

Summer 2012

Two Essays on Executive Pay and Firm Performance

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TWO ESSAYS ON EXECUTIVE PAY AND FIRM PERFORMANCE

by

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A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

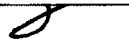
DOCTOR OF PHILOSOPHY

BUSINESS ADMINISTRATION
FINANCE

OLD DOMINION UNIVERSITY
June 2012

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ABSTRACT

TWO ESSAYS ON EXECUTIVE PAY AND FIRM PERFORMANCE

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Two essays of this dissertation study the relationship between executive compensation and firm performance. These essays analyze both compensation level and compensation structure, and focus not only on CEO compensation but also on Top Management Team (TMT) compensation as well as Chief Financial Officer (CFO) compensation. Methodologically, these essays use different regression techniques to explore the nature of time series over cross sections of executive compensation data in order to find a reliable relationship between executive compensation and firm performance.

The first essay investigates the TMT compensation - firm performance relationship and finds that the compensation dispersion among TMT members is positively and statistically associated with firm performance measured by Tobin's Q. This result strongly supports the tournament effect hypothesis and not the equity fairness hypothesis. The effect of TMT total compensation on firm performance is also positive and significant, even after controlling for CEO compensation. The second essay is one of the first studies investigating how CFO pay structure relates to firm performance and finds a positive and significant relationship between CFO stock options and firm performance. Even more, the impact of CFO pay structure is statistically stronger than the effect of CEO compensation structure.

I dedicate this work to my family for their love and sacrifices.

ACKNOWLEDGMENTS

I wish to thank my professors at Old Dominion University for all the knowledge they teach in classroom as well as the experience they share in academic life. My special thanks are to Dr. Mohammad Najand, my advisor, for his constant and valuable support and advice; my dissertation cannot succeed without his help. I am highly indebted to Dr. Kenneth Yung for his detailed comments on this dissertation and his support since my first year at Old Dominion University. Last, but not least, I wish to thank Dr. David Selover for his enthusiasm and energy in Econometrics classes, the knowledge I have learned from him is very important for my dissertation as well as for my future career.

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1. INTRODUCTION

Executive compensation overview

Executive compensation refers to the pay managers receive from the company in the form of salary, bonuses, stock options, among other components. Executive compensation is a crucial part of corporate governance, and it plays an important role in corporate finance. As a consequence, executive compensation receives increasing attention in both the academic and the practical world. Historically, before the 1980s the number of research studies in executive compensation is very limited, and since 1980s the number of studies in this field begins to increase exponentially (Murphy 1999).

While researchers have used multiple theories in the executive compensation literature, agency theory, introduced by Jensen and Meckling (1976), is the first and the most widely used. The agency theory proposes that executives try to maximize their gain from the firms; they work mainly for their own interests and benefits, and not for shareholders' wealth. Executive compensation represents a good opportunity to study this problem because executive compensation reflects most of the incentives of the executives.

In executive compensation literature, other theories are also employed such as industrial organizational economics theory: regulation and compensation (Hubbard and Palia 1995), strategic interaction (Aggarwal and Samwick 1999), sociology and organizational behavior: social comparisons and wage dispersion effects (Hambrick and Cannella 1993; O'Reilly, Main and Crystal 1988).

There is a large debate in the literature about the efficiency of executive pay, especially CEO pay. Various researchers claim that Chief Executive Officers (CEOs) receive excessive payment packages even when their firms do not perform well (Harris 2009), while others show that it is not the case as they find that CEO compensation is positively associated with firm performance (Edmans and Gabaix 2009). The debate has continued during and after the recent global financial crisis (Bebchuk, Cohen and Spamann 2010).

Level and composition of executive compensation

Murphy (1999) provides a comprehensive overview of executive compensation from the viewpoint of labor economists. Executive compensation, or executive pay, consists of a base salary, bonuses, stock options, and other components such as restricted stocks, long-term incentive plans, and retirement plans, among others. The executive compensation level refers to the total compensation that managers receive from the companies. The executive compensation structure, or pay composition, refers to the portion of base salary, bonus, and stock options in executive compensation level. Level and composition of executive compensation are objects of two main research streams in executive compensation and receive much attention in the literature.

In the first essay, I investigate the relationship between executive compensation level and firm performance, also known as the pay-for-performance relationship in the finance literature. While most studies in the pay-for-performance literature deal with CEO compensation, I focus my research on the compensation of Top Management Team

(TMT) and investigate whether and how the TMT compensation influences firm performance after controlling for CEO compensation.

In the second essay, I explore the relationship between the executive compensation structure and firm performance. While most current research focuses on CEO pay structure, my research pays more attention on the effect of the structure of Chief Financial Officer (CFO) compensation on firm performance. As the CFO is a powerful executive who is responsible for financial risk and directly makes the corporate financial decisions, I propose a significant relationship between CFO pay structure and firm performance, even after controlling for the influence of CEO pay structure.

TMT pay for performance

Most of the previous studies in executive compensation literature focus on CEO compensation (Edmans and Gabaix 2009; Firth, Fung and Rui 2006; Hubbard and Palia 1995; Murphy 1999). On the one hand, it is true that CEOs play a very important role in corporate decision, and it is worthwhile investigating the influence of CEOs on firm performance in order to find the optimal executive compensation policy for firms.

On the other hand, today no one individual can scan all aspects of the business and environment of the firm because of the complex nature of the decision-making process in business; no one can have sufficient knowledge and information in a very fast changing economy (Hambrick and Mason 1984). Hence, the role of top executives in the company as a team, or Top Management Team (TMT), is gaining increasing importance in the

success of the firms, and the number of research studies committed to investigate and understand this role is also increasing very quickly, especially in the management science research (Hambrick and Mason 1984).

TMT is much more widely studied in the management literature than in the finance literature. The TMT includes top executives of the firm such as the president, CEO, and CFO, among other senior managers. Management researchers focus their investigation mainly on the tendency of TMT demographic characteristics such as age, gender, tenure, experience, and background of TMT members and/or the dispersion of these demographic characteristics. Many of them find a significant association between firm performance and TMT demographic characteristics tendency/dispersion.

In the executive compensation research, the number of studies in TMT compensation is still limited, although there are several potential research directions in this topic. For example, similar to general TMT research in management, TMT compensation research may investigate the compensation of the team as a whole in terms of compensation level, and compensation structure and explore how this TMT compensation affects firm activities and decisions.

TMT compensation research may also investigate the compensation dispersion among the members of TMT and its influences on firm characteristics on making decisions. In terms of the effect of compensation dispersion on firm performance, there are two opposite hypotheses in the literature: the tournament hypothesis and the equity fairness hypothesis.

The tournament hypothesis proposes that an increase in compensation dispersion motivates the competition among executives and thus increases firm performance (Kale, Reis and Venkateswaran 2009; Lee, Lev and Yeo 2008). The equity fairness hypothesis proposes the opposite: the lower the compensation dispersion among executives the better they work for the firm and then the higher performance the firm achieves (Akerlof and Yellen 1988; Drago and Garvey 1998; Milgrom 1988).

The first essay of my dissertation studies how the TMT compensation is associated with firm performance considering both compensation level and compensation dispersion simultaneously. The results will provide empirical evidence to support the tournament hypothesis or the equity fairness hypothesis. Another important feature of this research when studying the effect of TMT total compensation is the use of CEO compensation as a control variable to make sure that TMT compensation impact is actual and sound.

CFO compensation structure and firm performance

While the first essay investigates the effect of executive compensation level on firm performance, the second essay will focus on the impact of executive compensation structure. These two essays are complementary and together they provide a more complete view about the effect on firm performance of executive compensation in terms of both compensation level and compensation structure.

The CEO is the highest-level officer in charge of the total management of the corporation. The CEO's responsibilities vary across firms and industries. His/her core

duty is generally to facilitate the corporate development to achieve the corporate central objective. It is natural that the CEO has influence on financial decisions as they are very important for corporate development, and most researchers in the literature explore the relationship between CEO compensation structure and firm performance (Murphy 1999).

In practice, the CFO is the officer responsible mainly for managing corporate financial decisions such as corporate financial planning, financial investments, financial risk management, and financial reporting. Although CFOs directly manage corporate financial decisions, the literature studying the influence of CFOs on corporate financial decisions is still very limited (Burns and Kedia 2008; Chava and Purnanandam 2010; Fuller and Jensen 2002; Jiang, Petroni and Yanyan 2010). In particular, the number of research works on CFO compensation structure is much more limited than the number of CEO compensation studies.

On the policy making side, the Securities and Exchange Commission (SEC) did recognize the increasingly important role of the CFO in corporate finance. In the 2002 Sarbanes - Oxley Act, the SEC requires that both the CEO and CFO take ownership for their financial statements, meaning that both the CEO and CFO are responsible for the accuracy of the financial statements of their firms. Regarding the executive compensation issue, the SEC also requires new disclosures on CFO compensation since 2006, and the CFO compensation data has been available in the ExecuComp database since 2006.

2. TMT PAY FOR PERFORMANCE

2.1 Literature review

CEO compensation and firm performance

Before the 1980s, the number of research works in executive compensation is very limited (Ciscel and Carroll 1980; Lewellen and Huntsman 1970; Roberts 1956). Researchers focus mostly on study cases and the studies are limited in terms of both data availability and theoretical background. From the years of the 1980s, with the development of agency theory (Jensen and Meckling 1976), executive compensation begins to receive an increasing interest in finance literature, and as a consequence, the number of studies in this field increases exponentially (Coughlan and Schmidt 1985; Jensen and Murphy 1990; Leonard 1990; Murphy 1985), and most of these research papers focus on CEO compensation only.

Murphy (1999) provides a comprehensive review of executive compensation from the point of view of labor economics. He summarizes the executive compensation research both theoretically and empirically, analyzes both level and structure of CEO compensation and their association with firm performance, and points out some differences in compensation among countries and regions over the world. Murphy investigates the relationship between CEO pay and performance in the sense how firm performance and its measure influence CEO pay. Murphy also summarizes the concept of pay-performance sensitivity, which is measured by the coefficient of performance in the

regression of CEO pay on firm performance as the main independent variables and other control variables. Murphy finds that the total pay-performance sensitivities depend on firm size and vary from industry to industry, and these sensitivities are driven mainly by stock options incentives.

On an international scale, researchers also study characteristics of executive compensation in many other countries over the world such as the UK (Canyon 1997; Cosh and Hughes 1997), Japan (Kato 1997; Kato and Rockel 1992), Germany (Kaplan 1994), Canada (Zhou 2000), and recently China (Firth, Fung and Rui 2006; Groves, Yongmiao, McMillan and Naughton 1995).

Canyon (1997) investigates the effect of corporate governance innovations on executive pay of large companies in the UK. He finds that executive pay is positively associated with current shareholders' wealth but not the wealth of predated shareholders, and governance variables do play a role in executive pay. Other researchers (Cosh and Hughes 1997) find a positive association between executive compensation and shareholder wealth as well as firm size.

Regarding executive compensation study in Japan, researchers find that the CEOs of keiretsu, a typical grouping of enterprises in Japan, earn less than the CEOs of independent companies (Kato 1997). In this research, they also provide the empirical evidence that the monitoring role of the banks as institutional stakeholders becomes more important in the practices of corporate governance in Japan.

Executive pay in China may display an interesting example of an important emerging country in the literature. Some researchers (Groves, Yongmiao, McMillan and Naughton 1995) study the managerial labor market in China during the reform process in the years of the 1990s and find that Chinese managerial labor market incorporates many incentives suggested by competitive labor markets in developed countries. Managerial compensation is strongly linked to firm performance in terms of profitability, but this link is somewhat weaker in terms of sales.

More recently, other researchers (Firth, Fung and Rui 2006) investigate the relationship between corporate performance and CEO compensation in China and show that Chinese firms listed in stock exchanges normally have controlling shareholders, and different kinds of controlling shareholders have different impact on executive pay. Specifically, firms with State agency as the controlling shareholder do not use performance-based pay while firms with private block holders as major shareholders focus on firm performance when setting executive compensation.

One of the difficulties of doing comparative research in executive compensation is the issue of data availability. The data from developing countries is very limited and unreliable. Technically, data from different countries have very different format and it is difficult to integrate them in an executive compensation study. This technical problem exists among all countries, but is more notable in the developing world.

Overall, there are notable differences in the practices of executive compensation across countries over time, as well as across firms and industries (Murphy 1999). It makes international research in executive compensation more difficult.

Top Management Team theory

Hambrick and Mason (1984) are two of the first authors in management science investigating the “upper echelons” theory that refers to an organization as a reflection of its top managers. In the essence of the upper echelon theory, they propose that the strategic choices and performance of the organization can be predicted partially by the background and characteristics of their management team.

Following the “upper echelons” theory, researchers in the management field investigate the impact of TMT demographic characteristics on firm performance (Auden, Shackman and Onken 2006; Hambrick and D'Aveni 1992). Most of these TMT studies focus on the tendency and/or dispersion of these demographic characteristics of TMT members, and they do generally find some significant relationships between TMT demographic characteristics and firm performance.

Hambrick and D'Aveni (1992) investigate the relationship between TMT characteristics and firm failure in large bankruptcies and find that TMT weakness, through strategic mistakes and stakeholder uneasiness with TMT, causes firm deterioration; and that corporate deterioration brings TMT deterioration through different means. Auden and colleagues (Auden, Shackman and Onken 2006) provide empirical support for the

proposition that TMT is a suitable unit of analysis regarding its effect on firm performance.

On the one hand, the relation between TMT tendency and firm performance is somewhat consistent in the management literature. Most studies in management literature find that the tendency of demographic characteristics such as age, background, skill, and tenure of TMT members does statistically significantly influence firm performance (Auden, Shackman and Onken 2006; Carmeli and Tishler 2006; Koufopoulos, Zoumbos, Argyropoulou and Motwani 2008).

On the other hand, the association between TMT heterogeneity and firm performance is mixed (Cannella Jr, Park and Lee 2008). Cannella and colleagues (Cannella Jr, Park and Lee 2008) find the positive relationship between TMT functional diversity and firm performance. Some studies find a positive association (Eisenhardt and Schoonhoven 1990; Norburn and Birley 1988); other studies find no significant association between TMT heterogeneity and firm performance (West and Schwenk 1996); some others even find a negative relationship between them (Simons, Pelled and Smith 1999; Wei, Lau, Young and Wang 2005).

