (2009). The index is based on six equally weighted corporate governance provisions which provide the top management with protection from being removed, or the consequences of removal, and thus limit the power of shareholders vis-à-vis the top management. The E-index measures the level of managerial entrenchment on a scale

[22]Stock repurchases have become increasingly prominent to reward shareholders in addition to dividend payments. In a robustness check we find that our results do not change qualitatively when we add to DIV_{it} a proxy for stock repurchases (we discuss this proxy in the robustness section).

[23]Taking the Dollar value instead yields similar results but may -once again- be influenced by a firm size effect, because typically in large firms the managerial cash-flow share is small and the Dollar value of non-cash compensation is large.

from zero to six by counting the number of provisions in place. Hypothesis 4 implies a positive relation between the E-index and the top management's cash-flow share.

CEO pay slice. The CEO pay slice (CPS) is a measure introduced by Bebchuk et al. (2011) to analyze CEO power. CPS is defined as the fraction of top management cash compensation captured by the CEO. Hypothesis 4 implies a positive relation between CPS and the top management's cash-flow share.

Beyond this set of explanatory variables, we control for firm performance in each regression:

Firm performance. As performance measures we use annual stock returns and firm profitability measured by the ratio of net income to total assets. Superior firm performance is expected to translate into higher cash bonus payments.

However, firm performance will not impact the fraction of cash being paid to the top management as long as managerial participation in firm performance is constant (both in the cross section and over time). A positive (negative) relation between firm performance and the top management's cash-flow share would indicate that executives participate at an increasing (decreasing) rate[24]. We have no prediction for the impact of firm performance on the top management's cash-flow share and leave it as an empirical question.

Finally, in the regressions with the bonus ratio as the dependent variable, we add cash flow volatility as an additional explanatory variable. This is primarily motivated by the standard agency model in the executive compensation literature, originally developed in Holmström (1979) and extended by Holmström and Milgrom (1987, 1991):

Cash flow volatility. The Holmström and Milgrom (1987, 1991) model derives an optimal managerial participation rate in firm profits which is part of the compensation contract between the firm owner (the principal) and the employed manager (the agent). The optimal participation rate is negatively related to profit volatil-

[24]Note though that even with a constant participation rate, we might observe a *negative* relation between firm performance and the cash ratio, because lower earnings may lower the bonus but not the base salary, which may translate into an overall higher cash ratio for the top management. For example, consider two firms of equal size which pay equal base salaries (say 100.000 U.S. Dollar) and pay out an equal fraction of firm earnings as bonus payments (say 10 percent). If earnings of firm A are 1 million and those of firm B only 500,000 U.S. Dollar, firm A pays in total 200,000 U.S. Dollar and firm B pays 150,000 U.S. Dollar to the management. This amounts to 20 percent of earnings in firm A, but 30 percent of earnings in firm B.

ity, because a risk-averse manager demands compensation for the risk transfer in performance-related compensation. However, an alternative view is developed in Prendergast (2002). Motivated by empirical findings of a positive relation between performance volatility and the sensitivity of compensation to performance, he interprets firm performance volatility as uncertainty in which shareholders give managers more discretion in decision making, which is accompanied by more outcome-oriented compensation. Moreover, in the profit-sharing literature Kruse (1996) argues that firms with high performance volatility are more likely to use profit sharing, because such a mechanism is valuable for them as an insurance mechanism to share uncertainty with employees. Because of these conflicting predictions from the literature, we leave the impact of cash flow volatility on the top management's bonus ratio as an empirical question.

3.5 Empirical Analysis

We are interested in the fraction of net operating cash flows dedicated to top management compensation. Hence our variable of interest is a fractional response variable with outcomes on the unit interval [0,1][25]. From an econometric perspective, this makes standard OLS estimation inappropriate[26]. Two alternative approaches are common for cross-sectional analysis of fractional response models (see the discussion in Loudermilk (2007)). The first approach is to estimate with OLS the log-odds ratio model

$$E\left(log\left(\frac{y}{1-y}\right)|\boldsymbol{x}\right) = \boldsymbol{x}\boldsymbol{\beta}, \tag{3.3}$$

where $0 \leq y \leq 1$ is a fractional dependent variable, $\boldsymbol{x} = (x_1, x_2, ..., x_k)$ is a 1xK-vector of explanatory variables, and β is a Kx1-vector of parameters to be estimated. However, this model is not suitable for fractional variables with observations at the bounds 0 or 1.

[25]The cash ratio and the bonus ratio are never smaller than zero, because cash payments to the management cannot be negative and operating cash flows are always positive in our sample. For the cash ratio, no observations are at the bounds 0 or 1, because in every firm and every year the top management receives some cash but there is no case of the top management receiving the firm's entire operating cash flow. For the bonus ratio, there are some observations at the lower bound when the top management receives no bonus payments.

[26]See the discussion in Papke and Wooldridge (1996) or Ramalho et al. (2009). For example, standard OLS does not guarantee that the predicted values are restricted to the unit interval.

The second approach goes back to Papke and Wooldridge (1996). They show that misspecification of fractional dependent variables can be addressed by a logit transformation of the response variable and quasi-maximum likelihood estimation (QMLE). Papke and Wooldridge's (1996) approach confines the projected values on the unit interval[27] and makes the distribution closer to normal[28]. Since we have some observations at the lower bound of zero in the regression of the bonus ratio (BR_{it}), we choose Papke and Wooldridge's (1996) QMLE approach, but we use the linear log-odds model as a robustness check. Hence we specify for our fractional variable CR_{it} (and similarly for BR_{it}):

$$E\left(CR_{it}|\boldsymbol{x_{it}}\right) = G(\boldsymbol{x_{it}\beta}), \tag{3.4}$$

where $G(.)$ is the logistic function $G(\boldsymbol{x_{it}\beta}) = \frac{\exp(\boldsymbol{x_{it}\beta})}{1+\exp(\boldsymbol{x_{it}\beta})}$. The vector $\boldsymbol{x_{it}} = (x_{it1}, x_{it2}, ..., x_{itk}, ind_{i1}, ind_{i2}, ..., ind_{im}, year_{t1}, year_{t2}, ..., year_{t5})$ contains K explanatory variables, M industry dummies and five year dummies. This model is estimated by quasi-maximum-likelihood estimation (QMLE) based on a Bernoulli log-likelihood function (for details see Papke and Wooldridge (1996) or Ramalho et al. (2009)).

3.5.1 Determinants of the Top Management's Cash-Flow Share Based on Total Cash Compensation

We first estimate equation (3.4) to test Hypotheses 1a to 3 (Hypothesis 4 will be tested separately in section 5.4). Column one of Table 3.3 shows the results for

[27] As Ramalho et al. (2009) discuss, the QMLE approach can be applied to cases with a finite number of boundary observations. In our specification, there are some observations at the lower bound of 0, because some firms do not pay cash bonuses (but only cash salaries) in some years. However, in no case are there observations on the upper bound of 1. Note that this makes a Tobit approach inappropriate. Technically, only the two-limit Tobit model ensures that the predicted values are restricted to the unit interval, but the two-limit Tobit model can only be applied when there are observations in both limits (Ramalho et al., 2009); as is the case, for example, in estimating household portfolio shares of asset classes with households choosing to allocate none, some or all of their investments in a particular asset class (see the analysis in Poterba and Samwick (2003)). Conceptually, a Tobit model is appropriate for censored data, but fractional data is defined on the unit interval and not the consequence of any type of censoring (Ramalho et al., 2009).

