ACCOUNTING EARNINGS AND CHIEF EXECUTIVE OFFICER COMPENSATION: THE JOINT EFFECT OF EARNINGS' CONTRACTING AND VALUATION ROLES

A Dissertation

by

YING CAO

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2007

Major Subject: Accounting

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Approved by:

Chair of Committee,	Thomas C. Omer
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ABSTRACT

Accounting Earnings and Chief Executive Officer Compensation: The Joint Effect of Earnings' Contracting and Valuation Roles. (August 2007)

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This paper investigates the impact of accounting earnings on Chief Executive Officer (CEO) compensation by examining how the valuation role and the contracting role of accounting earnings jointly determine the value of CEO *total* compensation. Current earnings are informative about the firms' future cash flows and hence affect stock price, and the resulting price movement affects the value of CEO equity-based compensation. Thus, accounting earnings not only have a *direct* impact on CEO *cash* compensation, but also an *indirect* impact on CEO *equity-based* compensation due to earnings' valuation role. To my knowledge, this paper is the first to provide empirical evidence that because of earnings' valuation role, accounting earnings are an economically significant determinant of CEO *total* compensation.

Prior accounting research testing predictions of agent theory has focused on CEO *cash* compensation even though *total* compensation is a more relevant measure. Thus, the significant result of earnings in CEO *total* compensation enables re-examination of agency predictions. I provide evidence that earnings (but not stock returns) are used in CEO *total* compensation consistent with the "sensitivity vs. precision" hypothesis. That

is, accounting earnings receive less weight when earnings are relatively more volatile and when firms have significant growth opportunities.

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1. INTRODUCTION

In this paper, I investigate the impact of accounting earnings on Chief Executive Officer (CEO) compensation by examining how the valuation role and the contracting role of accounting earnings jointly determine the value of CEO *total* compensation. Total compensation includes cash compensation (salary and bonus), current year grants of stocks and stock options, and the value change in CEO beginning-of-the-year equity holdings. Earnings' contracting role refers to the explicit use of accounting earnings in CEO compensation contract. Earnings' valuation role refers to the ability of earnings to reflect firm value and affect stock price. I argue that news about accounting earnings affects stock price, and the resulting price movement affects the value of stocks and stock options held by CEOs. Therefore, accounting earnings not only have a *direct* impact on CEO cash compensation, which has been traditionally viewed as earnings' contracting role, but also an *indirect* impact on CEO equity-based compensation due to earnings' valuation role. In this paper I measure both the direct and the indirect impact of earnings, and document the overall impact of accounting earnings on CEO *total* compensation. To demonstrate the importance of incorporating the indirect impact of earnings I re-examine the classical "sensitivity vs. precision" hypothesis of agency theory which predicts that firms place more weight on a performance measure when it is more sensitive to managerial effort and when it is less noisy. Such evidence extends prior findings based exclusively on CEO cash compensation.

This dissertation follows the style of the Journal of Accounting and Economics.

A substantial accounting literature theoretically and empirically examines the use of accounting earnings in executive compensation contracts. Much of this work is motivated by the economic research on agency problems (for example, Ross, 1973; Mirrlees, 1976; Harris and Raviv, 1979; Holmstrom, 1979, 1982). Theoretical accounting work collectively demonstrates that accounting performance measures are used in managerial compensation to provide incentives, to filter common noise, and to balance efforts across multiple activities (see, for example, Banker and Datar, 1989; Paul, 1992; Bushman and Indjejikian, 1993a, b; Feltham and Xie, 1994; Hemmer, 1996; Bushman Indjejikian and Penno, 2000; Datar, Kulp and Lambert, 2001).

Concurrent with the development in analytical models, a large number of empirical studies test predictions of agency theory on the relative use of an accounting-based performance measure (for example, accounting earnings) and a market-based performance measure (for example, stock returns) in executive cash compensation. One line of the research tests the sensitivity vs. precision hypothesis and finds empirical evidence generally consistent with the hypothesis (Lambert and Larcker, 1987; Clinch, 1991; Sloan, 1993; Baber, Janakiraman and Kang, 1996). Another line of research tests the relative performance evaluation hypothesis, which predicts the use of a "relative" performance measure that is adjusted for market-wide or industry-wide fluctuations. Empirical evidence on the relative performance evaluation hypothesis is rather weak (Antle and Smith, 1986; Gibbons and Murphy, 1990; Janakiraman, Lambert and Larcker, 1992). A few studies examine how the characteristics of earnings affect its use in executive compensation, and find that firms rely more on accounting earnings in CEO

compensation when earnings are more persistent and more informative of stock prices (Baber, Kang and Kumar, 1998, 1999; Bushman, Engel and Smith, 2006). Researchers have also examined the role of other hypothesized determinants on the relative weights. These include industry group, existence of venture capital (Engel, Gordon and Hayes, 2002), takeover protection and CEO power (Davilia and Penalva, 2006), institutional ownership (Dikolli, Kulp and Sedatole, 2006), and regulatory changes (Vafeas and Afxentiou, 1998; Perry and Zenner, 2001). In general, these studies provide evidence that firms use accounting earnings and stock returns in CEO compensation consistent with the predictions of agency theory.

However, the majority of the empirical compensation research in accounting has focused on CEO *cash* compensation, but has ignored CEO equity-based compensation which includes current year grants of restricted stocks and stock options, and the value change in CEO beginning-of-the-year holdings of stocks and stock options. While evidence from cash compensation is important, it has become less relevant in the face of the explosion of equity-based compensation. Studies show that stock options experienced a seven fold increase for large U.S. public firms during 1980 and 1994 (Hall and Liebman, 1998), and replaced base salary as the largest single component in CEO total pay in the mid 1990s (Murphy, 1999). Bebchuk and Grinstein (2005) document that the value of stock options represents 59% of CEO total pay in 2003, where total pay is the sum of cash compensation and the value of stocks and stock options granted in the current year. Along with the expansion of equity-based compensation is the tiny pay-for-performance sensitivity (the change in a manager's compensation for a change in firm

value) from cash compensation as compared to that from equity-based compensation. For example, Jensen and Murphy (1990) show that CEO cash compensation changes by only two cents for each $1000 change in shareholders' wealth, as compared to a $2.5 change from CEO stock ownership. Subsequent studies such as Hall and Liebman (1998), Murphy (1999) and Core, Guay and Verrecchia (2003) provide evidence consistent with Jensen and Murphy (1990). An implication of the minimal pay-for-performance sensitivity of cash compensation is that no matter how important accounting earnings are to CEO *cash* compensation, earnings' impact on CEO *total* compensation is unlikely to be significant because the variation in cash compensation is too small to make a difference to CEO incentives. Consistent with this implication, Baber et al. (1996), Baber et al. (1998), Core et al. (2003), and Davila and Penalva (2006) provide evidence that conditional on stock returns, accounting earnings are insignificant to CEO total pay or total compensation even though earnings are significant to CEO cash compensation. In their survey paper, Bushman and Smith (2001, p243) call for an understanding of the "decline in the 'market share' of accounting information in top executive compensation…", and point out that future compensation research on the role of accounting information in executive cash compensation "must be prepared to defend its relevance in the face of this decline in market share."

In this paper I investigate the role of accounting earnings in CEO total pay and total compensation by examining the joint impact of earnings' valuation role and contracting role. The study makes three contributions to the accounting literature. First, it provides a comprehensive analysis of the impact of earnings on CEO *total*

compensation. It argues that as the practice of CEO compensation evolves, so do the ways accounting earnings influence CEO compensation. On the one hand, the traditional contracting role as reflected through earnings' impact on CEO cash compensation has become smaller due to the explosion of equity-based compensation; On the other hand, however, earnings' valuation role has become increasingly important in determining the value of CEO compensation due to the heavy reliance of CEO compensation on stock performance. To my knowledge, this study is the first to provide evidence that accounting earnings are an economically significant determinant of CEO total compensation. It also demonstrates that the economic significance comes entirely from earnings' indirect impact.