The literature also shows a positive three-way interaction between customer orientation, TMT functional diversity, and TMT experience diversity on organizational performance. Researchers (Wei, Lau, Young and Wang 2005) demonstrate a negative relationship between TMT education heterogeneity and experience heterogeneity with firm

performance. Others (Olson, Parayitam and Twigg 2006) find a negative relationship of age diversity and positive relationship of functional heterogeneity with strategic choice, they also find support for the upper echelons theory.

TMT compensation and firm performance

The literature on the relationship between TMT compensation and firm performance is still very limited. The study of Carpenter and Sanders (2002) is one of these few research papers studying the effect of TMT compensation level on firm performance. They find a positive relation between CEO pay and TMT pay. TMT compensation does predict firm performance when aligned with shareholder interest and internal contingencies, and the impact of CEO pay on firm performance depends on TMT pay. In other words, they do not study the direct association between TMT compensation and firm performance but propose TMT compensation as a missing link between CEO compensation and the performance of the company.

Regarding the effect of TMT compensation dispersion on firm performance, there are two different theories in the literature: the tournament effect and the equity fairness effect. The tournament effect hypothesis proposes that the wider the pay difference among TMT members, the stronger the competition incentive among these members in order to be promoted is, and the higher the performance the firm achieves (Kale, Reis and Venkateswaran 2009; Lee, Lev and Yeo 2008). Specifically, the tournament incentives, measured by the distance or dispersion of compensation figures between the CEO and

other executives, are positively associated with firm performance. Moreover researchers find that the association is stronger when a CEO is near his/her retirement and weaker when a new CEO is just appointed, this association is even weaker when the new CEO is outside (Kale, Reis and Venkateswaran 2009).

Similarly, Lee and colleagues (Lee, Lev and Yeo 2008) find empirical support for the tournament hypothesis. In this research, the authors also document that the positive relationship between TMT pay dispersion and firm performance is stronger for firms with high agency costs, and effective governance practices such as board independence increases this important relationship.

On the other hand, the equity fairness hypothesis proposes the opposite: Companies can achieve better performance by minimizing the pay dispersion among TMT members (Akerlof and Yellen 1988; Milgrom 1988). Some researchers provide empirical evidence that supports this argument. For example, Drago and Garvey (1998) investigate a sample of Australian companies and find the evidence supporting that the fairness in pay does have a positive effect on firm performance. Pfeffer and Langton (1993) also investigate the effect of pay dispersion among academic faculties and find that this compensation dispersion negatively affect faculty performance in terms of research satisfaction, and suggest that the dispersion in compensation produces an adverse impact on performance in higher education.

Carpenter and Sander (2004), in other research, study the effects of TMT compensation and firm internationalization on multinational corporation performance and find positive effects of non-CEO pay on future performance of the firms, but negative effects of the gap between CEO compensation and TMT compensation on multinational corporate performance. This finding is somewhat different than what they find earlier (Carpenter and Sanders 2002), and shows a clear signal that the debate between tournament hypothesis and equity fairness hypothesis may continue.

Gaps in the literature

The first notable gap of the current literature is that most research papers focus mainly on CEO compensation. Among those few articles investigating TMT compensation, the researchers focus only on one aspect of executive compensation such as total compensation or compensation dispersion of top executive members. They do not investigate the effect of both aspects concurrently.

Another limitation of the current literature is that most researchers do not control for the effect of CEO compensation on firm performance. Without controlling for the CEO effect, we cannot confirm the existence of the association between TMT compensation and firm performance. The association between TMT compensation and firm performance, if found in the analysis, may be a consequence of the actual relationship between CEO compensation and firm performance as firms may tend to pay CEO and TMT members proportionally. This essay covers these gaps of the literature by exploring

the relationship between firm performance and executive compensation of TMT in terms of both terms of compensation level and structure, and provides further empirical evidence for the debate between two opposite theories: the tournament hypothesis and the equity fairness hypothesis.

Research question and hypotheses

Covering these gaps of the literature, the first essay investigates the main research question of whether and how TMT compensation relates to firm performance. Again, I will also study whether the relationship between TMT compensation and firm performance is still significant after controlling for the impact of CEO compensation.

Analyzing the main question, this essay hypothesizes that TMT compensation in terms of total pay and pay dispersion is associated significantly with firm performance, and that this association is still statistically significant when we include CEO compensation in the model. If the empirical evidence supports this hypothesis, we can suggest that TMT compensation is an important factor in the study of executive pay-performance relationship. By answering the main research question, this essay also provides empirical evidence for the debate between two opposite hypotheses: the tournament effect hypothesis or the equity fairness hypothesis.

2.2 Data and methodology

Data

I collect executive compensation data from the Standard and Poor's ExecuComp database. This database provides comprehensive executive compensation data for 1500 S&P firms each year from 1992 to 2010, including S&P 500, S&P Midcap and S&P Smallcap index firms. This list changes from year to year allowing some companies to exit from the S&P classified list of firms and other companies to enter the list. This essay requires the availability of compensation data for at least three executives in the firm's TMT and compensation data of the CEO for each firm-year observation.

For each firm-year research unit in my sample, I collect the compensation data for all executives in the database such as the president, CEO, vice president, and CFO, among others. In general, Standard and Poor's ExecuComp includes the data for five top executives of the companies every year. Together with the compensation data, the ExecuComp database also provides basic accrual and financial data at firm level, including sales, assets, dividend payment, return on equity, and return on assets...

Table 1 summarizes the description of the ExecuComp database and its main data used in both essays of this dissertation.

[Insert table 1 here]

Variables

Dependent variable:

Firm performance is the main dependent variable of the analysis. While many previous studies use Return on Assets as a measure of firm performance, this measure also receives many critics in the literature. Some possible disadvantages are that total assets and return on assets are based on historical cost, while firm performance should be based on current dollars; Also, firm performance focuses on operating assets while returns on assets are based on not only operating assets but also on total assets (Barber and Lyon 1996). Following Kale (Kale, Reis and Venkateswaran 2009) and other researchers, I use Tobin's Q as the measure of firm performance in the main analysis. Firms with high Tobin's Q ratio tend to have attractive investment opportunities and competitive advantage. I estimate Tobin's Q as the market value of equity plus book value of debt divided by book value of total assets. I also use Earnings per Share (EPS) as a measure of firm performance for robustness check purpose.

Independent variables:

I calculate independent variables related to TMT compensation from annual compensations of all executives on the ExecuComp database for a firm in a specific year. I collect Total Compensation data item (TDC2) as executive compensation of a senior manager in a specific year, which is the summation of salary, bonus, value of options exercised, restricted stock grants, and other items. Some studies in the literature select the

compensations of only three or four executives from the database (Carpenter and Sanders 2002). This approach may lose some valuable data and does not reflect the complete information of TMT compensation.

In this essay, I compute TMT total pay as the logarithm of the summation of all individual executive compensations of a firm in a specific year. TMT mean pay is the logarithm of the compensation mean of all individual executives. We can observe that CEO compensation data also contributes in this calculation of TMT pay variables. TMT pay dispersion is the ratio of the compensation standard deviation divided by the compensation mean of all TMT members of a firm in a year. I require that the number of TMT members of a firm in a specific year should be at least three so that the TMT pay dispersion is meaningful in our analysis.

Figure 1 plots CEO pay, TMT total pay and TMT mean pay over the 1992-2010 period and over all 2-digit SIC industries. Overall, we can observe that CEO pay, TMT total pay, and TMT mean pay are highly and positively correlated. The executive compensation tends to increase over time while this compensation differs from industry to industry. Thus, I will have to deal with the potential problem of multicollinearity carefully in the next sections.

[Insert figure 1 here]

Control variables:

CEO compensation is the most important control variable. Many of previous studies ignore this control variable when investigating the effect of TMT compensation on firm performance. As a result, we cannot confirm the actual existence of the relationship between TMT compensation and firm performance. I select CEO compensation from the ExecuComp database by computing the logarithm of annual compensation data of an executive of each firm with the Annual CEO Flag.

Firm specific control variables such as firm size, leverage, book to market ratio, free cash flows, sales growth are also collected from ExecuComp database. Specifically, firm size is the logarithm of the firm total assets. Leverage is the ratio of equity book value divided by equity market value. The book to market ratio is the ratio of common equity divided by market value. Free cash flow is the operating income before depreciation divided by total assets. Finally, sales growth is the sales percent change in one year. This use of logarithm and standardized variables reduces the potential problem of nonstationarity.

I also winsorize the data to reduce the effect of possible spurious outliers by excluding observations with the values of variables such as Tobin's Q, firm size, leverage, free cash flows, sales growth, and book to market at the 1 percentile of the sample data.

For illustration purpose, I plot the Tobin's Q and Book to Market before the winsorizing process in Figure 2:

[Insert figure 2 here]

Similarly, in Figure 3, I plot the Tobin's Q and Book to Market ratio before winsorizing process:

[Insert figure 3 here]

Figure 2 and Figure 3 show the effectiveness of this winsorizing process for Tobin's Q and book to market. We can observe notable outliers of Tobin's Q in panel A and outliers of Book to Market in panel B. After winsorizing these variables, they are much smoother as in figure 2. In the case of BTM variable, I also require that it take a positive value.

Industry performance, the only industry specific control variable in this essay, is the performance mean of all firms in the same industry, classified by the two-digit SIC code of the firms, in a specific year. All this data also comes from Standard and Poor's ExecuComp database.

Table 2 provides details about definitions and computations of dependent variable, independent variables as well as control variables.

[Insert table 2 here]

Descriptive statistics

Summary statistics

I merge compensation related variables and finance based variables into a data sample for regression analysis. This sample includes 26,951 firm-year observations of 3,075 firms in 66 industries over the period from 1992 to 2010.

Table 3 shows the summary statistics of all variables used in this essay: Firm performance measured by Tobin's Q, TMT pay dispersion, TMT total pay, TMT mean pay, CEO pay, firm size, leverage, book to market ratio, free cash flows, sales growth, and industry's average performance.

[Insert table 3 here]

We observe no irregularity in the summary statistics of all dependent, independent, and control variables used in this essay in terms of values such as number of observation, mean, standard deviation, summation, minimum, and maximum. These results are due to the process of winsorizing and transformation of variables,

Correlation coefficients

Table 4 displays the Pearson correlation coefficients among dependent, independent, and control variables.

[Insert table 4 here]

From this correlation coefficients' table we can observe that variable TMT total pay and variable TMT mean pay are very highly correlated with a coefficient of about 98 percent. It is a strong signal of a multicollinearity problem among studied dependent variables. I need to fix it by excluding the TMT mean pay variable and keeping the TMT total pay variable as one of the independent variables in this essay.

Research methodology

To investigate the relationship between executive compensation and firm performance, many studies use the concept of “pay-performance sensitivity”, this sensitivity is used to investigate how firm performance influences the compensations of the firm's executives (Murphy 1999). They run a regression of executive pay on firm performance and pay-performance sensitivity is the coefficient of independent variable firm performance. The simplest form of this type of regressions is

$$\textit{Executive Compensation} = \beta_0 + \beta_1 \textit{Firm Performance}$$

The literature also uses first different variables in the regressions:

$$\Delta (\textit{Executive Compensation}) = \beta_0 + \beta_1 \Delta (\textit{Firm Performance})$$

In this essay, I use a slightly different approach. As the final goal of the firm is to maximize the firm value and performance, I investigate how the executive pay influences

the firm's performance. Executive compensation is effective if it is positively associated with firm performance. In other words, the higher compensation the executives receive, the higher the firm performance is.

I first run the regression of firm performance on all independent variables such as TMT pay dispersion, TMT pay dispersion and CEO, controlling for all firm specific and industry specific variables:

$$\text{Firm performance} = \beta_0 + \beta_1 \text{TMT pay dispersion} + \beta_2 \text{TMT total pay} + \beta_3 \text{CEO pay} + \sum \beta_i \text{Firm and Industry control variables (1)}$$

Model (1) is the main model in this essay. In this model, we can analyze the effects of TMT total pay and TMT pay dispersion concurrently; we will find whether the effect of TMT compensation on firm performance is significant with the appearance of CEO compensation in the equation. A positive and statistically significant coefficient β_1 in this equation supports the tournament effect, while a negative coefficient provides empirical support for the equity fairness hypothesis. In Model (1), if β_2 is positive and significant then overall executive compensation is effective in the sense that firm performance is positively related to the compensation all executives receive.

In the next model, I exclude CEO compensation from my equation to investigate the effect of TMT pay dispersion and TMT total pay alone on firm performance:

$$\text{Firm performance} = \beta_0 + \beta_1 \text{TMT pay dispersion} + \beta_2 \text{TMT total pay} + \sum \beta_i \text{Firm and Industry control variables (2)}$$

Model (2) is also a simple way to deal with the potential multicollinearity issue. If multicollinearity is not a serious problem, the estimates of remaining variables should be stable in terms of sign and significance of the coefficients in comparison to Model (1).

In the last two models, I study the effect of TMT pay dispersion and TMT total pay on firm performance separately, also controlling for all firm and industry specific variables:

$$\text{Firm performance} = \beta_0 + \beta_1 \text{TMT pay dispersion} + \sum \beta_i \text{Firm and Industry control variables (3)}$$

$$\text{Firm performance} = \beta_0 + \beta_2 \text{TMT total pay} + \sum \beta_i \text{Firm and Industry control variables (4)}$$

Model (3) provides further empirical evidence for the debate between the tournament hypothesis and the equity fairness hypothesis. Similar to Model (1), a positive and significant β_1 supports the tournament effect; otherwise, it provides no empirical support for this tournament hypothesis. A positive and significant β_2 in Model (4) shows an overall effective executive compensation policy in the sense that firm performance relates positively to the compensation all executives receive.