[28] Papke and Wooldridge (1996) show that their estimation approach with a logit transformation and heteroskedastic-robust standard errors delivers robust estimates within the unit interval and with satisfactory efficiency properties. Their method was later implemented into statistical software such as STATA and is described in detail by Baum (2008).

the cash ratio, CR_{it}[29]. We find support for Hypothesis 1a. Capital intensity is negatively related to the cash ratio. Also the market-to-book ratio as a measure of investment opportunities is (weakly) significant and negatively related to the cash ratio. On the other hand, R&D intensity (R&D expenditures relative to total assets) and sales growth turn out to be insignificant. We conclude that firms with large capital investments allocate a lower fraction of cash to the top management, but these investments are not necessarily related to R&D. Also firms with superior investment opportunities retain cash and invest, rather than allocate a large fraction of cash to the top management.

We also find support for the two hypotheses on corporate financing and dividend policy. As predicted by Hypothesis 1b, the top management's cash ratio is negatively related to interest payments (relative to total assets), but the firm's overall level of indebtedness (measured by the leverage ratio) is not significantly related to the cash ratio. As predicted by Hypothesis 1c, the cash ratio is negatively related to dividend payments (relative to total assets). Also the dividend payout ratio is significant and positively related to the top management's cash ratio. This suggests an equal payout policy with respect to managers and shareholders: In firms where shareholders receive a higher share of cash flows, the managerial share in cash flows is also higher (and a lower share is dedicated to investments).

Long-term incentive compensation is highly significant and negatively related to the top management's cash ratio. This is strong support for Hypothesis 2 and suggests that cash compensation and non-cash compensation are used as substitutes. We also find support for Hypothesis 3. Firm size is significant and has the expected negative sign. Larger firms pay a lower fraction of cash flow as compensation to the top management. Firm performance measured by stock return is (weakly) significant and positive. Thus the fraction of generated cash flow spent on top management compensation increases with stock market performance, which may be driven by convex bonus compensation. On the other hand, the coefficient of profitability is significantly negative. More profitable firms allocate a lower fraction of cash to the top management.

The time structure described by the year dummies suggests that the cross-

[29]Note that there is no high pairwise correlation between any two explanatory variables. The two highest correlations are 0.42 between the leverage ratio and the market-to-book ratio, and 0.37 between the leverage ratio and interest to total assets. All other correlations are below 0.3.

sectional average of the top management's cash-flow share was not significantly different during the years 2005-2008, but in 2009 it was significantly lower. We also find that the industry dummies mainly confirm the differences between industries observed in Table 3.1 (not reported).

The coefficient estimates of the QMLE regression model cannot be interpreted as marginal effects because of non-linearities. Instead, we calculate the marginal effect of a statistically significant variable x_k by holding all covariates x_l, $l \neq k$, at their mean values. We then build two measures to assess the economic impact of x_k. First, we multiply the marginal effect by a one-standard deviation change in x_k. This measure indicates the effect of a one-standard deviation change in x_k on CR_{it}. Second, we also divide this measure by one standard deviation of CR_{it}. This measure indicates how much of a one-standard deviation variation in CR_{it} is explained by a one-standard deviation change in x_k. Column one of Table 3.4 shows the first measure. For example, in firms with a capital intensity of one standard deviation above the average, the top management's cash-flow share is 0.4 percentage points below the sample average of 3.2 percent (from Table 3.1). On average, the largest impact (in absolute terms) on the cash ratio stems from a one-standard deviation in firm size and long-term incentives. The second measure is listed in column two of Table 3.4. For example, one standard deviation in capital intensity explains about 7.7 percent of a one-standard deviation in CR_{it}. This measure is 65.7 and 9.0 percent, respectively, for firm size and long-term incentives.

Finally, we repeat our analysis to test whether cash flow participation of CEOs and non-CEO executives is driven by the same set of explanatory factors. We estimate equation (3.4) separately for the CEO's cash-flow share (the cash ratio based on cash payments to the CEO), and for the combined share of the four non-CEO executives of the top management in each firm. Columns one and three of Table 3.5 show the results[30]. Most of the coefficient estimates for CEOs and the top-four management team excluding the CEO are very similar to the estimates for the top-five management team in Table 3.3. The only notable difference is that the market-to-book ratio is not significant, whereas it was weakly significant in Table 3.3. We conclude that our previous findings are robust to excluding CEOs from the analysis and also hold for CEOs alone.

[30]The number of observations in the regressions based on CEOs alone is slightly lower because there are a few cases where we cannot identify the CEO.

3.5.2 Determinants of the Top Management's Cash-Flow Share Based on Cash Bonuses

Next we replace the cash ratio CR_{it} in equation (3.4) with the bonus ratio BR_{it}. We add cash flow volatility to the previous set of explanatory variables, because the bonus ratio may be related to cash flow volatility as discussed in section 4[31]. The results in column two of Table 3.3 show that the top management's bonus ratio is positively related to cash flow volatility. This is contrary to the prediction of the Holmström and Milgrom (1987, 1991) model, but in line with Prendergast (2002) and also Kruse (1996).

We find again support for Hypothesis 1a. The bonus ratio is negatively related to capital intensity. R&D intensity is again insignificant. Thus, although it was found in the profit sharing literature that firms with high R&D investments rely more on profit sharing schemes to foster cooperation between employees, this is not visible on the top management level. Unlike in the regression for the cash ratio, the market-to-book ratio is not significant. Sales growth turns out to be insignificant also for the bonus ratio. Hence we do not find that firms with higher growth rates dedicate a larger fraction of cash flows as bonuses to the top management.

In line with Hypotheses 1b and 1c, interest payments and dividends (both relative to total assets) are negatively related to the bonus ratio, while the coefficient of the dividend payout ratio is again positive and thus supportive to our idea of an equal payout policy with respect to managers and shareholders. As predicted by Hypothesis 2, the top management's bonus ratio and long-term incentives are negatively related. This suggests that ownership providing long-term incentives and cash-based participation with bonus payments serve as substitutes for shareholders to align their interests with those of the top management.

Finally, note that the estimated stock return coefficient is more than twice as large as the estimate in column one (and significant at a higher level). For the top management's bonus ratio, stock performance is a more important predictor than for the cash ratio, because the cash ratio includes fixed salaries which are, by definition, unrelated to performance. Moreover, it turns out that profitability is unrelated to the bonus ratio. We found that more profitable firms allocate in total

[31] Adding cash flow volatility as an explanatory variable already for the cash ratio does not affect the results in the previous subsection.

a lower fraction of cash to the top management, but this does not hold for cash bonuses alone.

The right part of Table 3.4 lists the estimated economic effects. Columns three and four show that variation in firm size, dividends and long-term incentives have the largest effect on BR_{it} (in absolute terms). On average, one standard deviation in these factors explains about 30.4, 14.3 and 10.9 percent, respectively, of a one-standard deviation in BR_{it}.

Again we repeat our analysis to test whether the bonus ratios based on CEO bonuses and bonuses for the four non-CEO executives are driven by the same set of explanatory variables. Columns two and four of Table 3.5 show the results. Similar to the cash ratio, most of the coefficient estimates for the bonus ratio based on CEOs and the top-four management team excluding the CEO are very similar to the estimates for the top-five management team in Table 3.3. Hence, also our findings for the bonus ratio are robust to excluding CEOs and hold for CEOs alone.