A second contribution of the paper is that it introduces an approach that enables examination of agency predictions for CEO *total* compensation. Only a few papers have included total pay or total compensation in testing agency predictions and most of them find earnings insignificant to CEO total pay or total compensation conditional on stock returns. Such evidence makes it difficult, if not impossible to further test how the weight on earnings varies with economic factors predicted by agency theory. However, tests based on total pay and total compensation are theoretically more relevant to agency models than tests based on cash compensation. This is because agency theory identifies managerial wealth, not annual cash compensation as the key variable of concern to managers (Baker, 1987; Bushman and Smith, 2001), and CEO total compensation is widely used as a proxy for managerial wealth in the economics and finance literatures (see, for example, Jensen and Murphy, 1990; Hall and Liebman, 1998; Aggarawal and

Samwick, 1999, among others). Under the new approach which incorporates earnings' indirect impact, I am able to find significant impact of earnings on CEO total compensation, which allows me to further test agency predictions in the context of CEO total compensation. To demonstrate the potential usefulness of the new approach, I re-examine the classical sensitivity-noise hypothesis for CEO total compensation. I find strong evidence that firms use accounting earnings (but not stock returns) in a matter that is consistent with the agency prediction. Such evidence extends prior findings which are exclusively based on CEO cash compensation.

A third contribution of the study is that it verifies a key assumption of recent earnings management research related to CEO equity-based compensation. This research provides evidence that earnings management activities are positively associated with CEO incentives arising from their equity-based compensation. The research suggests that CEOs manipulate earnings in order to maintain and/or realize the value of their equity-based compensation (see, for example, Cheng and Warfield, 2005; Bauman and Shaw; 2006; Bergstresser and Philippon, 2006; Burns and Kedia, 2006; Efendi, Srivastava and Swanson, 2006). An underlying assumption of the research is that the impact of accounting earnings on CEO equity-based compensation is economically significant. While plausible, this assumption receives little support from the empirical compensation research. The current study provides evidence that verifies this assumption and supports the argument that earnings' impact on CEO equity-based compensation may be large enough to induce CEOs to manipulate earnings.

While the research question of the paper is intuitive, it has been formally examined by analytical work such as Kim and Suh (1993) and Feltham and Wu (2000). These studies examine the optimal weights on accounting earnings and stock price in a manager's incentive contract. The authors recognize that assuming market efficiency, two equilibriums are present in the setting: an optimal contracting equilibrium and a rational expectation equilibrium in which stock price is determined by all available information including earnings news. The authors demonstrate that in this setting the optimal relative weight on earnings is *larger* than in a traditional agency model that assumes only the optimal contracting equilibrium. This is because some compensation impacts associated with stock price are actually driven by earnings news, and incorporating the rational expectation equilibrium in the model allows attributing such impacts to accounting earnings. The authors suggest that researchers use the "*filtered* price" instead of the *raw* stock price in empirical tests in order to find the "true" weights on stock price and accounting earnings. The "*filtered* price" refers to the portion of stock price unaffected by accounting earnings.

I apply two approaches in the empirical tests. Under the first approach I estimate a proxy for the *filtered* price and measure the relative weights on earnings and the *filtered* price. Under the second approach I examine the impact of stock returns around earnings announcement days on CEO compensation conditional on stock returns during non-earnings announcement days. Assuming that stock returns around earnings announcements are mostly driven by earnings news, a significant association between earnings-announcement-day returns and CEO compensation can be viewed as evidence

that earnings are important to CEO compensation conditional on stock returns. I further compute the percentage and dollar change of CEO compensation for a change in accounting earnings under the two approaches.

I examine the relative weights on earnings and returns for six measures of CEO compensation. These are CEO *cash compensation* (salary and bonus), CEO *equity grants (*grants of restricted stocks and stock options in the current year*)*, and the *value change in CEO beginning-of-the-year equity holdings* (stock holdings and option holdings). I also examine the relative weights for combined compensation items. These items are CEO *total pay* (sum of cash compensation, long term incentive plan payouts, other annual pay and equity grants), CEO *total equity-based compensation* (sum of equity grants and the value change in CEO beginning-of-the-year equity holdings), and CEO *total compensation* (sum of total pay and the value change in CEO equity holdings). [1]

The sample for the primary test is consisted of 12,326 CEO-year observations in ExecuComp database from 1993 to 2004. Consistent with my expectation, the results show that accounting earnings are important to all six measures of CEO compensation conditional on stock returns that are supposedly driven by non-earnings news. I summarize the results in terms of the change in CEO compensation for a one-standard-deviation movement in accounting earnings. Under the first approach, CEO cash compensation changes by 6.1% or $85,000 ($59,000) at the mean (median). These changes represent the *direct* impact of earnings. Combining cash compensation and

[1] Note that both total pay and total equity-based compensation include equity grants. I examine total pay to compare my results with prior studies that also use this measure. I examine total equity compensation because it captures all compensation components that are directly linked to stock price.

equity grants, CEO total pay changes by 5.8%, or $271,000 ($127,000) at the mean (median). In contrast, CEO beginning-of-the-year equity holdings change by 130%, or $19.4 millions ($1.77 millions) at the mean (median). These amounts represent the majority of the *indirect* impact. [2] Combining the direct impact and the indirect impact, accounting earnings have a mean (median) effect of $19.62 millions ($1.87 millions) on CEO total compensation. While both the direct and the indirect impacts are statistically significant, the indirect impact dominates the direct impact in determining CEO compensation and generating incentives.

The results under the second approach show that for a one-standard-deviation movement in accounting earnings, CEO cash compensation, equity grants and total pay change for less than 2%. The *direct* impact of accounting earnings is around $17,000 ($12,000) at the mean (median). CEO beginning-of-the-year equity holdings change by 26%, or $3.88 millions (.35 million) at the mean (median). Overall, CEO total compensation changes by $3.94 millions at the mean or $.38 million at the median. While these figures are less dramatic than those from the first approach, they still represent a large portion of CEO total compensation and appear economically significant. Because the information environment is continuous and multi-dimensional, it is hard if not impossible to measure the exact impact of earnings on stock price. In fact, the first approach may overestimate earnings' valuation role and the second approach may underestimate the valuation role, implying that the indirect impact of earnings on CEO compensation is also measured with error. Because of this, I view the two approaches as

[2] Technically, the indirect impact stems from both equity grants and equity holdings; empirically however, the indirect impact is almost entirely driven by equity holdings.

providing estimates of the upper bound and lower bound of the impact of earnings on CEO compensation.

Finally, to demonstrate the importance of incorporating the indirect impact in examining earnings' overall impact on CEO compensation, I re-examine the sensitivity vs. precision hypothesis for CEO total compensation. The "sensitivity" refers to the change in a performance measure in response to a change in the agent's action, and the "precision" refers to the lack of noise in the signal in measuring the agent's action. While sensitivity is unobservable, it is generally believed that stock returns are more sensitive to managerial actions than accounting earnings for firms with significant growth opportunities. This is because stock returns are more capable of reflecting long-term consequence of current managerial actions. Following Lambert and Larcker (1987), Sloan (1993) and Core et al. (2003), I use the book-to-market ratio to proxy for firms' growth and examine whether the weight on stock returns (accounting earnings) is higher (lower) for firms with significant growth opportunities. I measure the precision of accounting earnings and stock returns by a relative noise ratio defined as the time series variance of accounting earnings over the time series variance of stock returns, and examine whether the weight on earnings (stock returns) decrease with the relative noise ratio. I find that accounting earnings receive less weight in CEO compensation when firms have more growth opportunities and when earnings are relatively more volatile compared to stock returns. On the other hand, stock returns receive more weight for growth firms in equity grants, total pay and total compensation models but not in the other models. Furthermore, stock returns appear to receive more weight when earnings

are relatively more volatile compared to stock returns. Thus, the results based on accounting earning but not stock returns support the sensitivity vs. precision hypothesis.

The paper is organized as the following. In the next section I review the compensation literature that examines the relative weights on accounting earnings and stock returns. In section III, I discuss research designs and hypotheses. I describe the sample selection procedures, variable measurements and descriptive statistics in section IV. I report empirical results in section V and section VI and conclude in section VII.

2. LITERATURE REVIEW

The executive compensation research is a branch of the corporate governance literature which examines the mechanisms that mitigate the principal-agent problems due to the separation of ownership and control of modern firms. Researchers have identified a number of corporate governance mechanisms. They include external forces such as product market competition, the market for corporate control, and labor market pressure, and internal forces such as compensation contracts, board of directors, concentrated ownership, debt contracts and securities law (see Shleifer and Vishny 1997 for a review).