2.3 Empirical results

Table 5 shows the empirical results of Model (1), Model (2), Model (3) and Model (4) of firm performance on executive compensation level:

[Insert table 5 here]

Model (1) includes total compensation and compensation dispersion of TMT as well as all control variables for CEO compensation effect, firm specific effect and industry specific effect. The result of this model shows a positive and significant coefficient of the dispersion of TMT compensation. This provides strong empirical support for the tournament effect hypothesis. TMT total compensation also displays a positive and significant relationship to firm performance, showing the effectiveness of the total compensation for TMT on firm performance. Interestingly, the relationship between control variable CEO pay and firm performance is statistically significant, but negative; meaning that CEO compensation is not effective as expected in the sense that an increase in CEO compensation possibly does not lead to a increase in firm performance.

In Model (2), when excluding the effect of CEO compensation, I also find relationships between TMT compensation in terms of pay dispersion and total pay and firm performance very similar to those results found in Model (1). Specifically, the association between TMT pay dispersion and firm performance as well as the relationship between TMT total pay and firm performance are positive and significant.

I also find similar results from Model (3) and Model (4). Model (3) shows a positive and statistically significant association between TMT pay dispersion and firm performance. It supports the tournament hypothesis. Model (4) also displays a positive and statistically significant relationship between TMT total pay and firm performance. This result shows that TMT total pay may statistically affect firm performance, and then we should consider this effect of TMT compensation when studying the general executive compensation - firm performance relationship. We can also say that the compensation the firms pay for TMT as a whole team is effective in the sense that an increase in TMT total payment may lead to an increase in firm performance.

Overall, the empirical results show that TMT compensation does influence firm performance. Especially, the impacts of both TMT compensation dispersion as well as TMT total compensation on firm performance are positive and statistically significant. It strongly supports the tournament effect hypothesis and suggests further emphasis on TMT compensation research. As the results of Model (2), Model (3) and Model (4) are consistent with the results of Model (1) we find that although the correlation coefficient between CEO pay and TMT total pay is high, the problem of multicollinearity should not be serious in this data sample.

2.4 Robustness check

For robustness check purpose, I will use a different measure of firm performance as well as check for potential econometric issues such as multicollinearity and endogeneity of our

data sample. I also use different estimation techniques to investigate the relationship between firm performance and executive compensation. The results are in Table 6.

[Insert table 6 here]

Performance measure

To investigate how sensitive the relationship between TMT compensation and firm performance is to the measure of firm performance, I use earnings per share (EPS) as an alternative measure. I do not choose return on assets (ROA) or return on equity (ROE) for robustness test because of the reasons mentioned when selecting Tobin's Q as the main performance measure (Barber and Lyon 1996). In Panel A, with a positive and significant coefficient of TMT pay dispersion, we still have empirical evidence supporting the tournament effect hypothesis. Even though, the effect of CEO pay is no longer significant and that of TMT total compensation is negative. It suggests that the studied relationship is maybe sensitive to the measure of firm performance.

Statistical issues

Test for multicollinearity

I run Model (1) with the options for multicollinearity diagnostics. The result is in Panel B. According to Belsley, Kuh and Welsch (1980), when the largest condition index is larger than 100, the coefficient estimates might have a "fair amount" of numerical error

due to multicollinearity. In our sample, the maximum conditional index is approximately 64, which is much lower than 100, thus I can conclude that multicollinearity does not cause serious problem with this study.

Endogeneity issue

In the first essay, we have a potential problem of endogeneity because executive compensation may be determined on the basis of firm performance, and a good compensation policy motivates executives to work better in order to increase firm value. I employ Two-Stage Least Squares (2SLS) estimation to deal with this potential endogeneity problem. In the first stage, I run the regressions of main independent variables, which are CEO compensation, TMT total pay, and TMT pay dispersion, on firm and industry specific control variables and compute their predicted values. In the second step, I run the regression of firm performance on predicted values of independent variables previously computed. The result in Panel C shows that the relationship between firm performance and TMT compensation, adjusted for endogeneity effect, is statistically significant. Importantly, the tournament effect hypothesis is strongly supported. We should notice also that the signs of TMT total compensation and CEO compensation effects change, meaning that these effect may be sensitive to performance measure.

Generalized linear model

I also use a generalized linear model with maximum likelihood estimation to run the regression of firm performance on TMT compensation to overcome some limitations of

the OLS model, and the results in Panel D are consistent with those of Model (1). Specifically, the association between firm performance and TMT compensation in terms of pay dispersion and total pay is positive and statistically significant.

Panel regressions

As do most of the articles in the literature, I use ordinary least squares (OLS) regressions for the main analysis. On the one hand, this technique is simple, easy to interpret, and does not lose any observations in the analysis. On the other hand, OLS regressions ignore the panel nature of the compensation data: the combination of a cross section of firms and times series over the period from 1992 to 2010. For this reason, it is important to use panel regression to study the relationship between executive compensation and firm performance.

We can categorize panel models according to the structure of error terms such as one-way or two-way models, fixed-effect and random effect models, autoregressive models, or moving-average models. For robustness check purposes, in this essay I use five panel models: one-way fixed-effect, one-way time fixed-effect, two-way fixed effect, one-way random-effect, and two-way random-effect. I construct the balanced panel data requiring that the firms have compensation and financial data for all years from 1992 to 2010. The final data sample includes 2,299 firm-year observations from 121 firms in 37 industries over the period 1992 to 2010. As we can see, we lose a good number of observations in our panel data, and it is a disadvantage of panel data models.

Panel E presents the results of these panel models: These results are consistent and they are identical to the results of the OLS models. In all panel regressions, firm performance is positively and significantly associated with TMT compensation dispersion and TMT total pay. Firm performance is negatively and significantly related to CEO compensation. The results show that it is important to investigate the effect of TMT compensation beyond the CEO pay effect, and provide very strong empirical evidence for the tournament effect hypothesis.

2.5 Summary

This essay investigates the effect of TMT compensation on firm performance analyzing both the summation and dispersion of TMT compensation and controlling for the effects of CEO compensation, firm specific characteristics, and industry specific characteristics. The research provides some interesting empirical results. On the one hand, TMT compensation positively and significantly influences firm performance, even after controlling for the effect of CEO pay. Specifically, this positive, significant and large impact of TMT pay dispersion on firm performance strongly supports the tournament effect hypothesis. This effect and the significant and positive relationship between TMT total pay and firm performance suggest that we should explore further the effect of TMT compensation on financial decisions, although this relationship may be sensitive to performance measure. On the other hand, the effect of CEO pay on firm performance is negative in several specifications. This may suggest the ineffectiveness of CEO pay in firm performance.

In short, this essay suggests that executive compensation research should focus not only on CEO compensation but also on the compensation of all executives as a team, and, consistent with the upper echelon perspective, TMT compensation does play an important role in firm performance.

3. CFO PAY STRUCTURE AND FIRM PERFORMANCE

3.1 Literature review

Executive pay structure

In the first paper we find that the level of executive compensation in terms of TMT compensation and CEO compensation is significantly associated with firm performance. While TMT total compensation and pay dispersions are positively related to firm performance, the relationship between CEO compensation and firm performance is not positive as expected. In this second essay I will investigate the impact of executive pay structure on firm performance, focusing on the impact of CFO pay structure.

Murphy (1999) provides a description of executive compensation structure. The main components of executive pay are base salary, annual bonus plan, and stock options. Other pay components are restricted stocks, long-term incentive plan, health care plan, retirement plan, and so on. Typically, the formal employment will specify a minimum base salary, target bonus payment, terms of stock options and other salary plans.

According this study (Murphy 1999), the base salary is set mainly based on industry benchmarking. The base salaries for CEOs of similar firms in terms of size within the same industry tend to be similar to each other. Although base salaries comprise a decreasing portion of total compensation, executives do pay a lot of attention to these base salaries because they are the key component of the executive employment contract.

Murphy finds that the base salary is significantly associated with firm size, and that, during the 1990s, stock options replace base salaries as the highest portion of total compensation. As the base salary is a fixed component in the compensation, a higher base salary would lead to higher values of other components as most of these components may be measured as a percent of base salary.

CEO and other executives of the firms receive annual bonus plans based on firm performance in a given year, for this reason the bonus is the first component of executive compensation with the incentives to increase firm performance. Annual bonus plans can be characterized by performance measures, performance standards, and the relationship between performance and pay. Typically, the firms pay no bonus until an achievement of threshold performance, pay a minimum bonus at the threshold performance, and bonus payments have a cap or upper limit. Although annual bonus plans provide incentives to increase stockholders' wealth in terms of firm profitability as executives will only receive bonus payments if the firm achieves some threshold limits in performance, bonus plans also create incentive effects of firm performance measures in terms of manipulation of accounting profits, incentive effects of performance standards, and incentive effects of pay-performance structure (Murphy 1999).

Stock options give the executives the right to buy stocks at a predetermined price for a pre-specified time, sometimes stock options are referred as equity-based compensation. The incentives of executives here is to buy stocks at low prices and then increase stock prices. This increase in stock prices also increases the wealth of stockholders. Executive

stock options are non-tradable and voided if executives leave the company before the time specified in the employment contract. In practice, most options expire in ten years and are granted at fair market prices. There is a notable trend in executive compensation that stock options explode and contribute the single biggest portion of executive pay (Murphy 1999).

Several studies have investigated the relationship between executive compensation structure and firm performance. Mehran (1995) analyzes compensation structure and firm performance together with firm ownership and states that pay structure, especially equity-based compensation, rather than pay level, motivates managers to increase firm value. He also finds the important impact of ownership in the relationship between executive compensation and firm performance.

Rayton (2003) investigates the relation between firm performance and compensation structure of average employees in terms of performance elasticity and suggests a link between average employee compensation structure and performance in US manufacturing industries. This link is stronger for high performance firms and indistinguishable from zero for low performance.

Blackwell, Dudney and Farrell (2007) analyze the changes in CEO compensation structure and its influence on firm performance after CEO turnover. They find that the incoming CEOs do change their compensation structure in comparison to that of outgoing CEOs with more stock options and new stock grants. They also document a significant

association between CEO pay structure change in terms of new stock grants and firm performance after CEO turnover.

The literature of CFO compensation is much more limited in comparison to that of CEO compensation. Among these few researchers, some find an increasing association between CFO compensation and the organizational performance of hospitals in the US (Early and Cleverly 1995), others find a mixed association between CFO compensation and firm performance in banking industry (Bisson 2009). Bisson also concludes that there is a little connection between executive compensation structure and firm performance.

CEO versus CFO in corporate finance

In other fields of corporate finance, some researchers explore the role of CFO and compare it with the role of CEO in financial decisions of the firms. Some researchers (Jiang, Petroni and Yanyan 2010) investigate the influences of CEOs and CFOs on earnings manipulation. They document that, although both CEOs and CFOs influence accruals management, the impact of CFOs is stronger because CFOs are mainly responsible for financial reporting. They find that the probability and magnitude of beating analyst forecasts are more sensitive to the equity incentives of CFO than those of CEO, this finding provides support for SEC requirement of CFO disclosures in 2006.

In another article (Feng, Ge, Luo and Shevlin 2011), Feng and colleagues try to explain the reasons why CFOs are involved in material accounting manipulations. They find that CFOs of manipulation firms and CFOs of non-manipulation firms have similar equity

incentives, while CEOs of manipulating firms have more power than CEOs of non-manipulating counterparts. They propose that CFOs become involved in accounting management not because of their own immediate financial benefits but because of the pressure from their CEOs.

Other researchers (Chava and Purnanandam 2010) also analyze the difference between CEOs and CFOs in terms of incentives and corporate policies. They investigate risk-taking incentives on corporate financial policies and find that both CEO incentives and CFO incentives have a significant impact on the financial policies of the firms. They also find a causal link between executive compensation incentives and corporate policies, and suggest that both CEO and CFO incentives are important in designing optimal compensation for the firms.

The literature investigates possible links between executive compensation and the current financial crisis. Bebchuk, Cohen and Spamann (2010) provide a case study about the executive compensation issues of failed firms such as Bear Stearns and Lehman Brothers. They find that the top executive managers of these firms received very large performance-based compensation during the period 2000-2008, just before the financial crisis, and that some pay arrangements provide executives with excessive risk-taking incentives, which possibly help to cause the financial crisis in 2007-2008.

Gaps in the literature

Although CFOs are playing an increasingly important role in corporate finance, most research papers studying the impact of executive compensation on firm performance focus only on the CEO compensation structure, and the number of studies of CFO pay structure on firm performance is very limited. This essay will cover this gap by analyzing the effect of the CFO compensation structure on firm performance, and contribute to the literature by providing empirical evidence for the importance of CFO compensation on corporate finance decisions.

Research question and hypotheses

This second essay investigates how CFO compensation structure relates to firm performance, and whether this impact, if any, is significant after controlling for the impact of CEO pay structure. Investigating the main question about the association between CFO compensation structure and firm performance, this essay hypothesizes that CFO compensation structure in terms of bonus and stock options does significantly relate to firm performance, and that this relationship is still significant even after controlling for the effect of CEO compensation structure.

This hypothesis, is supported, suggests that CFOs play an increasingly important role in corporate financial decision-making; as a consequence, those responsible for executive compensation structure policy should not only focus on the CEO pay structure but also pay more attention to the effect of the CFO pay structure on firm performance.

3.2 Data and methodology

Data

I collect the executive compensation data from Standard and Poor's ExecuComp database, which includes more than 1500 S&P firms each year from 1992 to 2010, including S&P 500, Midcap and Smallcap index firms. This list of companies changes from year to year because companies leave the S&P classified list of firms and other companies enter the list according to the selection criteria from Standard and Poor's company.

While the compensation data of executives and particularly that of CEOs are available in general for long periods from 1992 to the present, the data for CFO compensation has been available only since 2006 as required by SEC. For each firm-year unit in my sample I collect the data of both CEO compensation and CFO compensation and then merge them into a dataset for further analysis.

Similar to the first essay, the second essay also uses basic accrual and financial data such as total assets, common equity, total debt, market value, free cash flows, sales growth, and so forth from Standard and Poor's ExecuComp database.

Variables

The dependent variable:

I use Tobin's Q as the measure of firm performance for the main analysis.

Independent variables:

The main independent variables are CFO pay structure variables measured by CFO bonus portion and CFO stock options portion. As their names indicate, the CFO bonus portion is the percentage of bonus on CFO total compensation and the percentage of stock options on CFO total compensation respectively.