One issue of concern is the fact that BR_{it} is zero in 226 cases because for these firm-year observations the top management team receives no cash bonus at all[32]. Unlike in the regression analysis of CR_{it}, we have thus observations at the lower bound of the fractional response variable[33]. With observations at the lower bound, we have to specify whether the decision to pay no cash bonus at all to the top management is truly governed by the same process as the decision to pay any other positive cash bonus. So far our regression approach implicitly assumes that the impact of the explanatory variables on the firm's decision on how much to pay as cash bonuses to the top management is the same as the impact on the decision whether to pay bonuses at all. However, zero cash bonuses may simply be due to a firm's compensation policy of not paying any variable cash compensation at all, or, one could think of zero cash bonus payments as a "political" signal to shareholders and the public as firms fear negative publicity from bonus payments, even small ones, in times of economic hardship[34].

[32]This also implies that in 94 percent of firm-year observations the top management was rewarded with bonus payments.

[33]There is no zero observation for CR_{it}, because in every firm and every year the top management receives some positive amount of cash compensation. There are no observations at the upper bound (1), because there is no firm-year observation in which the top management receives the entire operational cash flow of the firm.

[34]There were several examples of press announcements in which firms in the financial industry stated that the top management would not receive, sometimes waive voluntarily, bonus payments

Cook et al. (2008) discuss the issue of boundary observations in studies of some proportion in other corporate finance applications (e.g. debt/total capital ratio, type of debt/total debt ratio, managerial ownership, proportion of outside directors on the board). They argue that ignoring the presence of boundary observations will produce biased and inconsistent estimates. Cook et al. (2008) propose a statistical model which explicitly allows for a different treatment of boundary observations, the zero-inflated beta model. The regression approach consists of two parts[35]. A logistic regression for the probability of $BR_{it} = 0$, and maximum likelihood beta-regression for $0 < BR_{it} < 1$:

$$f\left(BR_{it} = 0|\boldsymbol{x_{it}}\right) = prob(BR_{it} = 0) \qquad \text{for } BR_{it} = 0,$$
$$f\left(BR_{it}|\boldsymbol{x_{it}}\right) = [1 - prob(BR_{it} = 0)] \times Beta(BR_{it}|\alpha, \beta) \qquad \text{for } 0 < BR_{it} < 1,$$

where $\alpha, \beta > 0$ are shape parameters of the Beta distribution. We use this regression model as a robustness check to account for zero-bonus observations in our sample. The regression results are shown in the first two columns of Table 3.6. The beta regression estimates for $0 < BR_{it} < 1$ in column one are based on 3633 observations. For this reduced dataset, the coefficients differ quantitatively, but the order of magnitude and the significance levels are the same as those estimated with our original regression framework where zero-bonus observations were included (column two of Table 3.3).

Column two of Table 3.6 shows the results of the logistic regression in which the dependent variable is one if the top management team receives no bonus at all, i.e. $BR_{it} = 0$. Quite intuitively, the top management is more likely to receive cash bonus payments in firms with higher sales growth, higher stock returns and higher profitability, and less likely to receive cash bonus payments in firms which grant a larger share of long-term incentives. Less intuitively, the top management is also more likely to receive a cash bonus in firms with higher interest payments on debt (relative to total assets). Finally, top management bonuses were less likely for fiscal year 2009 (year dummies not reported to save space).

Columns three to five of Table 3.6 show three estimated economic effects of

during and after the recent financial crisis.

[35]The zero-inflated beta regression approach was implemented into STATA by Maarten L. Buis, 2010, "ZOIB: Stata module to fit a zero-one inflated beta distribution by maximum likelihood," Statistical Software Components S457156, Boston College Department of Economics.

variable x_k on BR_{it}, each measured as marginal effects multiplied by one standard deviation of x_k. Column three contains this measure based on the beta regression and thus conditional on $BR_{it} > 0$. Column four shows the effect of a one-standard deviation shift in x_k on the probability of BR_{it} equaling zero, calculated from the logistic regression. Finally, column five shows the combined effect of a one-standard deviation shift in x_k on $BR_{it} \geq 0$, i.e. the unconditional effect which is comparable to the estimates in column three of Table 3.4. The (significant) estimates of this unconditional effect differ somewhat quantitatively, but the order of magnitude is similar to Table 3.4. The only exception is the impact of sales growth on BR_{it}, which was insignificant in our original regression framework and is now significantly positive. Since the likelihood of bonus payments is significantly driven by sales growth (as was shown by the logistic regression), we find a significant effect of sales growth on BR_{it} only in this regression framework which explicitly accounts for zero-bonus observations.

3.5.3 The Dividend Payout Ratio and the Top Management's Cash-Flow Share

When we choose the dividend payout ratio as an explanatory variable, we implicitly assume that it is predetermined. The dividend payout ratio was highly significant for the top management's cash-flow share, but the two may be related through corporate policy. Ultimately, cash payments for executives and dividends for shareholders are determined by the company's board of directors, and studies such as Smith and Watts (1992) and Gaver and Gaver (1993) argue and find evidence that these two corporate policy decisions are related.

Hence dividend payments may not be predetermined in the analysis above, but could be driven by the same factors that explain the management's cash-flow share[36]. We account for this potential endogeneity problem in two ways. First, we regress the dividend payout ratio on our set of explanatory variables and use the residual instead of the dividend payout ratio in the main regressions with the management's cash and bonus ratios as the dependent variables. Second, we use lagged dividend payments and the lagged dividend payout ratio as instruments to account for po-

[36]The empirical correlation between the dividend payout ratio and the management's cash ratio (bonus ratio) is small though with 0.06 (0.04).

tential endogeneity problems[37].

The first-stage regression of the dividend payout ratio on the set of explanatory variables yields some interesting findings by itself (not reported). The dividend payout ratio is negatively related to capital intensity and sales growth, and positively related to the market-to-book ratio (weakly), firm size and profitability. The findings for capital intensity, firm size and profitability are in line with studies from the literature on cross-sectional differences in dividend payout decisions (e.g. Fama and French (2001) or Bhargava (2010)), whereas the market-to-book ratio as a proxy for investment opportunities is usually found to be negatively related to dividend payments. The second-stage regression with the dividend payout ratio substituted by the residual from the first stage confirms our previous findings. The coefficient estimates of all explanatory variables are very similar (hence unreported) to those reported in Table 3.3.

When we use lagged dividend payments and the lagged dividend payout ratio as instruments, the number of observations drops by about one fourth, because of gaps in the unbalanced panel (not all firms are in the panel for five consecutive years) and because we lack 2004 compensation data to calculate the dividend payout ratio based on $OCFBC$ and $OCFBB$ for the year 2004. However, based on the reduced sample we find support for our findings. The coefficient estimates of lagged dividend payments and the lagged dividend payout ratio are significant and of similar magnitude as those without a lag in Table 3.3 (hence unreported).

3.5.4 Managerial Power and the Top Management's Cash-Flow Share

In this subsection we test whether the top management's cash-flow share is related to managerial power (Hypothesis 4). The argument is that a larger cash-flow share for the top management may be partly explained by greater managerial bargaining power vis-à-vis firm owners, i.e. a more powerful management may be able to capture a larger share of cash. We test Hypothesis 4 with two alternative measures of managerial power. First, we use a measure of managerial entrenchment developed by Bebchuk et al. (2009). This entrenchment index ("E-index") is based on six equally weighted corporate governance provisions which provide the top management with

[37] Dividend payments are highly persistent over time.

protection from being removed, or the consequences of removal, and thus limit the power of shareholders[38]. These include staggered boards, limits to shareholder bylaw amendments, supermajority requirements for mergers and charter amendments, poison bills, and golden parachutes[39]. The E-index measures the level of managerial entrenchment on a scale from zero to six by counting the number of provisions in place. We merge our data with firm-level data on the E-index which is provided on Bebchuk's website[40].