The compensation research in accounting examines theoretically and empirically the role of accounting information in managerial compensation contracts. The theoretical work is largely inspired by classical principal-agent studies (Ross, 1973; Mirrlees, 1976; Harris and Raviv, 1979; Holmstrom, 1979, 1982) that model the trade-off between risk sharing and incentives in the optimal design of compensation contracts. These studies show that in an optimal compensation contract, the principal rewards the agent based on the outcome of one or more performance measures in order to induce the effort-averse and risk-averse agent to work in the best interests of the principal; however, the agent also wants to minimize whenever possible the risks shifted onto the agent because the agent will have to be compensated for these risks. The trade-off between incentives and risk sharing underlies the informativeness principle of Holmstrom (1979) which argues that any informative signal, regardless of how noisy it is, may be used in an optimal compensation contract as long as it provides additional information about the agent's

actions. The informativeness principle supports the existence of complex structures of actual compensation contracts. For example, given that the objective of shareholders is to maximize firm value, stock-based performance measures seem to be sufficient in providing for incentive alignments. However, empirical evidence shows that other performance measures such as accounting profitability measures are extensively used in CEO cash compensation (See Murphy 1999 for a review). According to the informativeness principle, accounting earnings are useful not because investors care about earnings *per se*, but because information of accounting earnings reveals the manager's actions beyond what can be revealed by stock returns.

Following Holmstrom (1979) and other agency studies, accounting researchers have used agency models to analyze various accounting problems (see Lambert 2001 for a review). In their seminal paper, Banker and Datar (1989) show that the relative weights of two performance measures are proportional to their sensitivity and precision, where "sensitivity" refers to the expected change in a performance measure in response to a change in the agent's action, and "precision" refers to the lack of noise in the performance measure. Following Banker and Datar (1989), subsequent analytical work has examined the agency problem using more complicated models (see for example, Paul, 1992; Bushman and Indjejikian, 1993a, b; Feltham and Xie, 1994; Hemmer, 1996; Bushman Indjejikian and Penno, 2000; Datar, Kulp and Lambert, 2001). Overall, this research demonstrates that in an optimal contract accounting performance measures are used to create incentives, to filter common noise, and to balance managerial actions

across multiple activities (see Lambert, 2001; Bushman and Smith, 2001, section 2.4 for a review).

The development in agency theory has inspired an empirical literature in accounting that examines whether the use of performance measures varies along with the economic determinants as predicted by agency theory. Here, I provide a review of the literature that tests the weights on an accounting-based performance measure (for example, accounting earnings) and on a market-based performance measure (for example, stock returns) in executive compensation. One line of the research tests the trade-off between the sensitivity and precision of accounting earnings and stock returns in executive compensation. That is, whether a performance measure receives more weight when it is more sensitive and/or less noisy about managerial actions. The precision of a performance measure is usually measured as the inverse of its time-series standard deviation or variance. The measurement of "sensitivity" is much less straightforward because it is unobservable. Nevertheless, it is generally believed that when firms have significant investment or growth opportunities, accounting earnings poorly reflect the long-term consequence of current managerial actions and thus are less "sensitive" to managerial actions than stock returns. Therefore, a testable hypothesis is that firms with significant growth or investment opportunities assign more (less) weight on stock returns (accounting earnings) in executive compensation contracts. Proxies for growth or investment opportunities include market-to-book ratio, price-earnings ratios, real growth in assets or sales, R&D expenditures, consensus investment choices of

growth fund mangers, length of product development cycles, or measures based on combinations of individual measures.

In a seminal study that applies the above methodology, Lambert and Larcker (1987) examine whether the weight on stock returns relative to accounting earnings increases with the magnitude of firms' growth proxy and the noise of accounting earnings relative to stock returns. The authors first run a regression of CEO cash compensation on accounting earnings (proxied by the changes in Return On Equity, ROE) and stock returns, and use the ratio of the slope coefficients (coefficient on stock returns divided by coefficient on earnings) as the dependent variable in a second regression where the independent variables are firms growth proxy and the relative noise ratio measured as the variance of the changes in ROE to the variance of stock returns.[3] Based a sample of 370 firms covered by Forbes annual compensation survey from 1970 to 1984, the authors find that the coefficient on growth and the noise ratio are both positive after controlling for other relevant factors, indicating that firms place more weight on stock returns relative to earnings in CEO cash compensation when experiencing high growth and when accounting earnings are more volatile relative to stock returns. These findings are consistent with the trade-off hypothesis.

Clinch (1991) examines whether the use of stock returns (accounting earnings) in executive compensation increases (decreases) with the magnitudes of firms' R&D expenditures. The author runs a pooled cross sectional regression of executive compensation on ROE, stock return, and the interactions of these variables with R&D

[3] The authors use a latent variable approach to measure the growth and the noise variables in order to reduce the measurement error.

expenditures for a sample of 1,841 observations of 200 companies randomly selected between 1981 and 1985. The author finds that the weight on earnings in executive *cash* compensation increases for firms with high R&D whereas the weight on stock returns does not change with firms' R&D level. In contrast, large firms with high R&D assign more (less) weight on stock returns (accounting earnings) as predicted by theory. The author also examines the trade-off hypothesis for executive total pay. Consistent with the hypothesis, high R&D firms place more weight on stock returns for all firm size. However, these high R&D firms also place more weight on accounting earnings (for the full sample and the small firm sample). Finally, while stock returns are always significant in the total pay regression, accounting earnings are insignificant for the full sample and the large firm sample. Overall, Clinch (1991) provides mixed evidence on the trade-off hypothesis.

Baber, Janakiraman and Kang (1996) extend Lambert and Larcker (1987) and Clinch (1991) by developing a more comprehensive measure of firms' investment opportunities using factor analysis techniques. Based on a pooled regression for a sample of 1,249 firms for year 1992 and 1993, the authors find that accounting earnings and stock returns are positively associated with CEO cash compensation, but the interaction between the investment opportunity proxy and accounting earnings and the interaction between the proxy and stock returns are insignificant. In CEO total pay model accounting earnings and its interaction with the investment opportunity proxy are statistically insignificant, but stock returns receive a positive weight which increases for firms with significant investment opportunities. Overall, Baber et al. provide some

evidence that stock returns but not accounting earnings are used in CEO compensation consistent with the sensitivity vs. precision hypothesis.

Sloan (1993) predicts and finds evidence that earnings-based performance measures are used in addition to stock returns because they help to shield executives from market-wide factors that are beyond the executives' control. Based on a pooled regression analysis of 6,132 observations for 538 firms covered by Forbes annual CEO compensation surveys from 1970 to 1988, Sloan finds that CEO cash compensation is more sensitive to earnings in firms where stock returns have a higher association with the market-wide "noise" in equity values, where accounting earnings have a higher association with the firm-specific "signal" in stock returns, and where earnings have a less positive or more negative association with the market-wide "noise" in equity values. Accounting earnings are proxied by changes in return on assets or changes in earnings per share. The market wide "noise" refers to the portion of stock returns determined by the general stock market which is beyond managerial control. The firm-specific "signal" in stock returns is the difference between raw stock returns and the market-wide "noise".

Another line of research examines the relative performance evaluation hypothesis (RPE), which argues that a contract based on a raw performance measure is less optimal than a contract based a relative performance measure which is adjusted for market-wide or industry-wide factors. This is because the RPE reduces unnecessary risks the agent would otherwise have to share and be compensated for. A common approach to test the RPE hypothesis is to run a regression of managerial compensation on raw stock returns and market (or industry) returns, and a significant negative coefficient on market (or

industry) returns is consistent with firms using RPE in CEO compensation. Similarly, researchers have also examined whether the RPE exists for accounting performance measures. A few papers test for the RPE for both accounting earnings and stock returns, and find little evidence of the existence of the RPE (see, for example, Antle and Smith, 1986; Gibbons and Murphy, 1990; Janakiraman, Lambert and Larcker, 1992).[4]

A number of papers examine how certain properties of accounting earnings affect the use of earnings in executive compensation conditional on stock returns (Baber, Kang and Kumar, 1998, 1999; Bushman, Engel and Smith, 2006). In general, these papers find that more persistent earnings or earnings that are more informative of stock returns as proxied by a higher earnings response coefficient (ERC) receive greater weight in CEO compensation. Leone, Wu and Zimmerman (2006) examine how one particular property of stock returns – the sign of stock returns affects the use of stock returns in CEO cash compensation. The authors find that CEO cash compensation is twice as sensitive to negative stock returns as it is to positive stock returns, consistent with boards of directors exercising discretion to reduce costly ex post settling up in cash compensation paid to CEOs.