I plot the CFO pay and CEO pay over years and over industries in Figure 4 as well as the CFO options and CEO option in Figure 5:

[Insert figure 4 here]

[Insert figure 5 here]

Figure 4 shows the relationship between CFO pay and CEO pay, and we can observe a close relationship between these compensations over years as well as over industries. More importantly, Figure 5 presents a positive correlation between CFO pay structure and CEO pay structure in terms of options. It is a signal of collinearity and I will deal with this issue in more detail in the methodology and robustness check sections.

Control variables:

In this essay, I use variables related to CEO compensation structure such as CEO bonus portion and CEO stock options portion to control for the effects of CEO pay on firm performance, which are more widely investigated in the literature and found related to firm performance.

Similar to the first essay, the second essay also uses firm specific control variables such as firm size, leverage, book to market ratio, free cash flows, and sales growth. Some variables are measured in logarithm and others are standardized to reduce the potential problem of nonstationarity. I also apply the process of winsorizing for many financial data variables to reduce the effect of possible spurious outliers by excluding observations with the values of variables such as Tobin's Q, firm size, leverage, free cash flows, sales growth, and book to market are above the top or below the bottom 1 percentile of the sample data. Industry specific control variable is the performance mean of all firms in the same 2-digit SIC industry.

Table 7 presents the definitions and measures of all variables used in the second essay:

[Insert table 7 here]

Descriptive statistics

Summary statistics

After computing CEO compensation structure variables, CFO compensation structure variables, and other firm/industry specific control variables, I merge all the variables into a data sample for main analysis. This data sample includes 7,414 firm-year observations from 1,898 firms in 65 industries over the period from 2006 to 2010.

Table 8 represents the summary statistics of dependent variable, firm performance; independent variables such as CEO bonus portion, CEO options portion, CFO bonus portion, and CFO options portion; as well as firm specific and industry specific control variables such as firm size, leverage, book to market ratio, free cash flows, sales growth, and industry performance.

[Insert table 8 here]

Correlation coefficients

Table 9 shows displays the Pearson correlation coefficients among firm performance, CFO pay structure, and control variables in this essay:

[Insert table 9 here]

Unlike in the first essay, in the second essay I do not find any pair of variables with extremely high correlation coefficients, and I keep all the variables and do not exclude any variable from my analysis.

Methodology

I run the regression of firm performance on CFO pay structure variables, CFO bonus and CFO options, controlling by effects of CEO pay structure as well as firm and industry specific characteristics:

$$\begin{aligned} \text{Firm performance} = & \beta_0 + \beta_1 \text{CFO Bonus Portion} + \beta_2 \text{CFO Stock Options Portion} \\ & + \beta_3 \text{CEO Bonus Portion} + \beta_4 \text{CEO Stock Options Portion} + \sum \beta_i \text{Control} \\ & \text{variables (5)} \end{aligned}$$

Model (5) is the main model of this essay. In this model, we can interpret the sign and significance of coefficients β_1 and β_2 to investigate the effect of CFO compensation structure on firm performance after controlling for all CEO pay structure as well as firm and industry-specific characteristics. We can also compare the effect of CFO pay on firm performance to that of CEO compensation structure by comparing the magnitude and significance of β_1 and β_2 to those of β_3 and β_4 if they are significant.

I exclude CEO structure from Model (6) and run the regression of firm performance on CFO pay structure only to study its effect on firm performance:

$$\begin{aligned} \text{Firm performance} &= \beta_0 + \beta_1 \text{CFO Bonus Portion} + \beta_2 \text{CFO Stock Options Portion} \\ &+ \sum \beta_i \text{Control variables (6)} \end{aligned}$$

In this model, if β_1 and/or β_2 are significant, this is the first evidence that the compensation structure of the CFO does influence firm performance, or CFO pay structure and firm performance are statistically significantly related.

Finally, I run the regression of firm performance on CEO pay structures to investigate whether it independently affects firm performance:

$$\begin{aligned} \text{Firm performance} &= \beta_0 + \beta_3 \text{CEO Bonus Portion} + \beta_4 \text{CEO Stock Options Portion} \\ &+ \sum \beta_i \text{Control variables (7)} \end{aligned}$$

Similarly, in Model (7), the significance of the coefficients β_3 and/or β_4 will confirm that firm performance and CEO pay structure are statistically and significantly associated with each other after controlling for firm and industry characteristics. Model (6) and Model (7) also provides a simple way to deal with multicollinearity issue: Multicollinearity is not a serious issue if the beta coefficients do not change much in comparison to those in Model (5) in terms of sign and significance.

3.3 Empirical results

Table 10 presents the empirical results of this second essay:

[Insert table 10 here]

Model (5) confirms that pay structure of CFO and CEO are significantly associated with firm performance. The CFO stock options portion and CEO stock options portion positively relate to the performance of their firms. More importantly, we can observe that in this model the impact of CFO pay structure on firm performance is positive and very significant even after controlling for CEO pay structure as well as other firm and industry specific characteristics.

Even more, we can observe that at first glance CFO options portion's impact is stronger than the impact of CEO options portion on firm performance in both magnitude in terms of coefficient values and significance in terms of t-value. I use the method of Gujarati (2004) to statistically compare these coefficients as following. First, I run Model (5) with appropriate options to obtain coefficient estimates of CFO options portion and CEO options portion as well as the variance - covariance matrix of these estimates, this matrix is in Panel B of Table 10. Second, I compute t-statistics according to the formula:

$$t = \frac{\hat{\beta}_{CFO\ options} - \hat{\beta}_{CEO\ options}}{\sqrt{var(\hat{\beta}_{CFO\ options}) + var(\hat{\beta}_{CEO\ options}) - 2COV(\hat{\beta}_{CFO\ options}, \hat{\beta}_{CEO\ options})}}$$

From Panel A and Panel B of Table 5, I compute $t = 1.89$, and this statistic supports the alternative hypothesis that $\hat{\beta}_{CFO\ options} > \hat{\beta}_{CEO\ options}$ with a 5% confidence level. In other words, I find that the effect of the CFO option portion on firm performance is stronger than that of the CEO option portion on firm performance.

Model (6) demonstrates that CFO pay structure, in terms of CFO stock options portion in the total compensation package is positively associated with firm performance. The association between CFO bonus portion and firm performance is negative but not significant. The results show the empirical evidence that CFO compensation structure does influence significantly firm performance, and suggest that CFO compensation is playing an important role in firm performance

Model (7) finds a similar relationship between CEO compensation structure and firm performance. Specifically, the CEO stock options portion positively affects firm performance in the sense that some of the coefficients of CEO pay structure variables are statistically significant. Regarding CEO bonus portion, its relationship to firm performance is also negative but not significant. These results are consistent with the literature documenting that the effect of stock options on firm performance becomes increasingly stronger and that of bonus becomes weaker over time (Murphy 1999).

The effects of firm specific and industry specific control variables in Model (5) are very similar in Model (6) and Model (7). Firm size, firm leverage, and book to market ratio are negatively and significantly related to firm performance, and industry performance is positively and significantly associated with firm performance. We can also observe some interesting patterns from the effects of control variables in Model (6) and Model (7). For example, firm size, firm leverage, and book to market ratio are negatively and significantly associated with firm performance, while free cash flows and average performance of the industry are positively and significantly associated with firm

performance as expected. The association between sales growth and firm performance is positive but also small in magnitude.

Overall, the empirical results show that CFO pay structure significantly relates to firm performance. The CFO compensation's stock options portion statistically and significantly associate with firm performance, although the bonus portion does not. This impact is even stronger when controlling for the possible effects of CEO compensation. This empirical evidence may further explain the reason why the SEC requires firms to disclose executive compensation structure from 2002 and specially focuses on CFO compensation from 2006.

3.4 Robustness check

Similar to the first essay, in this section I also use different measure of firm performance, check for potential econometric issue of multicollinearity, and employ different techniques such as maximum likelihood estimation and panel regression to investigate the relationship between firm performance and CFO compensation structure. Table 11 presents all the results of these robustness checks.

[Insert table 11 here]

Performance measure

When I use earnings per share (EPS) as a firm performance measure to investigate relationship of executive compensation on firm performance measure, I find a positive

and significant relationship between CFO options and firm performance, which is consistent with Model (5). The CEO options portion also positively relates to firm performance, although the significance level of this relationship is lower. We can observe also that the CFO bonus portion and the CEO bonus portion seem to have insignificant association with firm performance.

Statistical issues

Test for multicollinearity

Panel B shows the multicollinearity diagnostics for Model (5). I conclude that multicollinearity is not a serious problem in this essay because the maximum condition index is approximately 27. In more details, Belsley, Kuh and Welsch (1980) suggest that a condition index higher than 100 will cause serious errors due to collinearity.

Generalized linear model

Panel C presents the regression results when using a generalized linear model with maximum likelihood estimation, and these results are very consistent with those previously obtained from Model (5).

Panel regressions

The second essay also uses panel models for robustness check purpose to explore accurately the panel nature of compensation and financial data as the combination of

cross sectional and times series data. Five panel models used are one-way fixed-effect, one-way time fixed-effect, two way fixed effect, one-way random-effect, and two-way random-effect.

I construct the balanced panel data merging CFO compensation structure, CEO compensation structure and firm financial data. The final panel data contains 3,975 firm-year observations from 795 firms in 63 industries over the period from 2006 to 2010. I run Model (5) using five different specifications. The results are in Panel D.

Overall, the results are identical to those from Model (5). In details, the relationship between CFO pay structure in terms of stock options portion and firm performance is positive and statistically significant. This impact is still significant when we control for CEO compensation effect.

3.5 Summary

Following the still young literature studying the impact of CFO's on corporate finance decisions, the second essay investigates the impact of CFO compensation structure on firm performance, and achieves some important research results and may provide useful suggestions in practice.

The essay proposes and demonstrates empirically that the CFO compensation structure, in terms of the portion of stock options in the total compensation, influences positively and significantly firm performance, even after controlling for the impact of the CEO

compensation structure and other effects. The essay also confirms the results in the literature that the CEO pay structure, especially the CEO stock options portion does influence positively firm performance. More importantly, the second essay shows that the impact of CFO compensation structure on firm performance is stronger than that of CEO compensation structure in terms of both value and t-statistic of their coefficients in the corresponding regressions. This result is still strongly robust for different measures of firm performance and regression models.

This essay suggests that researchers and policy makers on executive compensation structure should not focus only on CEO compensation structure but also pay more attention to CFO compensation structure when analyzing the executive pay structure effect on firm performance. More generally, CFOs should receive more attention in the investigation of corporate finance because CFOs are playing an increasingly important role in corporate financial management.

4. CONCLUSION

This dissertation investigates the relationship between executive compensation and firm performance analyzing both level and structure of executive compensation. I do not only focus on the effect of CEO compensation but also explore the effect of compensation on all top executives of the firm as a team, as well as the effect of CFO compensation because of their increasing importance in firm business decision making.

The first essay investigates executive pay level, focusing on the effect of TMT compensation on firm performance and finds that TMT compensation in terms of the compensation dispersion among executives of Top Management Team does influence firm performance significantly and positively. The results strongly support the tournament effect hypothesis. The first essay also shows that the effect of TMT total compensation on firm performance is also positive and statistically significant, although it may be sensitive to performance measure. Interestingly, the effect of CEO compensation on firm performance is statistically significant but negative, indicating that CEO pay is probably not effective.

The second essay analyzes executive pay structure exploring the influence of CFO pay structure on firm performance. On the one hand, this essay finds the empirical support for the literature stating that CEO pay structure in terms of CEO stock options portion has a significant and positive effect on firm performance. On the other hand, the essay shows that CFO compensation structure also positively and significantly relates to firm

performance after controlling the impact of CEO pay structure and other firm and industry characteristics. This effect of CFO pay structure is even stronger than that of CEO compensation structure.

This dissertation suggests that future research on executive compensation should focus not only on CEO compensation but also on compensation of top executives as a team TMT, as well as CFO compensation. Analyzing all these features will provide us a more comprehensive and complete picture of executive compensation and executive pay effect on firm performance. It is important not only in academic research but also in the practical financial decisions of the firms.

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Table 1. Brief summary Standard and Poor's ExecuComp database*(Source: CompuStat.com)*

ExecuComp includes annual compensation data from 1992 forward of the top executive officers within a company. In total, this database contains compensation data of more than 32,000 top executives from over 2,900 companies over the period from 1992 to present. Each year ExecuComp includes annual compensation data of top executives of about S&P 1500 companies, from which 600 are small, 400 are mid and 500 large cap firms. Following are the datasets that are provided. Fields identifying unique records for each table are noted in parenthesis.

N	Description
1	ANNCOMP – (co_per_rol + year). Lists all named executives, titles, and their compensation data. Compensation data includes salary, stock options, bonuses, and shares owned.
2	BLACK_SCHOLES_MEANS – (Year) Applies to the 1992 reporting format only. Includes the highest and lowest volatility and yield figures that were used the Compustat Black Scholes Model. A description of this model is available on the S&P Compustat website at www.compustatresources.com .
3	CODIRFIN – (gvkey + year).Includes director compensation data for 2005 and prior as well as company financial data. The director compensation data includes items such as: number of board meetings, annual options received, annual shares received, and annual retainer. The company financial data includes various income statement and balance sheet data items in addition to market value and share price data.
4	COLEV – (gvkey).Contains company level information. The company level information includes items such as: address, SIC, CUSIP number, ticker, stock exchange, and industry/index information.
5	COPEROL – (co_per_rol).Contains items specific to each person working at a given company. Items such as: most recent title held, when executive became/left CEO, when executive joined/left company, and reason for leaving company.
6	DEFERREDCOMP – (co_per_rol + year + defer_id).Applies to the current reporting format only.Includes detailed information about deferred compensation plans including contribution information and individual plan balances.