Second, we follow Bebchuk et al. (2011) and proxy managerial power by a measure of CEO power. We calculate Bebchuk et al.'s (2011) "CEO Pay Slice" (CPS) as the fraction of top-five executive cash compensation captured by the CEO. Bebchuk et al. (2011) conclude that a high CPS indicates agency problems and managerial rent extraction, which has a negative impact on performance and firm value. As a robustness check, we also follow Frydman and Saks (2010) and calculate as another measure of CEO power the ratio of CEO cash compensation to the average cash compensation of the other four members in the top management team. We do not report results for this measure because they are very similar to the ones reported for the CPS measure.

Table 3.7 shows descriptive statistics for the E-index and the CPS for different industries and years. On average, the E-index is 2.4 over all years and also in every year 2005-2009. There is some variation in average index levels across industries. With 2.9 the E-index is highest for firms in the Chemical, Basic Resources and Automobile sectors. With an average of 1.9, managerial entrenchment measured by this index is lowest in the Media and Telecommunications sectors. The right part of

[38]The E-index is based on six out of 24 provisions monitored by the Investor Responsibility Research Center (IRRC). Bebchuk et al. (2009) choose this subset of IRRC provisions based on observed shareholder opposition and activism against them. They use the fact that shareholders focus their opposition on these provisions and not on others to argue that this subset is potentially significant for the shareholders' view on corporate governance.

[39]Bebchuk et al. (2009) discuss these provisions extensively. Very briefly, in firms with staggered boards, shareholders cannot replace a majority of the directors in any given year, because directors are divided into (typically three) separate classes with overlapping terms and with only one class coming up for reelection each year. Limits to bylaw amendments typically come in the form of supermajority requirements making it difficult for shareholders to remove provisions that managers placed in the bylaws. Supermajority requirements for mergers and charter amendments are another set of defense against takeover threats, because they might discourage a hostile buyer from acquiring a control block. Poisson pills effectively preclude a hostile buyer from acquiring shares without the board of directors' approval. Golden parachutes provide top executives with monetary benefits in case they lose their jobs due to a change in control.

[40]`http://www.law.harvard.edu/faculty/bebchuk/data.shtml`

Table 3.7 shows that the average CPS calculated for total cash compensation is 37.5 percent over time and across industries, whereas CPS based on cash bonuses alone is 39.9 percent. These numbers are close to the CPS of 35.7 percent in Bebchuk et al. (2011), calculated for the period 1993-2004 and based on total compensation, including the grant-date value of long-term compensation such as company stock and options. In our dataset the average CPS based on total compensation is 40.5 percent (not reported). There is some variation in average CPS across industries. With 40.8 and 40.2 percent, respectively, average CPS based on cash compensation is highest in the Construction and Chemical sectors. This holds true for CPS based on cash bonuses alone. On the other hand, average CPS is lowest in the Media and Personal & Household Goods sectors (34.1 and 36.2 percent, respectively). Hence, to some extent the industry patterns of managerial entrenchment and CPS are similar. From Table 3.7 we also see that across industries CPS is fairly stable over time during our sample period 2005-2009. Average CPS based on total cash compensation and bonuses is highest in the years 2006 and 2007, and lowest in 2009. This holds true for CPS based on total compensation (not reported).

Comparing these summary statistics with those in Table 3.1 does not provide evidence for a strong relation between the top management's cash-flow share and the E-index or CPS on the industry level. Over time the top management's cash-flow share is lowest in 2009, and also CPS is lowest in 2009. On the firm level, the average correlation between the top management's cash-flow share and the E-index or CPS is positive but small in the range of 0.01-0.10. However, we should test Hypothesis 4 only in a multivariate regression framework with control variables for firm characteristics.

We first estimate equation (3.4) for the top management's cash ratio (CR_{it}) or bonus ratio (BR_{it}) as the dependent variable and with the E-index as an additional explanatory variable. The first two columns of Table 3.8 show the results[41]. The coefficient of the E-index is positive in both regressions, but it is significant only for the bonus ratio. Thus the top management's cash-flow share based on cash bonuses is higher in firms with a higher level of managerial entrenchment. The last two columns of Table 3.8 show the results with CPS as an additional explanatory variable in equation (3.4). The result is similar; CPS is positively related to the top

[41]The number of observations is lower because for some firms E-index data was not available.

management's cash-flow share, but only significant for the bonus ratio[42]. Note that the other coefficient estimates are very similar to those in Table 3.3, which indicates that CPS is an additional factor explaining the top management's bonus ratio[43].

Thus, based on two very different measures of managerial power we find support for Hypothesis 4, but only for the bonus ratio. This indicates that a more powerful management or CEO is able to capture a larger share of firm profits as cash bonuses for the top management team[44]. Managerial power can explain higher managerial profit sharing in the form of cash bonuses, but does not imply that more powerful managers also receive a higher cash-flow share in the form of fixed salaries[45].

3.6 Robustness

We run several robustness checks on our results which we will briefly discuss in this section.

Earnings or cash flow measure. So far, we run a cash-flow based analysis and choose net cash flows from operating activities as a measure for firm earnings. As a robustness check we repeat the analysis with other accounting measures such as operating income (gross operating income minus operating expenses - depreciation & amortization) or net income (income after interest and taxes, with and without an adjustment for depreciation), and calculate the top management's cash-based share of these measures[46]. Of course, our estimates change quantitatively, but there

[42]The number of observations (3538) is lower for the bonus ratio, because CPS is undefined in a year when the top management of a firm receives no cash bonuses at all.

[43]There are more pronounced quantitative differences between the results with the E-index and Table 3.3, but this is mainly due to the reduced sample because of missing E-index data.

[44]The fact that a high CPS is related to a high bonus ratio of the top management team does not imply that a powerful CEO is able to capture a larger cash-flow share for himself and for the other top management team members as well. Unfortunately, we cannot test whether a powerful CEO, defined as a CEO with a high CPS, channels more cash to himself and/or to the other management team members. If we regress the CEO's (top-4 management's) cash-flow share on CPS, the coefficient of CPS is by construction positive (negative). We could test this only with a CEO power measure which is not based on the relative distribution of cash among the top-5 management team. Examples of such measures can be found in the literature, e.g. Adams et al. (2005) define a CEO as powerful if she is also chairman of the board, one of the firm's founders, or the only insider on the board. These measures require a much richer dataset than ours.

[45]In unreported regressions we tested the relation between managerial power and the top management's cash-flow share based on fixed salaries alone. There is no positive impact of managerial power measured by the E-index or CPS on this cash-flow share.

[46]Note that these measures can take negative values which yields our main variables of interest, the fractions CR and BR, negative as well. Our regression design from equation (3.4) cannot

is only one minor qualitative change (hence we do not report a table): The profitability measure is often significantly negative also in the regressions with BR as the dependent variable, which was not the case in our main specification. Thus, we find that our main results are robust to a change of the firm earnings measure.