Other papers have examined how industry characteristics, firm characteristics (governance structure in particular), and regulatory changes affect the relative weights on earnings and stock returns in executive compensation. For example, Engel, Gordon and Hayes (2002) find that internet firms place less weight on earnings and more weight

[4] Rajgopal, Shevlin and Zamora (2006) provide one explanation to the lack of the RPE following theoretical work of Oyer (2004) who argues that CEO's reservation wages from outside employment opportunities vary with the economy's fortunes which may make the absence of RPE optimal.

on stock returns in determining their CEO's compensation than do non-internet firms. In addition, compensation of firms with little or no venture capital influence displays significantly stronger association with accounting and stock performance measures than that of firms with more intense monitoring by venture capitalists, consistent with firms using incentive contracts as a supplement to direct monitoring. Dikolli, Kulp and Sedatole (2006) argue that high transient institutional ownership may induce managers to over-allocate efforts towards increasing current earnings and under-allocate efforts towards creating long-term firm value. Thus, firms with high transient institutional ownership may try to mitigate such managerial incentives by reducing the weight on accounting earnings in CEO compensation. The authors find evidence consistent with their hypothesis for CEO bonus pay. Davilia and Penalva (2006) show that compensation contracts in firms with higher takeover protections and firms whose CEO possessing more influence on governance decisions put more weight on accounting earnings compared to stock returns, consistent with CEOs exerting their bargaining power through the design of the contract. Vafeas and Afxentiou (1998) examine how the 1992 SEC rule on the disclosure of executive compensation affects CEO compensation and find that the weights on both earnings and stock returns in CEO cash compensation increase after implementation of the new disclosure rule. Perry and Zenner (2001) examine the impacts of two regulation changes occurred during 1992 and 1993, the new SEC disclosure rule and tax legislation limiting the deductibility of nonperformance-related compensation over one million dollars [Section 162(m) of the Internal Revenue Code]. The authors find that CEO compensation becomes more sensitive to stock returns

after 1993 especially for firms with million-dollar pay packages although changes in the sensitivity of compensation to accounting profitability measures do not show clear patterns.

The board of directors not only relies on performance measures to determine the level of CEO compensation, but also refers to them in making a decision of whether to keep or fire the CEO. Studies such as Weisbach (1988) and Murphy and Zimmerman (1993) provide evidence that both accounting earnings and stock returns are relevant in predicting CEO turnover. Weisbach (1988) further finds that the board appears to rely more on accounting performance than stock performance to make its decision of keeping or firing the CEO. This is probably because stock returns embed the market' expectations of the future including the possibility of the firm hiring a new CEO, leaving accounting earnings a cleaner measure of the incumbent CEO's performance. Finally, A few papers discuss methodological issues in examining the relative weights on earnings and stock returns in CEO compensation such as differential multi-period effects of different performance measures (Boschen, Duru, Gordon and Smith, 2003) and the simultaneity of performance and pay (Anderson, Banker and Ravindran, 2000).

In sum, the empirical research provides rich evidence on the relative use of accounting earnings and stock returns in CEO compensation. Some studies find evidence consistent with the predictions of agency theory, others do not. At the minimum, however, almost all studies have documented a positive association between CEO *cash* compensation and accounting earnings conditional on stock returns. While evidence from CEO cash compensation is important, it has become less relevant in the face of the

explosion of equity-based compensation in the past several decades. Recent studies show that equity-based compensation has become a major part of CEO total pay. For example, Hall and Liebman (1998) document a seven fold increase in the value of stock option grants to CEOs as compared to a 100 percent increase in salary and bonus for a sample of Forbes 500 firms from 1980 to 1994. Murphy (1999) shows that during the mid 1990s, stock options replaced base salaries as the single largest component of CEO compensation for large US public companies (in all sectors except utilities). In year 1996, stock options account for 36% of CEO total pay as compared to 27% from base salary and 20% from bonus. Bebchuk and Grinstein (2005) show that this trend continues into the 21st century; the proportion of stock options in total CEO pay for S&P 500 firms has increased to 59% by 2003. [5]

Along with the explosion of stock options is the tiny pay-for-performance sensitivity from cash compensation as compared to equity-based compensation. The pay-for-performance measures the change in the manager's compensation for a change in shareholders' wealth (or firm's market value). For example, Jensen and Murphy (1990) show that during 1974 and 1986, CEO cash compensation changes only by 2 cents for each $1000 change of shareholders wealth, as compared to a $2.5 change in CEO's wealth due to stock ownership. Hall and Liebman (1998) find that for a given change in firm value, the change in CEO equity-based compensation is 53 times greater than that in CEO cash compensation. More recently, Core et al. (2003) find that for 81% of the

[5] Note that the above evidence is concerned with CEO total pay which includes cash and grants of stocks and stock options but excludes the value change in CEO beginning-of-the-year holdings of stocks and options. The proportion of equity-based compensation will be even larger if equity holding is considered.

CEOs in their sample from 1993 to 2000, the incentives provided by cash compensation are less than 10 percent of the incentives provided by the CEO's stocks and stock options.

An implication of the tiny pay-for-performance sensitivity of cash compensation is that no matter how important accounting earnings are to CEO *cash* compensation, earnings are unlikely to play a significant role in determining the value of CEO *total* compensation because the variation in CEO cash compensation is too small as compared with that of equity-based compensation to make a difference to CEO incentives. Consistent with this implication, Core et al. (2003) show that for a substantial majority of CEOs, cash compensation variance is less than 1 percent of the variance of the equity-based compensation. In addition, a few studies directly include CEO total pay or total compensation in testing the relative weights on earnings and returns and most of them fail to find a significant association between accounting earnings and CEO total pay or total compensation conditional on stock returns. For example, Baber et al. (1996) find earnings significant in CEO cash compensation but not in CEO total pay, and that the interaction of earnings and investment opportunity proxy is statistically insignificant in both cases. Baber et al. (1998) find that earnings receive greater weight in CEO cash compensation when earnings are persistent, but earnings and its interaction with earnings persistence are statistically insignificant in CEO total pay. Similarly, Davila and Penalva (2006) find earnings and its interaction with relevant corporate governance factors significant for CEO cash compensation but insignificant for CEO total pay. Finally, Dikolliet et al. (2006) find earnings significant to CEO cash pay but not to CEO total pay

even though the interaction between earnings and the variable of interest (transient institutional ownership) is significant in the total pay model. In all these papers, stock returns are statistically significant in both CEO cash compensation and CEO total pay. [6]

Because of the small impact of cash pay on CEO incentives some economics and finance studies simply ignore cash compensation in examining the pay-for-performance sensitivity and view the sensitivity related to cash compensation as lost in the rounding error (Hall and Liebman, 1998; Baker and Hall, 2004). Bushman and Smith (2001, p243) comment that "*There is clearly a challenge here for accounting researchers to understand this decline in the 'market share' of accounting information in top executive compensation…*", and "*It is also the case that future compensation research focuses on the role of accounting information in the cash compensation of top U.S. executives must be prepared to defend its relevance in the face of this decline in market share.*"

The current study argues that earnings' impact on CEO compensation goes beyond CEO cash compensation. Accounting earnings are informative about firms' future cash flows and hence affect firm value, and news of accounting earnings usually has a significant impact on stock price. This "valuation role" of accounting earnings is viewed as a primary function of accounting earnings in the capital markets and has been extensively studied. (See Kothari, 2001, section 4.1.1 and section 4.3 for a detailed

[6] Perry and Zenner (2001) find that EPS is significantly positive but stock return is insignificant for CEO total pay for their sample. Boschen, Duru, Gordon and Smith (2003) examine the long-run (multi-year) effects of accounting earnings and stock returns on CEO compensation. In their replication of the traditional test that is based on annual changes in CEO compensation, they find evidence that accounting earnings are significant to CEO total pay conditional on stock returns. However, their sample consists of only 30 firms that have survived the sample period from 1959 to 1995, and the equity-based compensation was not a major component of CEO compensation for at least half of their sample period. In addition, their measure of compensation does not include the value change in CEO beginning-of-the-period equity holdings.

review.) As CEO equity-based compensation is directly linked to stock price, any price movement due to earnings news also affects the value of CEO equity-based compensation. Thus, accounting earnings not only have a *direct* impact on CEO cash compensation which has been viewed as earnings' traditional contracting role, but also an *indirect* impact on CEO equity-based compensation due to earnings' impact on stock price. The current study estimates both the *direct* and *indirect* impacts of earnings and provides evidence on the joint effect of earnings' valuation role and contracting role on CEO total compensation.