- 7 DIRECTORCOMP – (gvkey + year + dirnbr).Applies to the current reporting format only.Includes compensation information by director, including items such as cash fees, stock awards, and pension compensation.
 - 8 LTAWDTAB – (co_per_rol + year + awdnum).Applies to the 1992 reporting format only. Contains data pertaining to long term incentive awards. It includes information such as: shares awarded, value of shares, and payout term.
 - 9 OUTSTANDINGAWARDS – (co_per_rol + year + outawdnum).Applies to the current reporting format only. Includes detailed information about outstanding option and restricted stock awards.
 - 10 PENSION – (co_per_rol + year + penid).Applies to the current reporting format only.Includes detailed information about executive pension plans including the credited years of service and the plan value.
 - 11 PERSON – (execid).Provides specific executive information. Items such as: first and last name, age and gender.
 - 12 PLANBASEDAWARDS – (co_per_rol + year + grntnum).Applies to the current reporting format only.Includes detailed information about option, stock, and long-term incentive awards made to executives during the year. Data items include the option exercise price, the grant date fair value of the stock/option award, and the potential cash payout under cash-based incentive plans.
 - 13 STGRTTAB – (co_per_rol + year + grntnum).Applies to the 1992 reporting format only.Contains data pertaining to stock option grants. It includes information such as: stock option value, exercise price, market price, and expiration date.
-

The Securities and Exchange Commission implemented a major overhaul in the requirements for reporting executive compensation data for companies with fiscal years ending in December 2006 and later. Many items in the database apply to only one of the reporting formats.

Table 2. Variable definitions, TMT pay level and firm performance*(Source: ExecuComp)*

This table presents the definitions of all variables used in the first essay such as firm performance, executive pay, TMT pay dispersion and mean, TMT total pay, CEO pay and other control variables such as firm size, leverage, book to market ratio, free cash flows, sake growth and industry performance.

The data is selected from ExecuComp database with all not null data items in a single observation, moreover, total assets, market value, common equity must be positive.

Variables	Description
Firm performance	Tobin's Q
TMT pay dispersion	The ratio of the standard deviation divided by the mean of executive pay of all TMT members
TMT total pay	The logarithm of summation of executive pay of all TMT members
TMT mean pay	The logarithm of mean of executive pay of all TMT members
CEO pay	The logarithm of CEO's total compensation
Firm size	The logarithm of total assets
Firm leverage	$1 - (\text{common equity} / \text{total assets})$
Book to market ratio	$(\text{common equity} / \text{market value})$
Free cash flows	Operating income before depreciation (OIBD) divided by total assets of the firm
Sales growth	Percent sale change in 1 year
Industry performance	The mean of Tobin's Q of all companies in the same 2-digit-SIC industry

Table 3. Descriptive statistics, TMT pay level and firm performance

This table presents the descriptive statistics of dependent, independent and control variables used in the regression of firm performance on TMT compensation. The definitions and measures of these variables are in table 2.

Variables		N	Mean	StdDev	Sum	Minimum	Maximum
Firm performance	(1)	26951	1.8490	1.1124	49834	0.7448	9.0273
TMT pay dispersion	(2)	26951	0.7138	0.3453	19240	0.0004	3.4105
TMT total pay	(3)	26951	8.8074	0.9992	237369	4.7770	14.2838
TMT mean pay	(4)	26951	7.0459	0.9931	189896	3.3907	12.6743
CEO pay	(5)	26951	7.6105	1.2422	205111	-6.9077	14.2791
Firm size	(6)	26951	7.4875	1.6316	201797	2.5745	11.9901
Firm leverage	(7)	26951	0.5568	0.2164	15006	0.0776	1.0000
Book to market	(8)	26951	0.5183	0.3258	13971	0	2.3974
Free cash flows	(9)	26951	0.1309	0.0888	3529	-0.4072	0.4333
Sales growth	(10)	26951	12.6771	25.3205	341661	-50.3000	219.6130
Industry performance	(11)	26951	1.8598	0.5422	50125	0.9016	5.4509

Table 4. Pearson correlation coefficients, TMT pay level and firm performance

This table presents the correlation coefficients among variables in the first essay about the relationship between TMT compensation and firm performance. The variable definitions and measures are in table 2.

Var		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Firm performance	(1)	1.0000										
TMT pay dispersion	(2)	0.1738	1.0000									
TMT total pay	(3)	0.1818	0.4915	1.0000								
TMT mean pay	(4)	0.1893	0.4595	0.9777	1.0000							
CEO pay	(5)	0.0912	0.4753	0.8299	0.8397	1.0000						
Firm size	(6)	-0.2272	0.1221	0.5967	0.5744	0.4974	1.0000					
Firm leverage	(7)	-0.3940	-0.0227	0.1343	0.1118	0.1460	0.5456	1.0000				
Book to market	(8)	-0.6096	-0.1568	-0.2427	-0.2447	-0.1781	0.0328	0.0804	1.0000			
Free cash flows	(9)	0.4649	0.1058	0.1565	0.1622	0.1330	-0.1376	-0.3157	-0.3946	1.0000		
Sales growth	(10)	0.2444	0.0951	0.0794	0.0877	0.0446	-0.0776	-0.0897	-0.1958	0.1346	1.0000	
Industry performance	(11)	0.4725	0.0754	0.0178	0.0087	-0.0268	-0.3378	-0.4005	-0.3461	0.2403	0.1240	1.0000

Table 5. Pooled regression of firm performance on TMT compensation level

This table shows the results of pooled regressions of firm performance on TMT compensation. The dependent variable is firm performance, measured by Tobin's Q. Main independent variables are TMT pay dispersion and TMT total pay. Control variables are CEO pay and other firm/industry specific variables. Variable definitions and measures are in table 2.

Models:	(1)		(2)		(3)		(4)	
Variables	Coef.	<i>t-Stat</i>	Coef.	<i>t-Stat</i>	Coef.	<i>t-Stat</i>	Coef.	<i>t-Stat</i>
Intercept	1.4260	26.41	1.5525	28.66	2.2129	55.97	1.4963	28.75
TMT pay dispersion	0.1001	6.46	0.0666	3.95	0.2042	15.15		
TMT total pay	0.2298	23.92	0.1309	18.11			0.1463	23.26
CEO pay	-0.1001	-15.55						
Firm size	-0.0661	-14.62	-0.0642	-13.78	-0.0091	-2.70	-0.0685	-15.47
Firm leverage	-1.0047	-37.00	-1.0308	-38.35	-1.1255	-41.88	-1.0261	-37.71
Book to market	-1.4469	-89.35	-1.4552	-88.57	-1.5039	-93.26	-1.4552	-89.49
Free cash flows	1.8793	32.31	1.8380	31.36	1.9687	33.80	1.8310	31.38
Sales growth	0.0035	19.54	0.0036	19.99	0.0038	20.99	0.0036	20.16
Industry performance	0.3229	32.71	0.3312	33.25	0.3534	35.75	0.3303	33.35
Adjusted R-Square	0.5559		0.5520		0.5466		0.5517	

Table 6. Robustness check

Panel A: Use of EPS as a measure of firm performance in Model (1)

This panel shows the results of pooled regressions of firm performance on TMT compensation. The dependent variable is firm performance, measured by Earnings per Share (EPS). Main independent variables are TMT pay dispersion and TMT total pay. Control variables are CEO pay and other firm/industry specific variables. Variable definitions and measures are in table 2.

Variable	(1.1)	
	Coefficient	<i>t Value</i>
Dependent variable: Firm performance (EPS)		
Intercept	12.1558	7.38
TMT pay dispersion	1.1372	2.19
TMT total pay	-3.4619	-10.79
CEO pay	0.3381	1.58
Firm size	2.5873	17.21
Firm leverage	-8.0083	-8.92
Book to market	-2.4703	-4.72
Free cash flows	7.6559	3.90
Sales growth	0.0196	3.18
Industry performance	1.1158	65.32
Adjusted R-Square	0.1500	

Table 6. Robustness check (continued)

Panel B: Multicollinearity diagnostics

This table shows the collinearity diagnostics among regressors of Model (1) using tol, vif and collin options.

Collinearity Diagnostics						
#	Eigenvalue	Condition Index	Proportion of Variation			
			Intercept	Tmt PayDispersion	Log TmtTotalPay	Log CEOPay ...
1	8.235700	1.000000	0.000099	0.001670	0.000040	0.000117
2	0.817470	3.174060	0.000028	0.000001	0.000007	0.000023
3	0.412150	4.470140	0.000003	0.004580	0.000004	0.000018
4	0.207900	6.293900	0.000026	0.124350	0.000068	0.000408
5	0.155750	7.271630	0.000241	0.470970	0.000021	0.000004
6	0.107000	8.773220	0.002170	0.104070	0.000251	0.000197
7	0.040670	14.230260	0.000856	0.112950	0.006200	0.030090
8	0.013190	24.986540	0.070080	0.069080	0.008360	0.137520
9	0.008160	31.766740	0.468700	0.057420	0.003310	0.366810
10	0.002010	64.084040	0.457800	0.054910	0.981740	0.464810

Table 6. Robustness check (continued)

Panel C: 2SLS results

This panel shows the results of 2SLS regression to solve for endogeneity problem. In the first stage, I run the regressions of main independent variables on controlling variables and compute the predicted values of these independent variables. In the second stage, I run the regression of dependent variable on these predicted values. The main dependent variable is firm performance, measured by Tobin's Q. Main independent variables are TMT pay dispersion and TMT total pay. Control variables are CEO pay and other firm/industry specific variables. Variable definitions and measures are in table 2.

Models:	(1.2)		(1.3)		(1.4)		(1.5)	
	Coef.	<i>t-Stat</i>	Coef.	<i>t-Stat</i>	Coef.	<i>t-Stat</i>	Coef.	<i>t-Stat</i>
Dependent variable	IV1		IV2		IV3		Q	
Intercept	0.4304	24.52	5.4975	146.95	4.3162	79.57	3.6438	27.70
TMT pay disp. (IV1)							18.7893	126.24
TMT total pay (IV2)							-1.9068	-20.18
CEO pay (IV3)							0.2099	2.48
Firm size	0.0422	28.11	0.4650	145.18	0.4544	97.85		
Firm leverage	-0.1281	-10.64	-0.8584	-33.46	-0.6313	-16.97		
Book to market	-0.1147	-15.92	-0.4931	-32.12	-0.4436	-19.93		
Free cash flows	0.1670	6.39	1.1738	21.08	1.6290	20.18		
Sales growth	0.0009	11.44	0.0024	14.05	0.0017	6.82		
Industry performance	0.0343	7.75	0.2055	21.76	0.1321	9.65		
Adjusted R-Square	0.0585		0.4913		0.3139		0.4887	

Table 6. Robustness check (continued)

Panel D: GLM using MLE

This panel shows the results of generalized linear model of TMT compensation on firm performance using maximum likelihood technique. The dependent variable is firm performance, measured by Tobin's Q. Main independent variables are TMT pay dispersion and TMT total pay. Control variables are CEO pay and other firm/industry specific variables. Variable definitions and measures are in table 2.

Variable	(1.6)	
	Coefficient	<i>p Value</i>
Dependent variable: Firm performance (Tobin's Q)		
Intercept	1.4260	<.0001
TMT pay dispersion	0.1002	<.0001
TMT total pay	0.2299	<.0001
CEO pay	-0.1001	<.0001
Firm size	-0.0662	<.0001
Firm leverage	-1.0048	<.0001
Book to market	-1.4469	<.0001
Free cash flows	1.8793	<.0001
Sales growth	0.0036	<.0001
Industry performance	0.3230	<.0001

Table 6. Robustness check (continued)

Panel E: panel regressions

This table presents the results of panel regressions of firm performance on TMT compensation. The models are one-way fixed-effect (1.7), one-way time fixed-effect (1.8), two way fixed effect (1.9), one-way random-effect (1.10) and two-way random-effect (1.11). Dependent variable, independent variables, and variable definitions and measures are in table 2.

Variable	Fix one (1.7)		Fix one time (1.8)		Fix two (1.9)		Ran one (1.10)		Ran two (1.11)	
	Coef.	<i>t Value</i>	Coef.	<i>t Value</i>	Coef.	<i>t Value</i>	Coef.	<i>t Value</i>	Coef.	<i>t Value</i>
Independent variable: Firm performance (Tobin's Q)										
Intercept	0.8249	2.81	0.4084	1.92	1.5950	3.98	0.8265	3.66	0.7754	2.96
TMT pay dispersion	0.1615	3.85	0.1595	3.47	0.1175	2.75	0.1971	4.75	0.1335	3.18
TMT total pay	0.1933	7.78	0.1042	4.16	0.1632	6.14	0.1440	6.14	0.1523	6.04
CEO pay	-0.0395	-3.37	-0.0446	-4.15	-0.0306	-2.63	-0.0401	-3.52	-0.0297	-2.63
Firm size	-0.1858	-6.54	0.0485	3.48	-0.2363	-6.99	-0.0744	-3.31	-0.0669	-2.92
Firm leverage	-1.0394	-7.80	-1.0140	-10.85	-1.2461	-9.29	-0.9403	-7.71	-1.0634	-8.72
Book to market	-0.9888	-14.59	-1.2985	-19.64	-1.0039	-14.49	-1.0593	-16.01	-1.0577	-15.76
Free cash flows	4.6786	16.06	5.2164	20.12	4.7198	16.01	4.8839	17.51	4.9378	17.52
Sales growth	-0.0001	-0.09	0.0011	1.44	0.0009	1.27	0.0001	0.08	0.0004	0.62
Industry performance	0.5163	12.69	0.2876	9.84	0.5259	10.99	0.4666	12.54	0.4294	10.60
R-Square	0.7748		0.6606		0.7862		0.5022		0.4855	

Table 7. Variable definitions, CFO pay structure and firm performance

Data source: ExecuComp

This table shows the definitions and measures of all variables used in the second essay.

The data is selected from ExecuComp database with all not null data items in a single observation, moreover, total assets, market value, common equity must be positive.

Variables	Description
Firm performance	Tobin's Q
CFO Bonus Portion	The ratio of CFO bonus divided by CEO total pay
CFO Options Portion	The ratio of CFO stock options divided by CEO total pay
CEO Bonus Portion	The ratio of CEO bonus divided by CEO total pay
CEO Options Portion	The ratio of CEO stock options divided by CEO total pay
Firm size	The log of total assets
Firm leverage	$1 - (\text{common equity} / \text{total assets})$
Book to market ratio	$(\text{common equity} / \text{market value})$
Free cash flows	Operating income before depreciation (OIBD) divided by total assets of the firm
Sales growth	Percent sale change in 1 year
Industry performance	The mean of Tobin's Q of all companies in the same 2-digit-SIC industry

Table 8. Descriptive statistics, CFO pay structure and firm performance

This table presents the descriptive statistics of dependent, independent and control variables used in the regression of firm performance on CFO pay structure. The definitions and measures of these variables are in table 7.