Total compensation including non-cash rewards. Bebchuk and Grinstein (2005) and Haid and Yurtoglu (2006) present measures of the top management's share in firm earnings based on total compensation including non-cash rewards such as (the grant-date value of) company stock and options. Our measures CR and BR do not include such rewards because we measure the top management's share in operating cash flow based on actual cash flow to the top management. However, in all our regressions we explicitly control for such non-cash rewards by including them on the right side of the regression model. If we add them to the top management's total rewards and run our analysis for the ratio of the top management's total compensation to net cash flow from operating activities (the equivalent labeling would be 'total ratio' or TR), only some of the results change (not reported). Compared to the results in Table 3.3, stock return is no longer significant. Compared to the results for CR in Table 3.3, the market-to-book ratio is no longer significant. In terms of economic significance, firm size has again the largest effect, but also capital intensity and dividend payments have pronounced effects on TR.

Dividend payout ratio and share repurchases. Our measure of the shareholders' cash-flow fraction is based on total dividend payments in a given year. Studies have shown, however, that although shareholders are primarily rewarded with cash dividends, they are increasingly rewarded also with share repurchase programs (see Jagannathan et al. (2000)). The empirical evidence on the question whether cash dividends and share repurchases are substitutes or complements is mixed (see, for example, Bhargava (2010) and Fama and French (2001)). Nonetheless, our measure for shareholder rewards is potentially downward biased because it does not include share repurchases.

To test the robustness of our previous results, we use the following proxy to measure share repurchases. We take the annual change in the number of outstanding

handle negative values of the dependent variable. However, it turns out that only 3-4 percent of the observations take negative values for CR or BR. We either exclude them from the analysis or set CR and BR to one for these cases (indicating that the top management receives the entire firm earnings which are actually non-positive) and mark these observations with a dummy variable in the regression analysis. The choice of the two approaches is non-critical for the results.

shares and evaluate it by the average annual share price[47]. In 1671 out of 3859 cases, this change is negative. We then control for proceeds from new share issues, and find that in 2023 out of 3859 cases there were decreases in outstanding shares after controlling for issuance of new shares. This measure of share repurchases is our best available proxy, but there is some discussion in the literature how to best measure share repurchases (see Banyi et al. (2008), and also the discussion in Bhargava (2013) and Fama and French (2001)).

Accounting for share repurchases does not change our results qualitatively (hence unreported). The top management's cash and bonus ratios are negatively related to expenses for dividends and repurchases (relative to total assets), and positively related to the payout ratio adjusted for repurchases.

Log-odds specification. In another robustness check, we repeat our analysis by estimating with OLS the log-odds ratio model specified in equation (3.3) instead of the QMLE approach presented in the main text. This model is not well defined for the boundary values 0 and 1 of a fractional response variable. Thus when we calculate the log-odds ratio we lose 226 observations, effectively excluding those firm-year observations with zero cash bonus payments. Based on this reduced sample, however, the regression results are very similar to our main results in Table 3.3 (thus again unreported).

Lagged structure and firm fixed effects. We also test the robustness of our results by including as an explanatory variable the top management's cash-flow share lagged by one period. The correlation over time is 0.42 for the cash ratio and 0.31 for the bonus ratio. In each regression, the lagged dependent variable is significantly positive, but all other results remain quantitatively similar (not reported). Some firm characteristics such as firm size differ substantially in the cross section, but there is not much variation in time during our five-year sample period. This implies that firm fixed effects should capture much of the explanatory power of these time-invariant variables. When we add firm fixed effects to our basic set of explanatory variables (instead of industry fixed effects), capital intensity, the market-to-book ratio, firm size and cash flow volatility are no longer significant, whereas interest and dividend payments, the dividend payout ratio and long-term incentives keep

[47]This assumes an open-market share repurchase program. Other methods include fixed-price offers and Dutch auctions with a given price range. We lack the information on any share repurchase modalities, but Bhargava (2013) reports that 75 percent of all share repurchases are open market.

their explanatory power for the top management's cash-flow share.

Time averages and year-by-year estimation. As another robustness check we estimate our basic equation (3.4) for CR_{it} and BR_{it} based on time-averaged observations. Averaging observations for all firms over time yields a total of 949 observations[48]. Compared to Table 3.3, the results do not change qualitatively for BR_{it} (hence unreported). The only difference for CR_{it} is that the market-to-book ratio, which was weakly significant in Table 3.3, is no longer significant and also dividend payments (relative to total assets) lose significance. Still, averaging firm observations over time yields results very similar to those from pooled observations in a panel regression.

We also estimate equation (3.4) year by year. The number of observations for the yearly regressions varies between 668 in 2005 and 840 in 2007. For the cash ratio, CR_{it}, most results can be confirmed for every single year (not reported). Only in 2008, capital intensity seems to be unrelated to the cash ratio, whereas in 2009 interest and dividend payments are not significant. For the bonus ratio, BR_{it}, capital intensity is not significant in 2008 and 2009, interest payments are not significant in 2005-2007, and stock returns are not significant in 2006 and 2009. Thus we cannot confirm every single result for every year, but the broad picture of our main results remains visible also in yearly regressions, maybe except for the year 2009.

3.7 Conclusion

Previous literature such as Bebchuk and Grinstein (2005) has shown that over time not only the level of top management compensation, but also the ratio of top management compensation to firm earnings has grown. We present evidence that such a ratio varies substantially between firms and industries. In particular, we calculate the fraction of operating cash flow, U.S. firms dedicate to top management compensation, and construct two measures for the top management's cash-flow share: The cash ratio, defined as the fraction of operating cash flow paid as cash (salaries and bonuses) to the top management, and the bonus ratio, defined as the corresponding fraction based on bonus payments alone. There are industries with firms in which

[48] We do not observe all firms over the whole 5-year horizon which makes our sample unbalanced.

the cash ratio is more than 80 percent, while in other industries this ratio never exceeds 12 percent in any firm during the sample period 2005-2009.

The contribution of this paper is to identify explanatory factors for this cross-sectional variation. We are not aware of any other study that explains differences between firms in relative expenses on top management compensation[49]. Our main findings are as follows: The cash ratio and the bonus ratio are lower in firms with higher expenses on capital investments (relative to total assets), but only the cash ratio is significantly lower in firms with superior investment opportunities, measured by the market-to-book ratio. The cash ratio and the bonus ratio are also lower in firms with higher expenses on interest and dividends (also relative to total assets). Interestingly, we find a positive relation between the two cash-flow shares and the dividend payout ratio, defined as the fraction of operating cash flow shareholders receive as dividends. We interpret this finding as evidence for a consistent cash-flow policy with respect to shareholders and managers, i.e. firms which pay out a lower fraction of cash as dividends also allocate a lower fraction to the top management.

The top management's cash ratio and the bonus ratio are also positively related to firm performance measured by stock return, but this relation is stronger for the bonus ratio. This is quite intuitive, because the cash ratio contains fixed salaries which are not performance related. Only the cash ratio is also negatively related to firm profitability. We also find that the top management receives a lower share of operating cash flow in larger firms. Moreover, we find that cash-flow participation and non-cash compensation (company stock, options, long-term incentive (LTI) plans) are substitutes. We conclude that firms use cash-based participation in firm earnings and ownership-providing LTI compensation as substitutes to align managerial interests with those of the shareholders.

Finally, we investigate whether the top management's cash-flow share is related to measures of managerial entrenchment and CEO power. Whereas the cash ratio is not related to such measures, we find that the bonus ratio is positively related to managerial entrenchment (measured by Bebchuk et al.'s (2009) E-index) and CEO power (measured by Bebchuk et al.'s (2011) CEO payout ratio (CPS)). We conclude

[49]Bebchuk and Grinstein (2005) investigate the increase in average compensation expenses relative to earnings over time, but not the cross section. Haid and Yurtoglu (2006) and Thanassoulis (2012) present evidence for average relative compensation expenses and also for some differences between industries, but they do not identify explanatory factors for these differences.

that a top management with more power vis-à-vis shareholders and more powerful CEOs are able to capture a larger share of cash flows as cash bonuses for the top management team. If we follow Bebchuk et al. (2011) who find that CEO power is associated with agency problems resulting in inferior firm performance, our finding may imply agency problems in firms where the top management captures a large share of cash flows.