The study contributes to the empirical compensation literature by providing a comprehensive analysis of the overall impact of earnings on CEO compensation. It demonstrates that as the practice of CEO compensation evolves, so do the ways accounting earnings influence CEO compensation. On one hand, the traditional contracting role as reflected in earnings' impact on CEO cash compensation has become less important in the presence of equity-based compensation; on the other hand, however, earnings' valuation role has become increasingly important in CEO compensation due to the heavy reliance of CEO compensation on stock performance. To my knowledge, this study is the first to demonstrate the joint effect of earnings' valuation role and contracting role on CEO compensation and the first to provide evidence that accounting earnings are an economically significant factor to CEO total compensation. Such evidence verifies the importance of accounting earnings in CEO compensation contract even in today's world where stocks and stock options dominate CEO compensation.

A second contribution of the study is that is introduces an approach that enables examination of agency predictions for CEO *total* compensation. As discussed earlier, most of the prior studies find earnings insignificant to CEO total pay or total compensation conditional on stock returns. Such evidence makes it difficult, if not impossible to further examine how the relative use of accounting earnings and stock returns varies with economic factors predicted by agency theory. However, tests based on total pay or total compensation are theoretically more relevant to agency models than tests based on cash compensation. Baker (1987) and Bushman and Smith (2001) point out that the slope coefficients on earnings and returns from a *cash* compensation regression do not have the theoretical interpretations derived from agency models because agency theory identifies managerial wealth, not current year cash compensation as the key variable of concern to managers. CEO total compensation, which includes not only cash and grants of stocks and options but also the reevaluation of CEO equity holdings is viewed as a proxy for managerial wealth and has been widely used in the economics and finance literatures (see, for example, Jensen and Murphy, 1990; Hall and Liebman, 1998; Aggarwal and Samwick, 1999). Under the new approach which incorporates earnings' valuation role in examining earnings' influence on CEO compensation, I am able to find significant impact of earnings on CEO total compensation, which allows me to further test agency predictions in the context of CEO total compensation. To demonstrate the potential usefulness of the new approach, I re-examine the classical sensitivity-noise hypothesis for CEO total compensation. I find strong evidence that firms use accounting earnings (but not stock returns) in a matter that

is consistent with the agency prediction. Such evidence extends prior findings which are exclusively based on CEO cash compensation.

A third contribution of the study is that it verifies a key assumption of recent earnings management research related to CEO equity-based compensation. This research provides evidence that earnings management activities are positively associated with CEO incentives arising from their equity-based compensation. This research suggests that CEOs manipulate earnings in order to maintain and/or realize the value of their equity-based compensation. For example, Cheng and Warfield (2005) find that CEOs with greater equity incentives (measured as the value of CEO stock option grants, the value of their outstanding stock options, and their stock ownership) are more likely to report earnings that just meet or beat analysts' forecasts, and are less likely to report large positive earnings surprise. This is consistent with managers reserving good news to avoid potential price drops due to future earnings disappointment. In addition, Cheng and Warfield (2005) and Bergstresser and Philippon (2006) find that CEOs with higher equity incentives are more likely to report income-increasing abnormal accruals and sell more shares following the year of high accruals. Bauman and Shaw (2006) extend the findings of Cheng and Warfield to the top five executives of US public firms and show that executives with a higher proportion of option grants in their total compensation are more likely to manipulate earnings. Focusing on extreme cases, Efendi, Srivastava and Swanson (2006) find a positive association between the amount of CEO in-the-money stock options and the propensity for the firm to misreport. Burns and Kedia (2006) find a

positive association between the sensitivity of CEO option portfolio to stock price and the propensity for the firm to misreport.

Overall, this research suggests that incentives arising from CEO stocks and stock options may drive CEOs to manage earnings. An underlying assumption of this research is that the impact of accounting earnings on CEO equity-based compensation is economically significant. That is, changes in the value of CEO equity-based compensation due to changes in earnings are large enough to induce CEOs to manipulate earnings. While this assumption sounds plausible, it receives little support from the empirical compensation research. As discussed earlier, most studies in this research have focused on *cash* compensation, and the only few that touch on CEO equity-based compensation do not find a significant association between accounting earnings and CEO total pay or total compensation. In contrast, the current study provides evidence that accounting earnings are economically significant to CEO equity-based compensation and CEO total compensation. Thus, the study verifies the underlying assumption of the earnings management research and supports the argument that earnings' impact on CEO equity-based compensation may be large enough to induce earnings management activities.

3. RESEARCH DESIGN

While the argument that accounting earnings affect CEO compensation via earnings' valuation role is intuitive, it has been formally examined by analytical work such as Kim and Suh (1993) and Feltham and Wu (2000). These papers provide not only theoretical support to the current study but also guidance on the research design. Kim and Suh (1993) and Feltham and Wu (2000) use agency model to examine the optimal weights on accounting earnings and stock price in a compensation contract. An important feature of these papers is that they explicitly model earnings' impact on stock price in determining the optimal relative weights. The authors assume that assuming market efficiency, two equilibriums are present when earnings and stock price are both used in a compensation contract: an optimal contracting equilibrium and a rational expectation equilibrium in which stock price is determined by all available information including accounting earnings. [7] Kim and Suh (1993) point out because stock price impounds earnings information the informativeness of stock price in a compensation contract should depend on the information price conveyed *incremental* to earnings. The authors call the price signal conveying the *incremental* information the "*filtered* price" because theoretically it can be obtained by filtering earnings information from the *raw* stock price. The authors solve for the efficient market price and the optimal weights on the *filtered* price and accounting earnings under the dual equilibrium conditions assumption. They document that the relative weight of earnings to the *filtered* price is

[7] Also see Diamond and Verrecchia (1982), Dye (1985), Paul (1992), Holmstrom and Tirole (1993) and Bushman and Indjejikian (1993b), Chen, Hemmer and Zhang (2007) that assume two equilibriums in examining the agency problem.

larger than the relative weight of earnings to the *raw* price. This is because a portion of the compensation impact of stock price is actually attributable to earnings; using the raw price double-counts the impact of stock price and underestimates the impact of earnings.

Feltham and Wu (2000) assume that stock price is jointly determined by a public report (for example, accounting earnings), non-observable private information and random supply of noise traders, and they use "*filtered* price" to proxy for the non-observable, private information which is orthogonal to the information in the public report. The authors examine how alternative types of private information determine the equilibrium market price and the relative weights on the public report and the *filtered* price. Like Kim and Suh (1993), Feltham and Wu (2000) provide that the relative weights on a public report and the *filtered* price differ from those on a public report and the *raw* price; the *raw* price captures not only investors' private information but also information in the public report, creating a "double counting" problem. Kim and Suh (1993) and Feltham and Wu (2000) suggest that researchers use the *filtered* price in empirical tests to avoid overstating the relative weight on stock price. While their focus is on the "correct" weight on stock price, the use of the *filtered* price will also yield the "correct" weight on earnings because in such a setting the weight on earnings reflects the full impact of accounting earnings on CEO compensation including the impact that would otherwise be subsumed by the *raw* stock price.

I apply two approaches in the empirical tests. Under the first approach I follow the suggestion of Kim and Suh (1993) and Feltham and Wu (2000) by estimating a proxy for the *filtered* price. Under the second approach I do not directly utilize the

filtered price concept; instead, I estimate earnings' impact on stock price and then compute the changes in CEO compensation corresponding to such price impact of earnings.