Variables	N	Mean	Std Dev	Sum	Minimum	Maximum
Firm performance	7414	1.7237	0.9383	12780	0.7456	8.7940
CFO Bonus Portion	7414	0.0531	0.1190	394.3042	0	0.9727
CFO Options Portion	7409	0.1145	0.2209	848.3897	0	1.0000
CEO Bonus Portion	7414	0.0451	0.1219	334.4017	0	1.0000
CEO Options Portion	7405	0.1615	0.2649	1196	0	1.0000
Firm size	7414	7.7466	1.6251	57434	2.5745	11.9901
Firm leverage	7414	0.5469	0.2198	4055	0.0776	0.9997
Book to market ratio	7414	0.5707	0.3579	4232	0.0007	2.3527
Free cash flows	7414	0.1241	0.0892	920.3868	-0.4072	0.4330
Sales growth	7414	8.3038	21.9818	61565	-50.1150	213.3100
Industry performance	7414	1.7264	0.4298	12800	0.9547	3.6880

Table 9. Pearson correlation coefficients, CFO pay structure and firm performance

This table presents the correlation coefficients among variables in the second essay about the relationship between CFO compensation structure and firm performance. The variable definitions and measures are in table 7.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
TobinQ	(1)	1.00										
CFOBonus	(2)	-0.06	1.00									
CFOOptions	(3)	0.29	-0.11	1.00								
CEOBonus	(4)	-0.04	0.66	-0.02	1.00							
CEOOptions	(5)	0.28	-0.05	0.42	-0.12	1.00						
LogFirmSize	(6)	-0.23	0.01	-0.02	-0.03	0.04	1.00					
Leverage	(7)	-0.33	0.00	-0.13	-0.01	-0.10	0.51	1.00				
BTM	(8)	-0.64	0.07	-0.23	0.03	-0.24	0.08	0.07	1.00			
FCF	(9)	0.50	-0.04	0.18	-0.01	0.20	-0.08	-0.29	-0.43	1.00		
SaleGrowth	(10)	0.24	0.03	0.18	0.07	0.16	-0.05	-0.12	-0.19	0.20	1.00	
IndTobinQ	(11)	0.45	-0.02	0.12	0.00	0.10	-0.32	-0.38	-0.39	0.25	0.16	1.00

Table 10. Regression of firm performance on CFO compensation structure

Panel A: OLS results

This table shows the results of pooled regressions of firm performance on CFO compensation structure. The dependent variable is firm performance, measured by Tobin's Q. Main independent variables are CFO Bonus Portion and CFO Options Portion. Control variables are CFO Base Salary, CEO Bonus Portion, CEO Options Portion, and other firm/industry specific variables. Variable definitions and measures are in table 7.

Variable	(5)		(6)		(7)	
	Coef.	<i>t Value</i>	Coef.	<i>t Value</i>	Coef.	<i>t Value</i>
Dependent variable: Firm performance (Tobin's Q)						
Intercept	2.1478	33.00	2.1620	33.12	2.1849	33.44
CFO Bonus Portion	0.0754	0.93	-0.0383	-0.63		
CFO Options Portion	0.3392	9.35	0.4373	12.98		
CEO Bonus Portion	-0.1688	-2.13			-0.1082	-1.82
CEO Options Portion	0.2340	7.66			0.3410	12.01
Firm size	-0.0430	-8.29	-0.0387	-7.45	-0.0420	-8.06
Firm leverage	-0.5332	-12.97	-0.5570	-13.52	-0.5584	-13.54
Book to market ratio	-1.1537	-47.28	-1.1761	-48.31	-1.1770	-48.28
Free cash flows	2.1113	22.57	2.1503	22.93	2.1283	22.64
Sales growth	0.0019	5.86	0.0020	6.23	0.0022	6.65
Industry performance	0.2916	14.68	0.2897	14.53	0.2921	14.63
Adj R-Sq	0.5477		0.5467		0.5516	

Table 10. Regression of firm performance on CFO compensation structure (continued)

Panel B: Variance/covariance matrix of coefficient estimates from Model (5)

	Intercept	CFO Bonus	CFO Options	CEO Bonus	CEO Options	Log Firm Size	Leverage	BTM	FCF	Sale Growth	Ind TobinQ
Intercept	0.00424	-0.00001	-0.00014	-0.00020	-0.00009	-0.00017	-0.00081	-0.00082	-0.00169	0.00000	-0.00101
CFO Bonus	-0.00001	0.00654	0.00045	-0.00427	-0.00028	-0.00001	0.00004	-0.00008	0.00020	0.00000	-0.00003
CFO Options	-0.00014	0.00045	0.00132	-0.00034	-0.00042	0.00000	0.00010	0.00009	-0.00006	0.00000	0.00000
CEO Bonus	-0.00020	-0.00427	-0.00034	0.00628	0.00040	0.00001	-0.00002	0.00002	-0.00016	0.00000	0.00003
CEO Options	-0.00009	-0.00028	-0.00042	0.00040	0.00093	-0.00001	0.00009	0.00009	-0.00017	0.00000	0.00001
Log Firm Size	-0.00017	-0.00001	0.00000	0.00001	-0.00001	0.00003	-0.00010	-0.00001	-0.00005	0.00000	0.00001
Leverage	-0.00081	0.00004	0.00010	-0.00002	0.00009	-0.00010	0.00169	0.00021	0.00105	0.00000	0.00022
BTM	-0.00082	-0.00008	0.00009	0.00002	0.00009	-0.00001	0.00021	0.00060	0.00085	0.00000	0.00017
FCF	-0.00169	0.00020	-0.00006	-0.00016	-0.00017	-0.00005	0.00105	0.00085	0.00875	0.00000	0.00000
Sales growth	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
IndTobinQ	-0.00101	-0.00003	0.00000	0.00003	0.00001	0.00001	0.00022	0.00017	0.00000	0.00000	0.00039

Table 11. Robustness check

Panel A: Use of EPS as firm performance measure

This table shows the results of pooled regressions of firm performance on CFO compensation structure. The dependent variable is firm performance, measured by EPS. Main independent variables are CFO Bonus Portion and CFO Options Portion. Control variables are CFO Base Salary, CEO Bonus Portion, CEO Options Portion, and other firm/industry specific variables. Variable definitions and measures are in table 7.

Variable	(5.1)	
	Coef.	<i>t Value</i>
Dependent variable: Firm performance (EPS)		
Intercept	-1.9789	-4.87
CFO Bonus Portion	0.1713	0.34
CFO Options Portion	0.5710	2.52
CEO Bonus Portion	0.5040	1.02
CEO Options Portion	0.3402	1.78
Firm size	0.5739	17.68
Firm leverage	-1.4157	-5.51
Book to market ratio	-0.9454	-6.20
Free cash flows	9.8696	16.89
Sales growth	0.0123	5.90
Industry performance	-0.6316	-5.09
Adj R-Sq	0.1212	

Table 11. Robustness check (continued)**Panel B: Test for multicollinearity**

This table shows the collinearity diagnostics among regressors of Model (5) using tol, vif and collin options.

Collinearity Diagnostics							
Number	Eigen value	Condition Index	Intercept	Proportion of Variation			
				CFO Bonus	CFO Options	CEO Bonus	...
1	6.3035	1.0000	0.0003	0.0028	0.0046	0.0023	...
2	1.4705	2.0704	0.0000	0.1107	0.0471	0.1212	...
3	1.0697	2.4275	0.0003	0.0260	0.0986	0.0465	...
4	0.7331	2.9323	0.0000	0.0130	0.1540	0.0100	...
5	0.4585	3.7079	0.0000	0.0696	0.5360	0.0498	...
6	0.3807	4.0689	0.0000	0.0093	0.0294	0.0123	...
7	0.2637	4.8894	0.0000	0.7658	0.1162	0.7560	...
8	0.1832	5.8656	0.0001	0.0008	0.0002	0.0001	...
9	0.0991	7.9769	0.0067	0.0015	0.0096	0.0000	...
10	0.0292	14.6972	0.0039	0.0005	0.0024	0.0003	...
11	0.0089	26.5889	0.9886	0.0001	0.0021	0.0015	...

Table 11. Robustness check (continued)

Panel C: GLM and Maximum Likelihood technique

This panel shows the results of generalized linear model of the relationship between CFO pay structure and firm performance using maximum likelihood estimation. The dependent variable is firm performance, measured by Tobin's Q. Main independent variables are CFO pay structure measured by CFO bonus portion and CFO options portion. Control variables are CEO pay structure and firm/industry specific variables. Variable definitions and measures are in table 7.

Variable	(5.2)	
	Coef.	<i>p Value</i>
Dependent variable: Firm performance (Tobin's Q)		
Intercept	2.1478	<.0001
CFO Bonus Portion	0.0755	0.3504
CFO Options Portion	0.3393	<.0001
CEO Bonus Portion	-0.1688	0.0330
CEO Options Portion	0.2340	<.0001
Firm size	-0.0431	<.0001
Firm leverage	-0.5332	<.0001
Book to market ratio	-1.1538	<.0001
Free cash flows	2.1114	<.0001
Sales growth	0.0020	<.0001
Industry performance	0.2916	<.0001

Table 11. Robustness check (continued)

Panel D: Panel regressions

This table presents the results of panel regressions of firm performance on CFO compensation structure. The models are one-way fixed-effect (5.3), one-way time fixed-effect (5.4), two way fixed effect (5.5), one-way random-effect (5.6) and two-way random-effect (5.7). The dependent variable is firm performance. Variable definitions and measures are in table 7. Tobin's Q is dependent variable.

Variable	Fix one (5.3)		Fix one time(5.4)		Fix two (5.5)		Ran one (5.6)		Ran two (5.7)	
	Coef.	<i>t Value</i>	Coef.	<i>t Value</i>	Coef.	<i>t Value</i>	Coef.	<i>t Value</i>	Coef.	<i>t Value</i>
Intercept	2.7884	8.90	2.0155	23.25	3.2245	9.86	1.4689	12.69	1.4613	12.29
CFO Bonus Portion	-0.1099	-1.38	0.0257	0.26	-0.0820	-1.03	-0.0939	-1.22	-0.0811	-1.04
CFO Options Portion	0.1553	4.77	0.3063	7.16	0.1742	5.36	0.1893	5.95	0.2017	6.24
CEO Bonus Portion	0.1078	1.29	-0.1731	-1.74	0.1080	1.30	0.0505	0.63	0.0323	0.40
CEO Options Portion	0.1415	5.05	0.2040	5.69	0.1615	5.76	0.1687	6.17	0.1795	6.47
Firm size	-0.3018	-10.12	-0.0316	-4.83	-0.3812	-11.74	-0.0565	-4.94	-0.0566	-5.11
Firm leverage	-0.5404	-5.49	-0.5232	-9.65	-0.4821	-4.84	-0.4049	-5.57	-0.3714	-5.14
Book to market ratio	-0.5346	-17.05	-1.1263	-33.78	-0.5167	-15.92	-0.6990	-23.87	-0.7025	-23.12
Free cash flows	1.7114	11.49	2.4252	18.31	1.7998	12.07	2.0653	15.52	2.1538	16.03
Sales growth	0.0002	0.70	0.0013	2.83	0.0008	2.40	-0.0002	-0.75	0.0001	0.30
Industry performance	0.6768	22.52	0.2750	10.52	0.7488	17.93	0.5817	21.77	0.5668	17.64
R-Square	0.8687		0.5743		0.8704		0.4638		0.3644	

Figure 1. Graph of CEO pay, TMT total pay, and TMT mean pay

Panel A: Years

This panel plots the CEO pay, TMT total pay, and TMT mean pay over years.

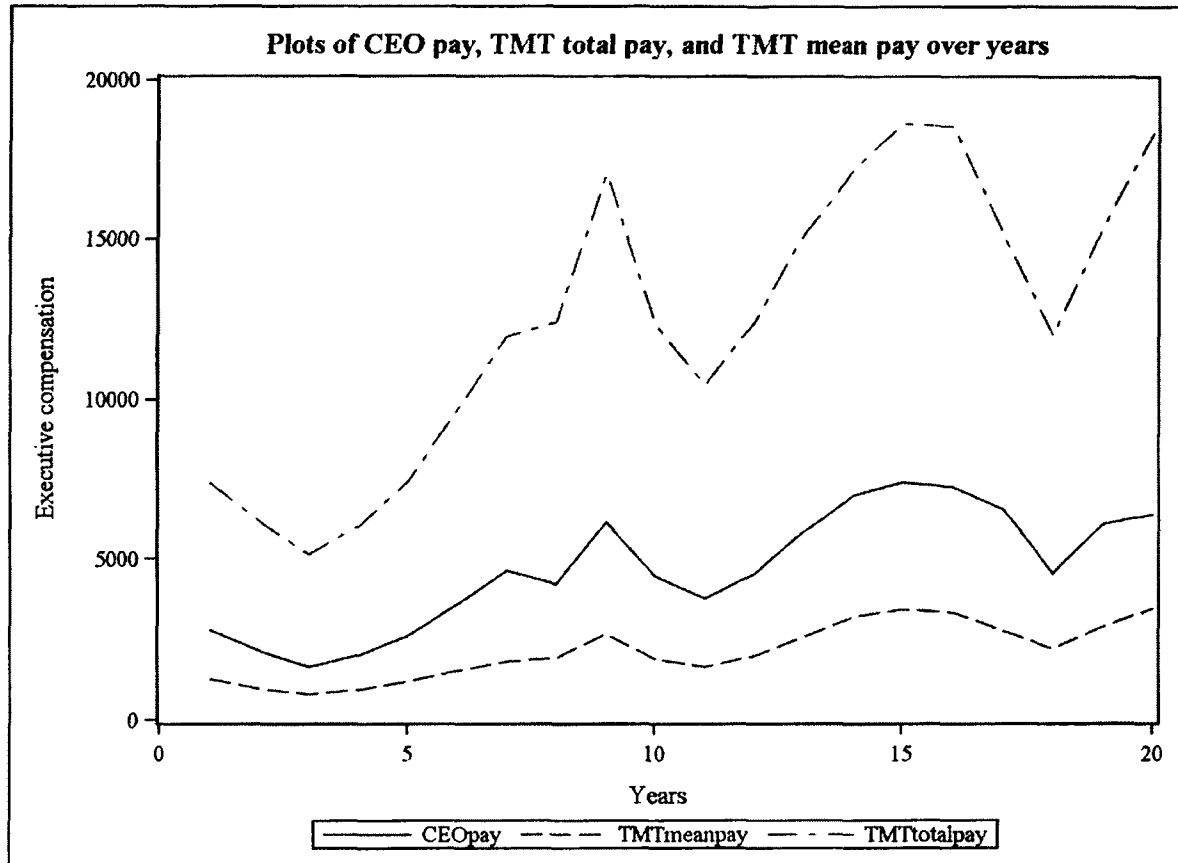


Figure 1. Graph of CEO pay, TMT total pay, and TMT mean pay (continued)

Panel B: Industries

This panel plots the CEO pay, TMT total pay, and TMT mean pay over industries.