This finding calls for further investigation of the implications from high managerial cash-flow participation. Future research may analyze whether a higher cash-flow share captured by the top management is indeed negatively associated with firm performance or firm value and thus evidence for agency problems and managerial rent extraction.

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Appendix

Table 3.1: Top-Five Executive Cash Compensation as Percentage of Operating Cash Flow

		Cash Ratio (CR)			Bonus Ratio (BR)		
2005-2009	Obs.	Mean	Median	Max	Mean	Median	Max
Chemicals	147	3.6	2.0	41.2	1.6	0.8	18.8
Basic Resources	93	3.3	1.5	58.8	1.9	0.6	53.0
Construction & Materials	117	3.0	2.1	28.2	1.7	1.1	22.2
Industrial Goods & Services	900	3.5	2.1	88.1	1.6	0.9	79.4
Automobiles & Parts	42	3.1	1.2	22.0	1.3	0.5	17.0
Food & Beverage	129	3.6	1.5	58.3	1.9	0.7	35.6
Personal & Household Goods	269	4.0	2.4	68.3	1.9	0.8	66.5
Health Care	438	3.7	1.9	43.1	1.4	0.7	15.1
Retail	516	2.4	1.2	54.6	1.0	0.4	28.0
Media	76	1.9	1.3	20.1	0.8	0.5	3.4
Travel & Leisure	285	2.4	1.6	47.3	1.1	0.6	17.6
Telecommunications	26	1.5	0.6	11.7	0.9	0.3	9.9
Utilities	278	1.3	0.8	17.4	0.5	0.3	9.6
Technology	543	4.1	2.2	68.0	1.6	0.8	24.6
All Industries 2005-09	3859	3.2	1.7	88.1	1.4	0.7	79.4
All Industries 2005	668	3.3	1.6	88.1	1.5	0.6	79.4
All Industries 2006	763	3.5	1.9	68.3	1.7	0.8	66.5
All Industries 2007	840	3.0	1.8	68.0	1.4	0.7	24.6
All Industries 2008	825	3.3	1.8	58.8	1.4	0.6	53.0
All Industries 2009	763	2.8	1.5	54.6	1.1	0.5	17.7

This table shows summary statistics for the fraction (expressed in percentages) of net cash flows from operating activities paid as cash compensation to the top five executives of firm i in year t. The cash ratio (CR) is this fraction based on total cash compensation which includes fixed salaries and cash bonus payments (left panel). The bonus ratio (BR) is based on cash bonuses only (right panel). Industries are classified according to the two-digit supersector Industry Classification Code (ICB).

Table 3.2: Description of Explanatory Variables

Variable	Description
Capital intensity	Capital expenditures divided by total assets in fiscal year t.
R&D intensity	R&D expenditures divided by total assets in fiscal year t.
Market-to-book	Ratio of market value to book value at the end of fiscal year t.
Sales growth	Annualized average growth rate in sales over three years prior to fiscal year t.
Interest	Net interest expenses on debt divided by total assets in fiscal year t.
Leverage	Total debt over equity at the end of fiscal year t.
Dividends	Dividend payments divided by total assets in fiscal year t.
Dividend payout ratio	Fraction of operating cash flow paid as dividends to shareholders in fiscal year t.
Long-term incentives	Fraction of total compensation paid as long-term incentive (LTI) compensation in fiscal year t.
Firm size	Total assets at the end of fiscal year t (in 2005 million U.S. Dollar).
Stock return	Annual stock return in year t.
Profitability	Ratio of net income to total assets in fiscal year t.
Cash flow volatility	Absolute coefficient of variation in annual operating cash flows, calculated over ten years before fiscal year t.
E-index	Entrenchment index developed by Bebchuk et al. (2009) (scale 0-6).
CEO pay slice	Fraction of top management cash compensation captured by the CEO.

Table 3.3: Determinants of the Top Management's Cash-Flow Share

	CR	BR
Capital intensity	-4.133***	-4.346***
	(-6.49)	(-5.13)
R&D intensity	0.433	-0.875
	(0.71)	(-1.11)
Market-to-book	-0.0174*	-0.0044
	(-1.74)	(-0.40)
Sales growth	-0.0213	-0.0144
	(-1.18)	(-0.69)
Interest	-11.94***	-9.363***
	(-4.65)	(-2.60)
Leverage	0.0102	0.0068
	(1.51)	(0.77)
Dividends	-8.576***	-15.57***
	(-3.40)	(-3.89)
Dividend payout ratio	0.492***	0.559***
	(3.93)	(4.86)
Long-term incentives	-1.137***	-1.488***
	(-12.24)	(-13.86)
Firm size	-0.0001***	-0.0001***
	(-12.73)	(-8.36)
Stock return	0.130*	0.306***
	(1.95)	(4.20)
Profitability	-1.254***	0.149
	(-4.00)	(0.31)
Cash flow volatility	-	0.0035***
		(2.64)
2006	-0.0195	0.0674
	(-0.23)	(0.56)
2007	-0.101	-0.0331
	(-1.33)	(-0.31)
2008	-0.0390	0.105
	(-0.47)	(0.92)
2009	-0.318***	-0.400***
	(-3.79)	(-3.73)
Industry dummies	yes	yes
Observations	3859	3859

The dependent variables in columns one and two are the top management's cash-flow share based on total cash compensation (cash ratio, CR) and cash bonuses (bonus ratio, BR), respectively. All estimates are based on QMLE estimation developed by Papke and Wooldridge (1996). Explanatory variables are defined in Table 3.2. All monetary variables are adjusted for inflation. All regressions include year and industry dummies. z-values in parentheses are calculated as coefficient estimates over robust standard errors. Significance levels of 1, 5 and 10 percent are indicated by ***, **, *, respectively.

Table 3.4: Economic Significance

	CR		BR	
	Δ SDx	Δ SDx/SDy	Δ SDx	Δ SDx/SDy
Capital intensity	-0.0038***	-0.0773***	-0.0022***	-0.0753***
	(-6.21)	(-6.21)	(-5.01)	(-5.01)
R&D intensity	0.0004	0.0071	-0.0004	-0.0134
	(0.71)	(0.71)	(-1.10)	(-1.10)
Market-to-book	-0.0012*	-0.0244*	-0.0002	-0.0058
	(-1.72)	(-1.72)	(-0.40)	(-0.40)
Sales growth	-0.0002	-0.0050	-0.0001	-0.0031
	(-1.18)	(-1.18)	(-0.70)	(-0.70)
Interest	-0.0023***	-0.0459***	-0.0010**	-0.0333**
	(-4.51)	(-4.51)	(-2.59)	(-2.59)
Leverage	0.0004	0.0082	0.0001	0.0051
	(1.50)	(1.50)	(0.77)	(0.77)
Dividends	-0.0042***	-0.0853***	-0.0041***	-0.1432***
	(-3.30)	(-3.30)	(-3.80)	(-3.80)
Dividend payout ratio	0.0030***	0.0603***	0.0022***	0.0771***
	(3.81)	(3.81)	(4.70)	(4.70)
Long-term incentives	-0.0045***	-0.0901***	-0.0032***	-0.1092***
	(-10.45)	(-10.45)	(-13.04)	(-13.04)
Firm size	-0.0325***	-0.6565***	-0.0088***	-0.3036***
	(-21.49)	(-21.49)	(-9.76)	(-9.76)
Stock return	0.0010*	0.0209*	0.0013***	0.0454***
	(1.94)	(1.94)	(4.22)	(4.22)
Profitability	-0.0019***	-0.0385***	-0.0001	-0.0042
	(-4.00)	(-4.00)	(-0.31)	(-0.31)
Cash flow volatility	-	-	0.0003***	0.0116***
			(2.63)	(2.63)
Year dummies	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes
Observations	3859	3859	3859	3859