3.1. Approach 1

Under the first approach, I run a regression of annual stock returns on changes in annual accounting earnings and view the residual term as a proxy for the *filtered* price.

$$RET_{i,t} = a_0 + a_1 \Delta E_{i,t} + e_{i,t} \quad (1)$$

Where $RET_{i,t}$ is the annual buy-and-hold return of firm i in year t, and $\Delta E_{i,t}$ is the change in firm i's EPS from year t-1 to year t scaled by share price at the beginning of year t. The residual term $e_{i,t}$ represents information content of stock price orthogonal to accounting earnings, and is viewed as a proxy for the *filtered* price. [8] Second, I estimate the relative weights on earnings and the *filtered* price for various compensation models. For simplicity I only write out models of individual compensation components but not the combined compensation components.

$$\Delta Cash_{i,t} = b_{10} + b_{11} * \Delta E_{i,t} + b_{12} * e_{i,t} + u_{1i,t} \quad (2a)$$
$$\Delta Equity\_grants_{i,t} = b_{20} + b_{21} * \Delta E_{i,t} + b_{22} * e_{i,t} + u_{2i,t} \quad (2b)$$
$$\Delta Equity\_holdings_{i,t} = b_{30} + b_{31} * \Delta E_{i,t} + b_{32} * e_{i,t} + u_{3i,t} \quad (2c)$$

Where $\Delta Cash_{i,t}$ is the change in CEO cash compensation in year t, $\Delta Equity\_grants_{i,t}$ is the value change in grants of stocks and stock options in year t, and $\Delta Equity\_holdings_{i,t}$ is the value change in CEO equity holdings at the beginning of year t. Take model (2c) for example. The coefficient on the *filtered* price (b_{32}) reflects the impact of stock price on CEO equity holdings free of the influence of earnings news.

[8] In the empirical tests I also control for years and industries in estimating model (1) and all compensation models.

The coefficient on accounting earnings (b_{31}) reflects earnings' full impact on the value of CEO equity holdings and represents a portion of the *indirect* impact of earnings. Another portion of the *indirect* impact comes from earnings' impact on CEO equity grants, as represented by b_{21}. Finally, the coefficient on earnings in model (2a) (b_{11} reflects earnings' full impact on CEO cash compensation, which is the *indirect* impact. These models differ from models used in prior studies based on the *raw* stock returns:

$$\Delta Cash_{i,t} = c_{10} + c_{11}*\Delta E_{i,t} + c_{12}*RET_{i,t} + u_{1i,t} \quad (3a)$$
$$\Delta Equity\_grants_{i,t} = c_{20} + c_{21}*\Delta E_{i,t} + c_{22}*RET_{i,t} + u_{2i,t} \quad (3b)$$
$$\Delta Equity\_holdings_{i,t} = c_{30} + c_{31}*\Delta E_{i,t} + c_{32}*RET_{i,t} + u_{3i,t} \quad (3c)$$

To see the difference between models (2a-2c) and models (3a-3c), note that the coefficient on earnings in model (3c) (c_{31}) reflects earnings' impact on CEO equity holdings conditional on *raw* stock returns. The coefficient is unlikely to be significant because any potential impact of earnings on CEO equity holdings may have been subsumed by raw stock returns. Model (2c) avoids the double counting problem by using a proxy for stock return that is orthogonal to accounting earnings, allowing the coefficient on accounting earnings (b_{31}) to pick up the full impact of earnings on CEO compensation. I expect earnings to be important to the value of CEO equity grants and CEO equity holdings conditional on stock returns that are driven by non-earnings news. That is, I predict b_{31} and b_{21} to be significantly positive. Prior studies have already found accounting earnings to be important to CEO cash compensation conditional on raw stock returns. To the extent that some of the positive association between CEO cash compensation and stock returns may come from earnings' influence on stock returns, I

expect the direct impact identified by Model (2a) to be even greater than what has been previously documented, i.e., I expect b_{11} to be larger than c_{11}.

3.2. Approach 2

The first approach is based on an association research design and implicitly assumes that the correlation of returns and earnings is driven by earnings' impact on stock returns. However, the correlation is a noisy proxy of earnings' valuation role as covariance does not necessarily imply causality. Consequently, the first approach may overstate the valuation role of earnings and hence earnings' impact on CEO compensation arising from earnings' valuation role. Approach 2 addresses this issue by taking advantage of an event study design. Assuming that stock movements around earnings announcement are mostly driven by earnings news, I examine the association between CEO compensation and stock returns around earnings announcement conditional on non-earnings-announcement-day stock returns. A significant association is viewed as evidence that earnings are important to CEO compensation conditional on stock returns driven by non-earnings news. Based on results from this test I provide alternative estimate of earnings' direct and indirect impact on CEO compensation.

In the first part of Approach 2, I run the following set of regressions for each compensation model. A demonstration using CEO equity holdings is shown below.

$$\Delta Equity\_holdings_{i,t} = d_0 + d_1 * NON\_EA\_RET_{i,t} + u_{i,t} \quad (4a)$$
$$\Delta Equity\_holdings_{i,t} = d_0 + d_2 * EA\_RET_{i,t} + u_{i,t} \quad (4b)$$
$$\Delta Equity\_holdings_{i,t} = d_0 + d_3 * NON\_EA\_RET_{i,t} + d_4 * EA\_RET_{i,t} + u_{i,t} \quad (4c)$$

Where $EA\_RET_{i,t}$ is the sum of the three-day cumulative raw returns around all earnings announcements of firm i in year t. That is,

$$EA\_RET_{i,t,} = \sum_{j=1}^{4} CUM\_RET_{i,t,j} \quad (5)$$

Where $CUM\_RET_{i,j,t}$ is the three-day (-1,0,1) cumulative raw stock return around the *jth* earnings announcement of firm *i* in year *t*. Thus, *EA_RET* represents a 12-day cumulative return for each firm-year. I treat the difference between annual stock return and *EA_RET* as stock return driven by non-earnings information, and call it *NON_EA_RET*.

Model (4a) measures the impact of non-earnings-announcement-day stock return on CEO compensation. It serves as a benchmark and I expect d_1 to be significantly positive. Model (4b) examines the impact of *EA_RET* on CEO compensation and I expect d_2 to be significantly positive. Model (4c) tests for the significance of *EA_RET* conditional on *NON_EA_RET*. This test controls for the possibility that the significance of *EA_RET* in Model (4b) may come from the correlation of *EA_RET* and *NON_EA_RET*. I expect d_3 and d_4 in Model (4c) to be both significantly positive. Assuming that *EA_RET* is driven by earnings news, a positive d_4 implies that earnings news is significant to CEO compensation conditional on stock return driven by non-earnings news.

In the second part of Approach 2 I re-examine the compensation impact of earnings based on an estimate of the short-window ERC. The ERC measures the market's reaction to unexpected earnings changes. The higher the ERC, the stronger reaction the market has towards earnings news, indicating a more important valuation role of earnings. I use changes in quarterly earnings as a proxy for unexpected earnings

changes and estimate the ERC based on the following short-window return-earnings model:

$$CUM\_RET_{i,t,j} = a_0 + a_1 \Delta QE_{i,t,j} + e_{i,t,j} \quad (6)$$

Where $\Delta QE_{i,t,j}$ is firm *i*'s j^{th} quarter EPS in year *t* minus the EPS of the same quarter in year *t-1*, scaled by stock price at the end of the earlier quarter. Next I rewrite Model (4c) by replacing *EA_RET* with *CUM_RET*, and further replacing *CUM_RET* with the right hand side of model (6). That is,

$$\Delta Equity\_holdings_{i,t} = d_0 + d_3 * NON\_EA\_RET_{i,t} + d_4 * \sum_{j=1}^{4} CUM\_RET_{i,t,j} + u_{i,t}$$

$$= d_0 + d_3 * NON\_EA\_RET_{i,t} + d_4 * \sum_{j=1}^{4} (a_0 + a_1 \Delta QE_{i,t,j} + e_{i,t}) + u_{i,t}$$

Define $\Delta\overline{QE}_{i,t}$ as the average quarterly earnings, that is, $\Delta\overline{QE}_{i,t} = \frac{1}{4}\sum_{j=1}^{4} \Delta QE_{i,t,j}$. The above can be written as:

$$\Delta Equity\_holdings_{i,t} = Const + d_3 * NON\_EA\_RET_{i,t} + 4a_1 d_4 * \Delta\overline{QE}_{i,t} + error_{i,t} \quad (7)$$

Where $Const = d_0 + 4d_4 a_0$, and $error_{i,t} = d_4 \sum_{j=1}^{4} e_{i,t,j} + u_{i,t}$

Intuitively, a_1 reflects stock movements in response to earnings news at a single earnings announcement, and $4a_1$ measures stock movements in response to earnings news from all four earnings announcements during a firm's fiscal year, or stock movements in response to annual earnings news. As the coefficient d_4 reflects the change in CEO compensation for a change in price due to annual earnings news, "$4a_1 d_4$" reflects the impact of annual earnings news on CEO compensation.