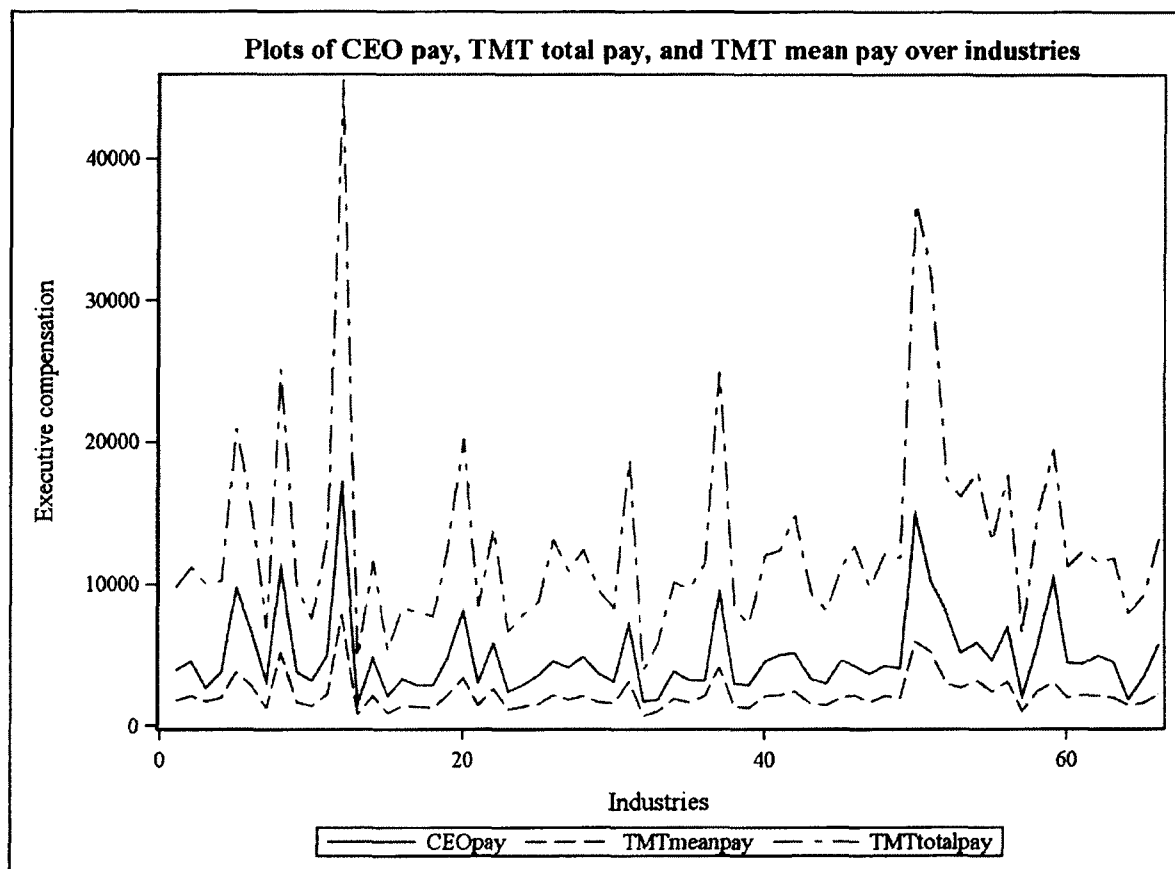


Figure 2. Tobin's Q and Book to Market variables before winsorizing

Panel A: Tobin's Q

This graph plots the value of Tobin's Q before winsorizing process.

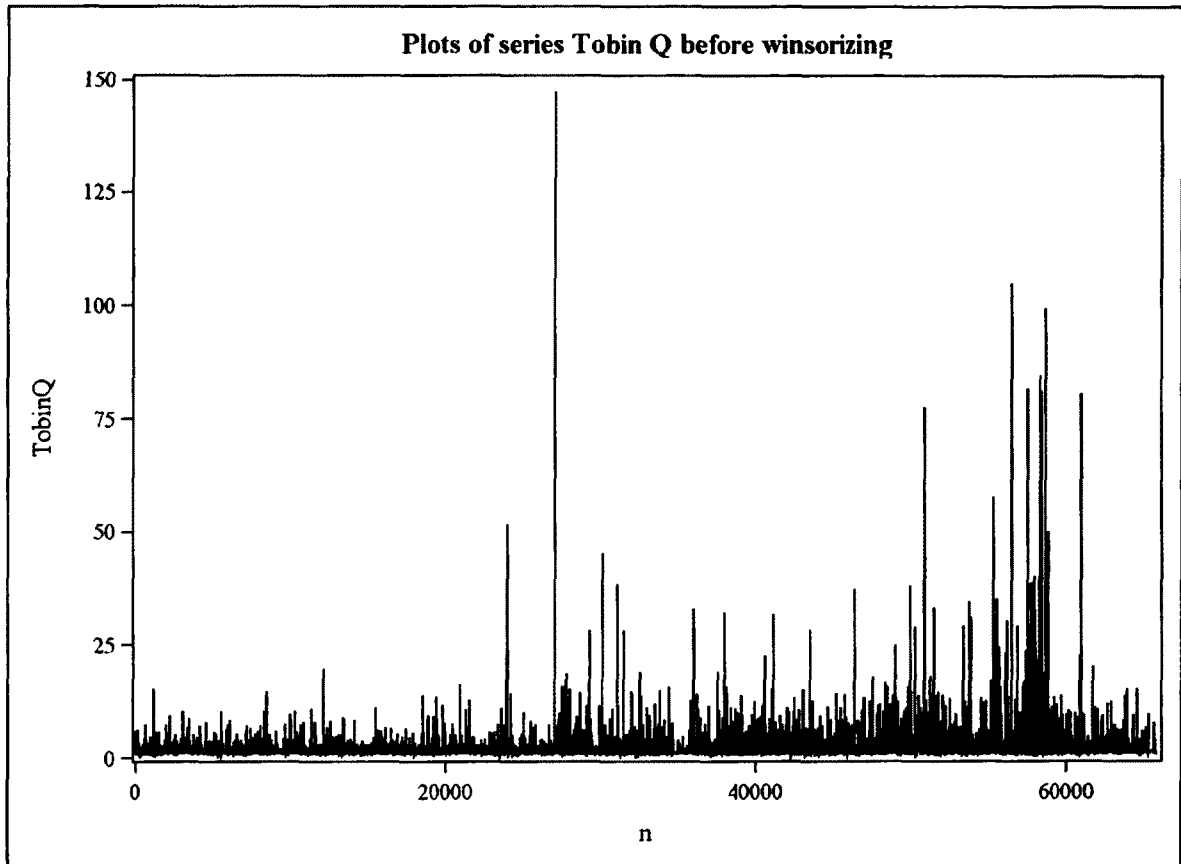


Figure 2. Tobin's Q and Book to Market variables before winsorizing (continued)

Panel B: Book to Market

This graph plots the value of Book to Market ratio before winsorizing process.

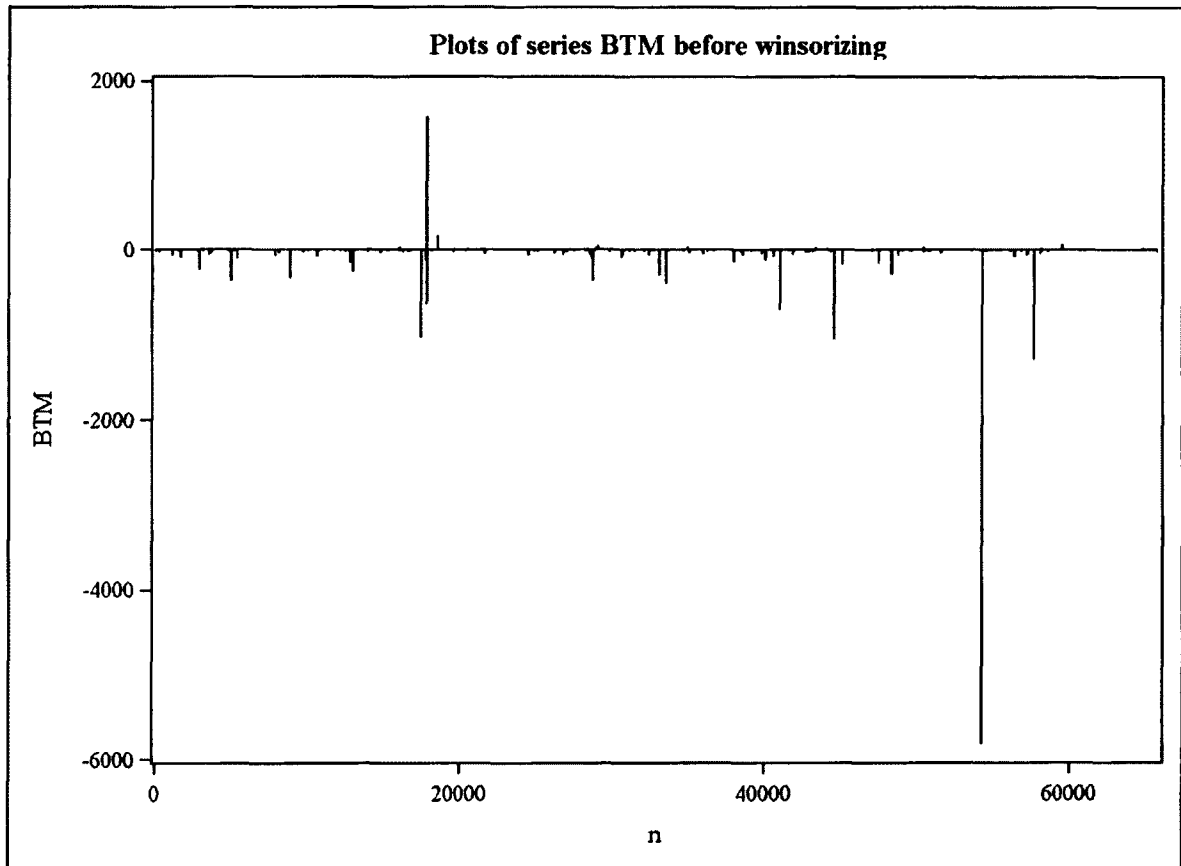


Figure 3. Tobin's Q and Book to Market variables after winsorizing

Panel A: Tobin's Q

This graph plots the value of Tobin's Q after winsorizing process.

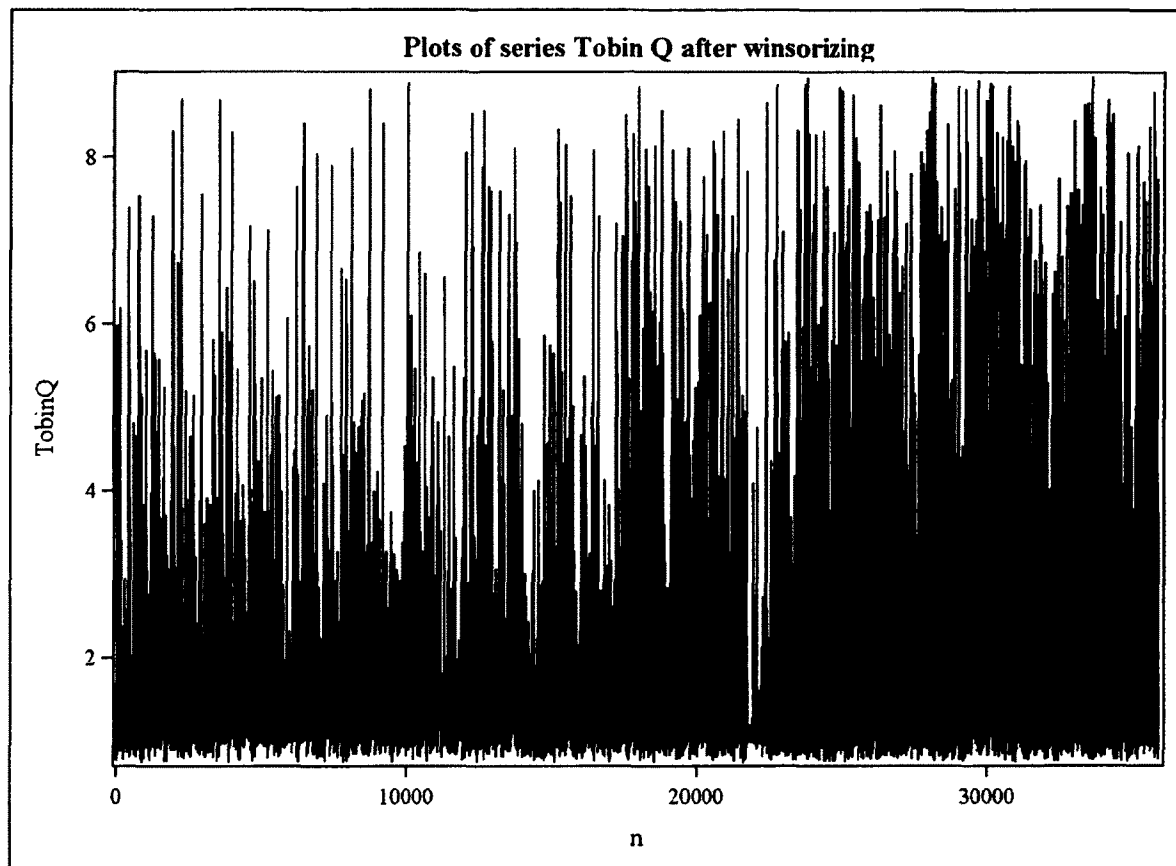


Figure 3. Tobin's Q and Book to Market variables after winsorizing (continued)

Panel B: Book to Market

This graph plots the value of Book to Market ratio after winsorizing process.