Based on the estimates in Table 3.3, columns one and three show the calculated effect of a 1-standard deviation change in x_k on CR and BR, respectively, with x_l evaluated at its mean $\forall l \neq k$. For example, in firms with capital intensity of 1 standard deviation above the average, the top management's cash-flow share is 0.4 percentage points below the average (3.2 percent, see Table 3.1). Columns two and four show how much of a 1-standard deviation variation in CR and BR, respectively, is explained by a 1-standard deviation change in x_k. This effect is calculated by dividing the estimates in columns one and three by 1 standard deviation of CR and BR, respectively. For example, variation of 1 standard deviation in capital intensity explains about 7.7 percent of a 1-standard deviation variation in CR. z-values in parentheses are calculated as coefficient estimates over robust standard errors. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 3.5: Determinants of the CEO's and the Top-4 Executives' Cash-Flow Share

	CEO CR	CEO BR	Top-4 CR	Top-4 BR
Capital intensity	-4.698***	-4.758***	-4.182***	-4.422***
	(-5.27)	(-4.12)	(-5.87)	(-4.85)
R&D intensity	0.0419	-1.335	0.417	-1.045
	(0.06)	(-1.36)	(0.64)	(-1.23)
Market-to-book	-0.0198	-0.0057	-0.0147	-0.0007
	(-1.34)	(-0.39)	(-1.42)	(-0.06)
Sales growth	-0.0231	-0.0116	-0.0185	-0.0201
	(-0.82)	(-0.37)	(-0.87)	(-0.80)
Interest	-13.38***	-10.48**	-12.82***	-11.09***
	(-3.99)	(-2.15)	(-4.43)	(-2.63)
Leverage	0.0159*	0.0133	0.0080	0.0016
	(1.82)	(1.27)	(0.99)	(0.13)
Dividends	-11.75***	-21.85***	-9.839***	-18.06***
	(-3.25)	(-3.30)	(-3.14)	(-3.65)
Dividend payout ratio	0.450***	0.679***	0.451***	0.628***
	(4.02)	(3.94)	(4.09)	(4.59)
Long-term incentives	-0.932***	-1.163***	-1.117***	-1.527***
	(-10.80)	(-11.48)	(-10.22)	(-12.47)
Firm size	-0.0001***	-0.0001***	-0.0001***	-0.0001***
	(-10.27)	(-6.99)	(-11.22)	(-7.06)
Stock return	0.162*	0.318***	0.0970	0.269***
	(1.85)	(3.07)	(1.27)	(3.25)
Profitability	-1.108***	0.469	-1.273***	0.328
	(-3.51)	(0.60)	(-3.64)	(0.56)
Cash flow volatility	-	0.0036***	-	0.0031**
		(2.75)		(2.40)
2006	-0.0402	0.0917	-0.0219	0.0494
	(-0.38)	(0.60)	(-0.23)	(0.35)
2007	-0.115	-0.0314	-0.134	-0.0969
	(-1.23)	(-0.26)	(-1.56)	(-0.78)
2008	-0.0336	0.135	-0.0733	0.0543
	(-0.33)	(1.01)	(-0.78)	(0.40)
2009	-0.365***	-0.426***	-0.327***	-0.434***
	(-3.53)	(-3.29)	(-3.53)	(-3.58)
Industry dummies	yes	yes	yes	yes
Observations	3758	3758	3859	3859

The dependent variables in columns one and two are the CEO's cash-flow share based on total cash compensation (cash ratio, CR) and cash bonuses (bonus ratio, BR), respectively. The dependent variables in columns three and four, respectively, are the same measures calculated for the four executives in the top management team excluding the CEO. All estimates are based on QMLE estimation developed by Papke and Wooldridge (1996). Explanatory variables are defined in Table 3.2. Monetary variables are adjusted for inflation. All regressions include year and industry dummies. z-values in parentheses are calculated as coefficient estimates over robust standard errors. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 3.6: Beta Regression Analysis and Economic Effects for the Top Management's Bonus Ratio (BR)

	Beta Reg. $0 < BR < 1$	Logit $BR = 0$	Δ SDx $0 < BR < 1$	Δ SDx $BR = 0$	Δ SDx $0 \leq BR < 1$
Capital intensity	-1.681***	1.827	-0.0012***	0.0032	-0.0012***
	(-6.33)	(1.22)	(-6.23)	(1.21)	(-6.31)
R&D intensity	0.1972	0.8794	0.0001	0.0014	0.0001
	(0.54)	(0.46)	(0.54)	(0.46)	(0.44)
Market-to-book	-0.0045	-0.0299	-0.0002	-0.0039	-0.0002
	(-1.21)	(-0.94)	(-1.22)	(-0.93)	(-0.88)
Sales growth	0.0023	-1.739***	0.00002	-0.0382***	0.0006***
	(0.33)	(-2.67)	(0.33)	(-2.84)	(2.78)
Interest	-4.038***	-21.95**	-0.0006***	-0.0079**	-0.0005**
	(-2.90)	(-2.22)	(-2.85)	(-2.13)	(-2.23)
Leverage	0.0046	0.0264	0.0001	0.0020	0.0001
	(1.43)	(0.59)	(1.42)	(0.58)	(0.95)
Dividends	-7.489***	4.600	-0.0028***	0.0043	-0.0028***
	(-6.35)	(1.25)	(-6.21)	(1.25)	(-6.21)
Dividend payout ratio	0.3198***	-0.0448	0.0018***	-0.0006	0.0018***
	(7.94)	(-0.33)	(7.62)	(-0.33)	(7.77)
Long-term incentives	-0.9318***	2.388***	-0.0028***	0.0177***	-0.0030***
	(-14.54)	(4.51)	(-13.51)	(5.04)	(-14.07)
Firm size	-0.00002***	-0.00003	-0.0035***	-0.0202	-0.0031***
	(-11.24)	(-1.41)	(-12.14)	(-1.56)	(-9.44)
Stock return	0.2894***	-1.256***	0.0018***	-0.0188***	0.0020***
	(7.94)	(-4.18)	(8.20)	(-3.94)	(9.00)
Profitability	-0.1264	-1.535**	-0.0001	-0.0044**	-0.0001
	(-0.70)	(-2.32)	(-0.71)	(-2.17)	(-0.39)
Cash flow volatility	0.0035***	-0.0006	0.0005***	-0.0002	0.0005***
	(4.72)	(-0.18)	(4.65)	(-0.18)	(4.97)
Year dummies	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes
Observations	3633	3859	3633	3859	3859