Approach 2 is a conservative test in that it may underestimate earnings' valuation role and hence the indirect impact of earnings on CEO compensation. One source of the underestimation is the existence of the post-earnings announcement drift (PEAD), the markets' delayed reaction to earnings news. Empirical studies have found that the PEAD may extend for several quarters after earnings announcement, and the phenomenon is persistent and economically significant (see Kothari 2001, section 4.4.2.1 for a review). To the extent that the market's response to earnings announcement continues for months instead of ending one day after earnings announcement, Approach 2 may fail to capture the market's full response to earnings news. Thus, the ERC will be underestimated and so will be the compensation impact of earnings calculated from the ERC.

Second, some earnings-related information (firms' earnings forecast, non-earnings- announcement-day conference calls, press news, and analysts' earnings forecasts, etc) may preempt quarterly earnings announcement and thus reduce the market's reaction around the subsequent earnings announcement. Analytical research argues that the quality or informativeness of predisclosure is inversely related to investors' reliance on a subsequent earnings announcement (see, for example, Holthausen and Verrecchia, 1988; Demski and Feltham, 1994; Subramanyam, 1996). Empirical studies such as Shores (1990), Gelb and Zarowin (2002), and Frankel and Li (2004) provide evidence consistent with these analytical findings.[9] To the extent that the market reacts to earnings news prior to earnings announcement, *EA_RET* may be underestimated as a portion of the stock returns driven by earnings news may have been

[9] Francis, Schipper and Vincent (2002) also examine the issue but provide mixed evidence on this issue.

absorbed by *NON_EA_RET*. Therefore, earnings' valuation role and its compensation impact arising from the valuation role will also be understated. As a matter of fact, because the information environment is continuous and multidimensional, it is very difficult, if not impossible to capture the exact impact of earnings on stock price. Therefore I view Approaches 1 and 2 as complements in the sense that they provide estimates of the upper bound and lower bound of the compensation impact of earnings.

4. SAMPLE SELECTION, MEASUREMENT OF VARIABLES AND DESCRIPTIVE STATISTICS

4.1. Sample Selection

I obtain an initial sample of 20,113 CEO-year observations in the ExecuComp database from 1993 to 2004. Similar to Sloan (1993), Baber et al. (1998) and Core et al. (2003), I require that the CEO provide full service in the current year and the prior year which reduces the sample to 13,870 observations. I eliminate 1,393 observations that do not have relevant compensation data. I then combine this sample with the Compustat database and CRSP database and require valid data on annual EPS, changes in annual EPS and annual stock returns. These procedures eliminate another 151 observations. The final sample consists of 12,326 CEO-year observations representing 2,376 firms from 1993 to 2004.

4.2. Compensation Variables

I obtain data on CEO cash compensation, equity grants, and total pay directly from ExecuComp database. The value change in CEO stock holdings is measured as the number of shares held by the CEO at the beginning of the year multiplied by annual buy-and-hold stock return calculated from the monthly stock returns in CRSP. The change in the value of CEO option holdings is measured as the number of options held by the CEO at the beginning of the year multiplied by an estimate of the change in the option price per share during the year. I follow Core et al. (2003) in estimating the change in the option price per share. Specifically, I compute the Black-Scholes value of option per share at the beginning of year *t*, and then estimate a "*pro forma*" option value per share

at the end of year *t*. I treat the difference between the two as the value change per share of CEO beginning-of-the-year option holdings. I apply the one-year approximation approach ("OA") of Core and Guay (2002) in computing the Black-Sholes value of option per share at the beginning of year *t*. The OA approach allows accurate estimate of the value and sensitivity of employee stock options using only the current year's corporate proxy statement. Core and Guay (2002) show the OA approach captures more than 99 percent of the variation of the values and sensitivities of employee stock options. The Black-Scholes model requires six parameters to calculate the option value: stock price, exercise price, time-to-maturity, stock volatility, dividend yield and interest rates. I obtain all parameters of the Black-Scholes model except the interest rates from ExecuComp database. The stock volatility is measured as the standard deviation of stock price over the past 60 months and the dividend yield is measured as the average dividend yield over the past three years. I obtain the interest rates information from the Federal Reserves Bank Report database in WRDS which is based on the Federal Reserve Board's H.15 release that contains selected interest rates for U.S. treasuries. To calculate the *pro forma* option price at the end of year *t*, I use the same parameters used to calculate the option price at the beginning of year *t* with two exceptions: I reduce the time-to-maturity of each option group by one year,[10] and replace stock price at the beginning of year *t* with stock price at the end of year *t*. This method allows researchers

[10] The OA approach classifies options into three groups: options granted in the current year, previously granted unexercisable options and previously granted exercisable options. Following Core et al (2003) I modify the OA approach by assuming time-to-exercise equal to 70 percent of the stated time-to-maturity. Therefore in calculating the value of previously granted options, I reduce the time-to-maturity of each category of stock options by 0.7 year.

to focus on the variation in option value due to stock price changes and ignore variation due to other factors such as interest rates.

Following Baber et al. (1998) and Core et al. (2003) I use unexpected percentage changes in CEO compensation in the empirical tests to remove the effect of scale differences in compensation across the sample. Specifically, I use actual compensation in year *t-1* to proxy for expected compensation in year *t* for cash compensation, equity grants and total pay. Thus,

Changes in CEO cash compensation:
$\Delta Cash_{i,t} = (Cash_{i,t}-Cash_{i,t-1})/ Cash_{i,t-1};$

Changes in CEO equity grants:
$\Delta Grants_{i,t} = (Grants_{i,t}-Grants_{i,t-1})/Grants_{i,t-1};$

Changes in CEO total pay:
$\Delta Total\_pay_{i,t} = (Total\_pay_{i,t} – Total\_pay_{i,t-1})/Total\_pay_{i,t-1};$

Where *Cash* is salary and bonus, *Grants* is the Black_Scholes value of current year grants of restricted stocks and stock options, and *Total_pay* is the sum of *Cash* and *Grants*. However, the above approach does not apply to the value change in CEO equity holdings because it assumes negative compensation in year *t* when stock returns are negative, even though expected returns and expected compensation are always positive. Following Core et al., I assume a 10% expected return on CEO stock holdings and option holdings. Thus, the changes in CEO beginning-of-the-year equity holdings, Δ*Equity_holdings* are the sum of the value change in CEO stock holdings (*chg_stk*) and the value change in CEO option holdings (*chg_opt*) minus 10% of the value of CEO stock holdings and CEO option holdings at the beginning of year *t*. The changes in CEO

total equity-based compensation, $\Delta Total\_equity$ are the changes in CEO equity holdings as defined above plus the changes in CEO equity grants from *t-1* to *t*. Finally, the changes in CEO total compensation, $\Delta Total\_comp$ are the changes in CEO equity holdings plus the changes in CEO total pay. All compensation variables are scaled by the expected compensation for year *t* so that all dependent variables are in percentage terms.