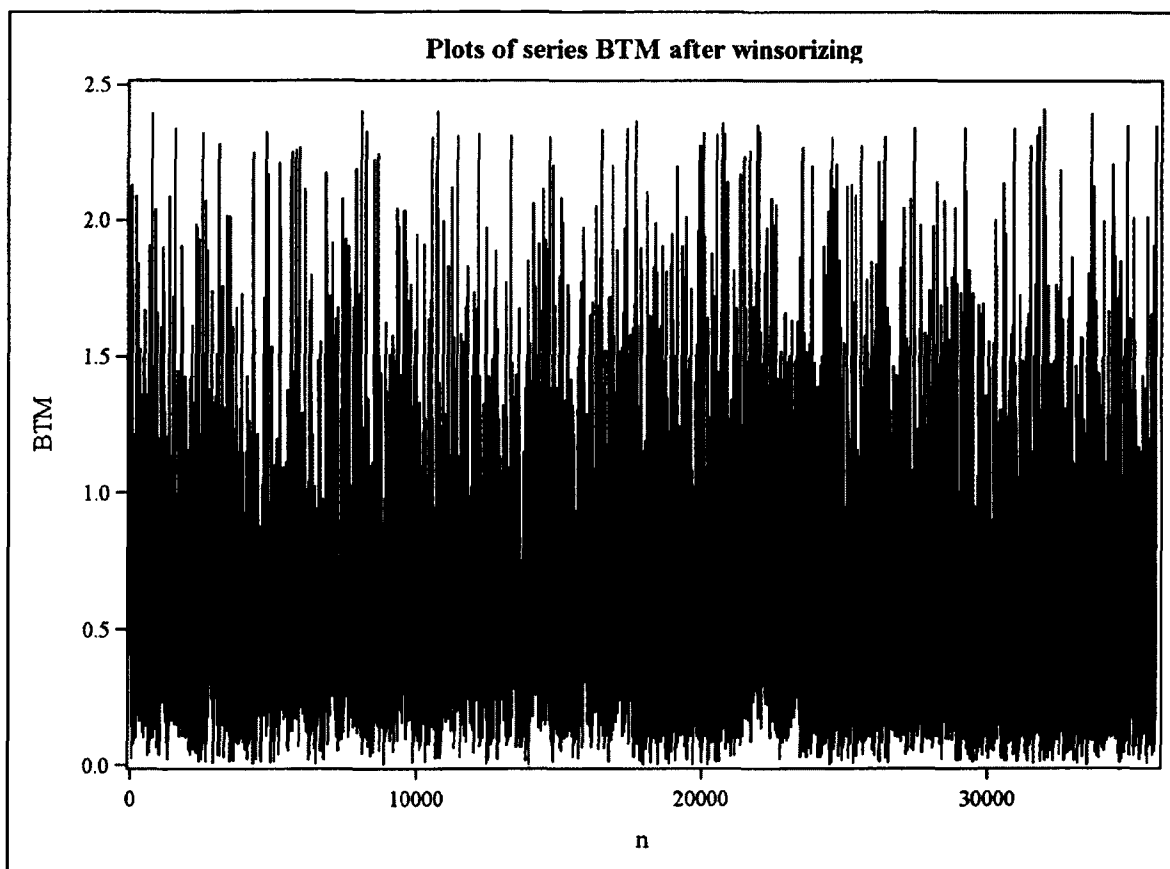


Figure 4. Graph of CEO pay and CFO pay

Panel A: CEO pay and CFO pay over years.

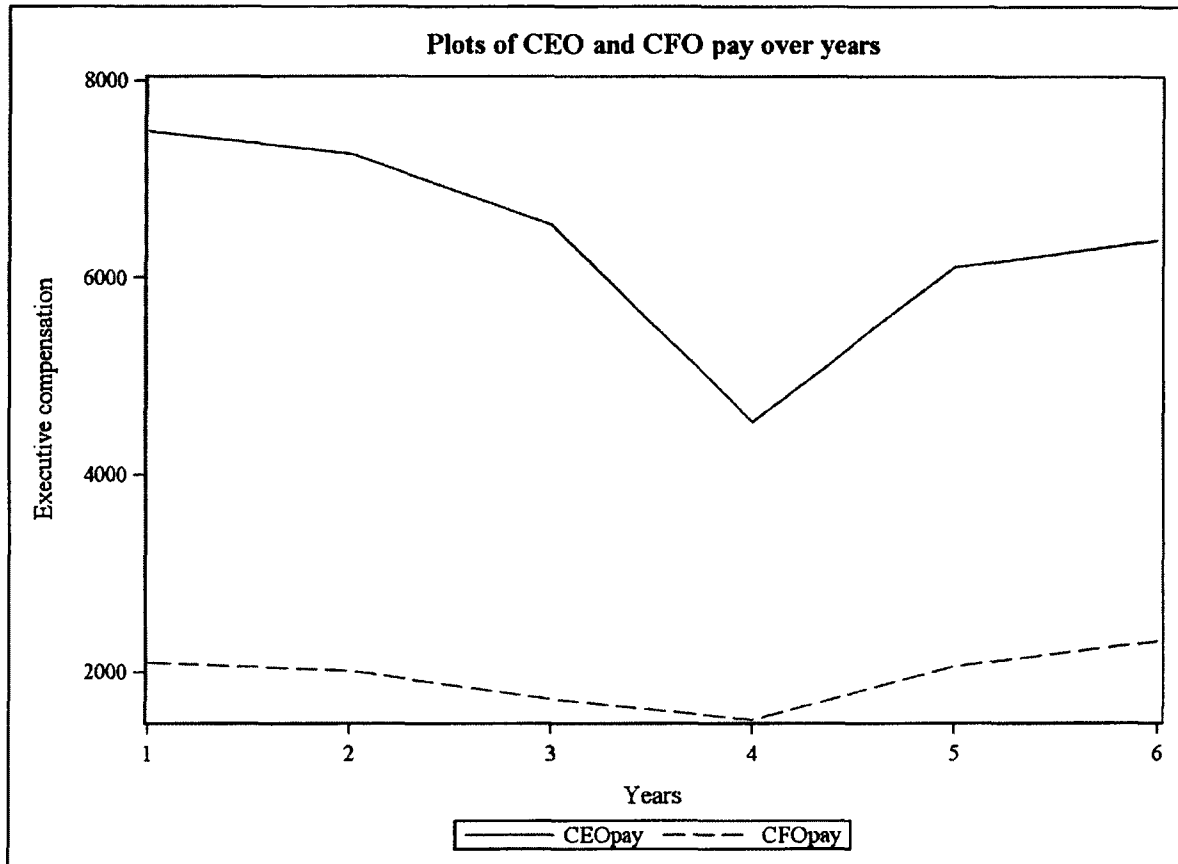


Figure 4. Graph of CEO pay and CFO pay (continued)

Panel B: CEO pay and CFO pay over industries.

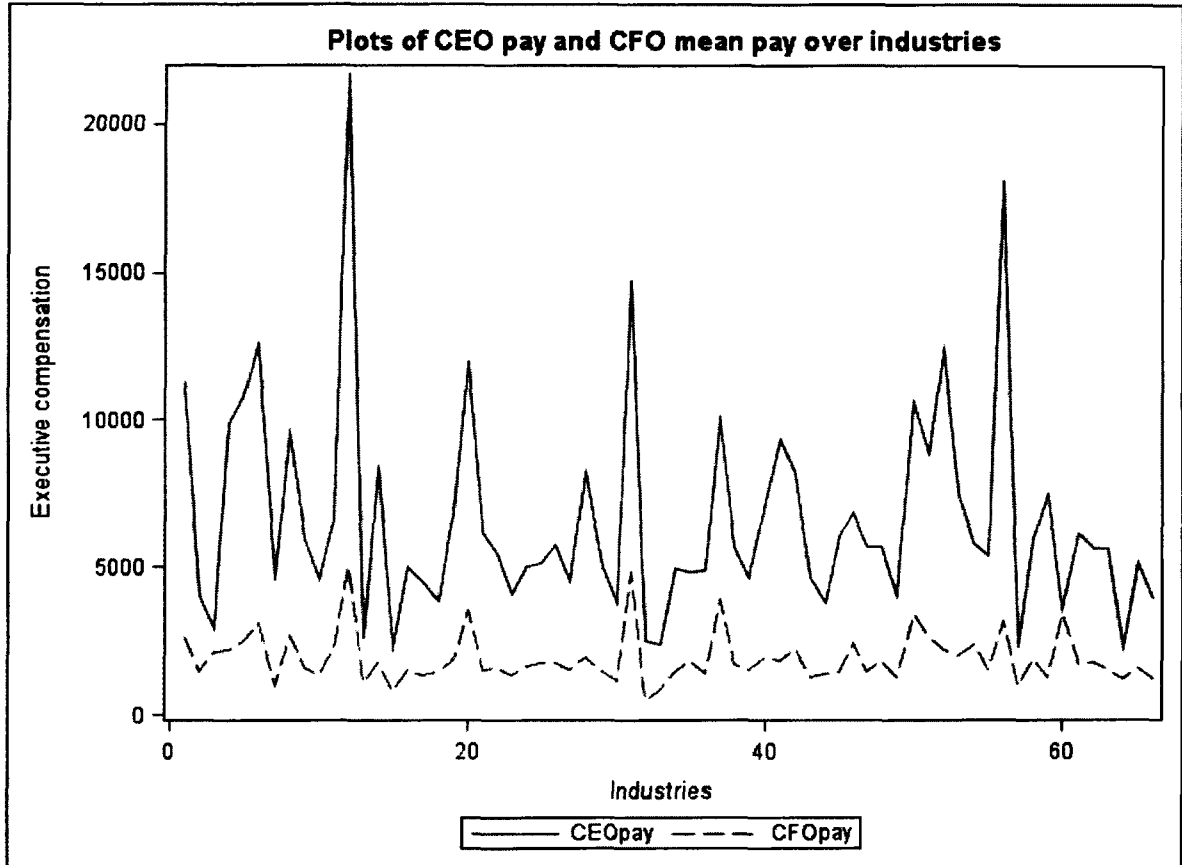


Figure 5. Graph of CEO options and CFO options

Panel A: CFO pay structure and CFO pay structure over years.

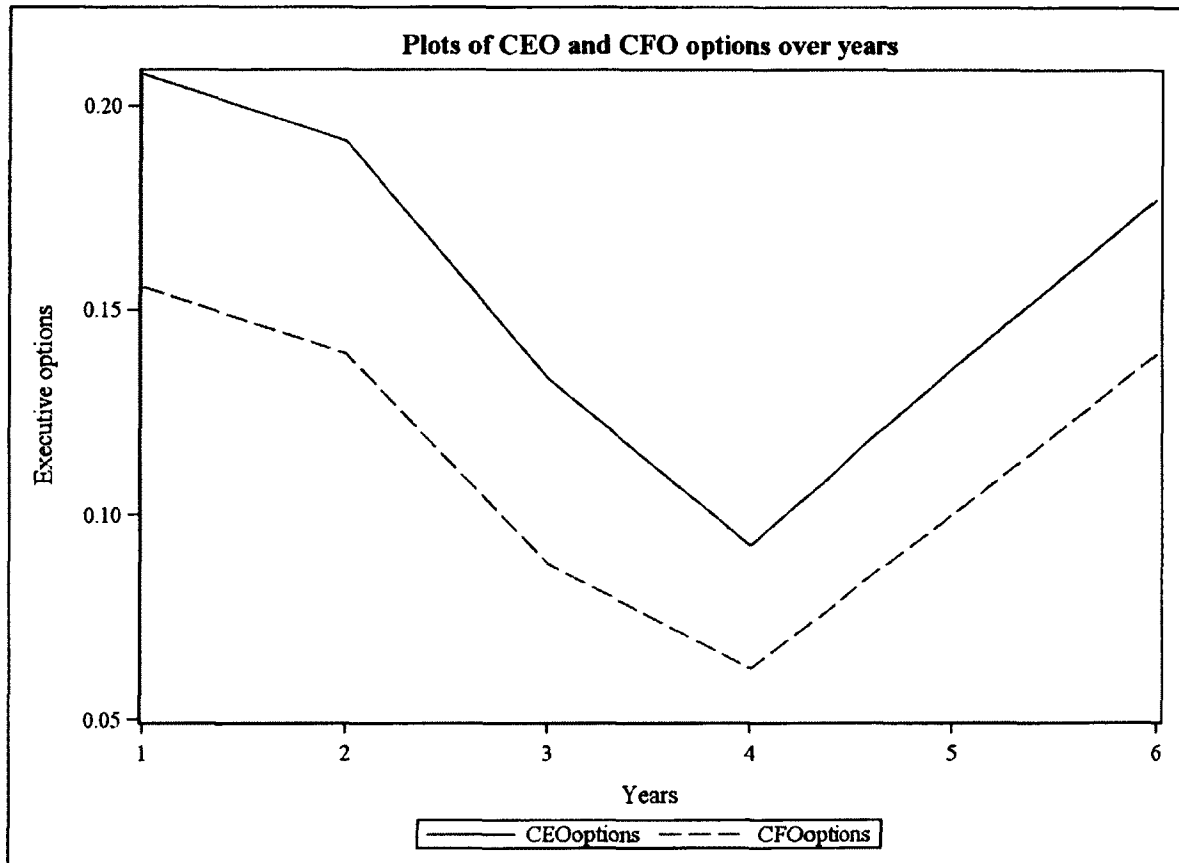


Figure 5. Graph of CEO options and CFO options (continued)

Panel B: CFO pay structure and CFO pay structure over industries.