Column one shows results of a beta regression with $0 < BR < 1$ as the dependent variable. Column two shows results of a logit regression with the dependent variable $y = 1$ if $BR = 0$. Columns three and four show estimates of the effect of a 1-standard deviation change in x_k, with x_l evaluated at its mean $\forall l \neq k$, and based on the marginal effects calculated from the estimates in columns one and two (similar to columns one and three of Table 3.4, see the caption of Table 3.4 for an example). Column five shows the combined estimate of a 1-standard deviation change in x_k on the dependent variable $0 \leq BR < 1$. Explanatory variables are defined in Table 3.2. All monetary variables are adjusted for inflation. All regressions include year and industry dummies. z-values in parentheses are calculated as coefficient estimates over robust standard errors. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

Table 3.7: Measures of CEO Power and Managerial Entrenchment

	E-Index (scale 0-6)	CEO Pay Slice (in %)	
2005-2009		Cash	Bonus
Chemicals	2.9	40.2	44.0
Basic Resources	2.9	38.1	39.4
Construction & Materials	2.7	40.8	42.9
Industrial Goods & Services	2.5	38.1	40.5
Automobiles & Parts	2.9	37.7	35.8
Food & Beverage	2.3	39.5	41.6
Personal & Household Goods	2.6	36.2	37.2
Health Care	2.4	37.5	40.5
Retail	2.2	36.5	39.0
Media	1.9	34.1	36.5
Travel & Leisure	2.3	37.6	39.9
Telecommunications	1.9	37.8	40.3
Utilities	2.9	37.3	40.1
Technology	2.1	36.4	39.2
All Industries 2005-09	2.4	37.5	39.9
All Industries 2005	2.4	37.1	39.3
All Industries 2006	2.4	38.0	40.5
All Industries 2007	2.4	38.0	41.3
All Industries 2008	2.4	37.3	39.6
All Industries 2009	2.4	37.0	38.9

The first column shows summary statistics for the entrenchment index (E-index) developed by Bebchuk et al. (2009). The right part of this table shows the CEO pay slice (CPS), defined as the fraction of top-five cash compensation (column two) and bonus compensation (column three) captured by the CEO and expressed in percentages. Industries are classified according to the two-digit supersector Industry Classification Code (ICB).

Table 3.8: The Top Management's Cash-Flow Share and Managerial Power

	CR	BR	CR	BR
E-index	0.00531	0.0844***	-	-
	(0.22)	(2.62)		
CEO pay slice	-	-	0.294	1.208***
			(1.20)	(6.46)
Capital intensity	-4.189***	-4.840***	-4.140***	-4.034***
	(-6.18)	(-5.86)	(-6.40)	(-4.80)
R&D intensity	0.114	-1.292	0.590	-0.672
	(0.16)	(-1.38)	(0.93)	(-0.84)
Market-to-book	-0.0203*	0.0002	-0.0162	-0.0027
	(-1.75)	(0.02)	(-1.45)	(-0.22)
Sales growth	-0.455**	-0.0769	-0.0221	-0.0198
	(-2.45)	(-0.46)	(-1.00)	(-0.67)
Interest	-11.97***	-8.608**	-11.81***	-10.98***
	(-4.21)	(-2.04)	(-4.46)	(-2.91)
Leverage	0.0191	0.0017	0.0087	0.0041
	(1.47)	(0.10)	(1.31)	(0.46)
Dividends	-16.95***	-24.55***	-8.345***	-14.44***
	(-5.97)	(-5.50)	(-3.26)	(-3.26)
Dividend payout ratio	0.641***	0.767***	0.420***	0.539***
	(6.22)	(6.36)	(3.84)	(4.20)
Long-term incentives	-1.021***	-1.466***	-1.135***	-1.436***
	(-9.62)	(-11.21)	(-12.02)	(-13.09)
Firm size	-0.0001***	-0.00004***	-0.0001***	-0.0001***
	(-12.43)	(-7.83)	(-12.66)	(-8.66)
Stock return	0.0235	0.252***	0.155**	0.262***
	(0.28)	(2.71)	(2.38)	(3.57)
Profitability	-1.168***	0.133	-1.246***	-0.151
	(-3.82)	(0.28)	(-3.85)	(-0.35)
Cash flow volatility	-	0.0039**	-	0.0031**
		(2.46)		(2.38)
2006	0.0088	0.0919	-0.0467	0.0146
	(0.10)	(0.69)	(-0.58)	(0.12)
2007	-0.140*	-0.0411	-0.125	-0.0944
	(-1.70)	(-0.36)	(-1.62)	(-0.91)
2008	-0.168**	0.0095	-0.0467	0.0731
	(-2.01)	(0.09)	(-0.55)	(0.64)
2009	-0.336***	-0.386***	-0.333***	-0.359***
	(-3.79)	(-3.29)	(-3.92)	(-3.35)
Industry dummies	yes	yes	yes	yes
Observations	3393	3393	3758	3538

The dependent variable in columns one and three (two and four) is the top management's cash ratio, CR (bonus ratio, BR). All estimates are based on QMLE estimation developed by Papke and Wooldridge (1996). The E-index is an index of managerial entrenchment developed by Bebchuk et al. (2009). The CEO pay slice is the fraction of top management cash compensation (column three) or bonus compensation (column four) captured by the CEO. The remaining explanatory variables are defined in Table 3.2. Monetary variables are adjusted for inflation. All regressions include year and industry dummies. z-values in parentheses are calculated as coefficient estimates over robust standard errors. Significance levels of 1, 5 and 10 percent are indicated by ***, ** and *, respectively.

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Erklärung

Ich versichere hiermit, dass ich die vorliegende Arbeit mit dem Thema:

Three Essays on Executive Compensation

ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Die aus anderen Quellen direkt oder indirekt übernommenen Daten und Konzepte sind unter Angabe der Quelle gekennzeichnet. Weitere Personen, insbesondere Promotionsberater, waren an der inhaltlich materiellen Erstellung dieser Arbeit nicht beteiligt.* Die Arbeit wurde bisher weder im In- noch im Ausland in gleicher oder ähnlicher Form einer anderen Prüfungsbehörde vorgelegt.

Konstanz, den 25.09.2013

(Moritz Heimes)

*Siehe hierzu die Abgrenzung auf der folgenden Seite.

Abgrenzung

Das erste Kapitel dieser Dissertation entstammt einer gemeinsamen Arbeit mit Steffen Seemann (Universität Konstanz). Die Idee zu diesem Projekt haben wir gemeinsam entwickelt. Zunächst haben wir Vergütungsdaten aus Geschäftsberichten gesammelt und eine Datenbank aufgebaut. Bei dieser vorbereitenden Tätigkeit haben wir zu gleichen Teilen mitgewirkt. Mein eigener Beitrag beim Aufbau eines geeigneten, empirischen Forschungsdesigns, bei der Regressionsanalyse auf Basis der gesammelten Daten, bei der Interpretation und Präsentation der Ergebnisse, und damit insgesamt an diesem Kapitel, beläuft sich auf 50%.

Auch das zweite Kapitel entstammt einem gemeinsamen Projekt mit Steffen Seemann (Universität Konstanz). Die Idee für eine vergleichende Studie deutscher und amerikanischer Vergütungsdaten haben wir gemeinsam entwickelt und daraus ein Forschungsprojekt strukturiert. An der Datenerhebung und -aufbereitung haben wir zu gleichen Teilen mitgewirkt. Auch die verschiedenen Regressionsansätze der Analyse haben wir gemeinsam diskutiert und umgesetzt. Mein eigener Anteil an der Interpretation und der Präsentation der Ergebnisse, und damit insgesamt an diesem Kapitel, beläuft sich ebenfalls auf 50%.

Das dritte Kapitel wurde von mir ohne Mitwirkung Dritter angefertigt.

Konstanz, den 25.09.2013

(Moritz Heimes)