Changes in the value of CEO beginning-of-the-year equity holdings:

$$\Delta Equity\_holdings_{i,t} = \frac{chg\_stk_{i,t} + chg\_opt_{i,t}}{10\% * (stock\_holdings_{i,t-1} + option\_holdings_{i,t-1})} - 1$$

Changes in CEO total equity-based compensation:

$$\Delta Total\_equity_{i,t} = \frac{chg\_stk_{i,t} + chg\_opt_{i,t} + equity\_grant_{i,t}}{10\% * (stock\_holdings_{i,t-1} + option\_holdings_{i,t-1}) + equity\_grant_{i,t-1}} - 1$$

Changes in CEO total compensation

$$\Delta Total\_comp_{i,t} = \frac{Total\_pay_{i,t} + chg\_stk_{i,t} + chg\_opt_{i,t}}{Total\_pay_{i,t-1} + 10\% * (stock\_holdings_{i,t-1} + option\_holdings_{i,t-1})} - 1$$

4.3. Other Key Variables

Similar to Sloan (1993) and Core et al. (2003), I define accounting earnings as annual basic EPS excluding extraordinary items (Compustat annual data item 58), and changes in annual EPS (ΔE) as EPS in year *t* minus EPS in year *t-1*, scaled by share price at the end of *t-1*. The quarterly changes in earnings (ΔQE) are measured as quarterly basic EPS excluding extraordinary items (Compustat quarterly data item 19) in year *t* minus EPS of the same quarter in year *t-1*, scaled by share price at the end of the earlier quarter (Compustat quarterly data item 14). All EPS variables and stock price are adjusted for stock dividends and stock splits. Annual stock return (*RET*) is the raw

annual buy-and-hold return calculated from monthly stock returns in CRSP database. The percentage changes of the compensation items can vary dramatically due to small denominators. Therefore, following Baber et al. (1996) and Core et al (2003), I winsorize all the percentage change variables at the top and bottom 0.5 percent. I also winsorize changes in EPS and *RET* to control for outliers in the independent variables.

4.4. Descriptive Statistics

Table 1 reports descriptive statistics of the full sample. In Panel A, the mean values of CEO stock holdings and option holdings are $128.93 millions and $20.15 millions, respectively. The corresponding median values are $7.86 millions and $5.70 millions, respectively. Overall, CEO equity holdings vary dramatically across the sample especially in the upper quartile. In addition, the variance and maximum value of stock holdings is 20-30 times those of option holdings. In Panel B, the mean (median) CEO cash compensation is $1.41 millions ($0.98 million). The cash compensation is relatively tightly distributed with a standard deviation of $1.87 millions. The equity grants have a mean (median) value of $2.83 millions ($0.80 million) and a standard deviation of $11.79 millions, which is more than four times its mean, and more than six times the standard deviation of cash compensation. Consistent with prior studies that find option grants a major component of CEO total pay, the value of option grants is 168% (63%) of cash compensation at the mean (median). The grants of restricted stocks are much less popular: more than 75 percent firms do not grant stocks to its CEO in an average year. Combining cash compensation and equity grants, CEO total pay has a mean (median)

value of $4.65 millions ($2.18 millions) and a standard deviation of $12.52 millions. Obviously, most of the variation in CEO total pay comes from the equity grants.

The mean (median) value change in CEO beginning-of-the-year equity holdings is $22.52 millions ($.58 million), which is around 480% (27%) that of total pay. [11] Unlike total pay, the value change in equity holdings can be negative; more than one quarter of the CEOs loses money in equity holdings in a given year. The standard deviation of the value change in CEO equity holdings is $637 millions. Further analysis (not tabulated) shows that the dollar value at the 5th and 95th percentiles are negative $36 millions and positive $69 millions, respectively. This range is much larger than that on CEO total pay ($0.4 million at the 5th percentile and $15 millions at the 95th percentile). Thus, consistent with Jensen and Murphy (1990), Hall and Liebman (1998) and Core et al. (2003), the value change in CEO equity holdings is the major source of the variation in CEO total compensation. The value change in equity holdings also determines the mean, min and max values of CEO total equity-based compensation and CEO total compensation. For example, the mean values of total equity-based compensation and total compensation are $25.35 millions and $27.16 millions, respectively, which are very close to the mean value ($25.22 millions) of the value change in CEO equity holdings.

[11] Note that the change in the value of equity holdings calculated may be different from the true value change. In the case of stock holdings, the CEO may have sold the shares during the year and the realized return may be different from the actual annual return. In the case of option holdings, the CEOs may exercise their vested options and sell the stocks during the year, and the selling price may be different from the year-end price used to calculated option value per share. In addition, because I only allow stock price and time-to-maturity to change in the Black-Sholes model and require other variables (interest rate, return volatility, dividend yield) to remain unchanged, the computed value change differ from the actual value change in options.

The median value of equity holdings is .58 million which is lower than both the cash compensation and equity grants.

Panel C reports descriptive statistics of the percentage changes in CEO compensation items. All the percentage changes are significantly positive at the mean. Cash compensation increases by 16% per year. The annual increases of equity grants, the value change in CEO equity holdings and total equity-based compensation are 66%, 65% and 69%, respectively. The annual change of total pay (42%) is about the average of that of cash compensation and equity grants. Overall, CEO total compensation increases by 38% in an average year over the sample period. At the median the increase of CEO compensation is between 5% and 11% except for the value change in equity holdings and the total equity-based compensation. The unexpected change in CEO equity holdings is -14% which implies that the stocks and options held by CEOs earn a median return of 8.6%. (Recall that I assume 10% *expected* return on CEO stock holdings and option holdings.) The median change in CEO total equity-based compensation is zero, resulting from the positive change in equity grants and the negative change in equity holdings. Finally, evidence in Panel C confirms findings in Panel B that the value change in CEO equity holdings is the driving force of the variation in CEO total compensation; the standard deviation of the value change in equity holdings (6.35) is twice that of equity grants and more than 13 times that of cash compensation.

Panel D reports descriptive statistics of other selected variables. The mean (median) EPS is $1.07 ($1.03), and mean and median change in EPS (scaled by share

price) is $0.01. Firms have an average ROE of 0.10. These accounting variables are symmetrically distributed around their respective medians. The sample consists of large firms with mean (median) market capitalization of $6.7 billions ($1.5 billions) and relatively low book-to-market ratios (0.50 at mean and 0.43 at median). The mean and median annual stock returns of the sample are 0.18 and 0.12, respectively.

Panel E of Table 1 reports the Pearson (upper) and Spearman (lower) correlations of selected variables. Cash compensation and the value change in CEO equity holdings are positively correlated (Pearson correlation .23), but their correlations with equity grants are much lower (Pearson correlation .03 for cash compensation and .08 for equity holdings). Note that the correlation between equity holdings and total equity-based compensation and between equity holdings and total compensation are above .85, indicating that these latter composite compensation items are dominated by the value change in CEO equity holdings. Importantly, the change in EPS is significantly correlated with the value change in CEO equity holdings, CEO total equity-based compensation and CEO total compensation (Pearson correlations .31, .31 and .32, respectively). These positive correlations are consistent with the argument that accounting earnings are linked to CEO equity-based compensation and CEO total compensation. Finally, the correlation between equity grants and stock returns/accounting earnings are relatively low (Pearson correlation 0.07 for accounting earnings and .10 for stock returns). Thus, accounting earnings and stock returns may not be the best explanatory variables to the value change in equity grants.

5. EMPIRICAL RESULTS

5.1. Replication of Prior Findings

In Table 2 I report replication results on the relative weights on accounting earnings and raw stock returns in CEO compensation. Consistent with prior findings (Baber et al., 1996; Baber et al., 1998, 1999; Core et al., 2003, among others), accounting earnings are significant in explaining CEO cash compensation (0.25, p-value <.001) but are insignificant in explaining equity grants (-0.23, p-value 0.19), the value change in CEO equity holdings (-0.43, p-value 0.30), and CEO total pay (0.00, p-value=1). Earnings are negatively associated with CEO total equity-based compensation (-1.33, p-value 0.003) and CEO total compensation (-1.39, p-value=0.001).[12] Overall, results in table 2 confirm previous findings that conditional on raw stock returns accounting earnings receive a significant positive weight in CEO cash compensation but not in CEO equity-based compensation or CEO total compensation.

5.2. Empirical Test Results – Approach 1

Table 3 reports test results of Approach 1. Panel A provides estimates of the *filtered* price based on a pooled cross sectional regression of annual returns on accounting earnings with year and industry (two-digit SIC code) indicators (Model 1). The R2 of the return-earnings regression is 14% (not reported). Thus, while accounting earnings explain some contemporaneous stock returns, a significant portion of stock returns remains unexplained. The mean value of the *filtered* price is zero by default. Apart from the mean and median values, the distribution of the *filtered* price is very

[12] These negative associations should be interpreted with caution because earnings are not negatively associated with any individual component of CEO equity-based compensation.

similar to that of the raw stock return. For example, the standard deviation of the *filtered* price is 0.49 which is slightly lower than that of the raw return (0.53); the full range of the *filtered* price is 6.85, comparable to that of the raw return (6.06). The Pearson correlation between the *filtered* price and accounting earnings is zero by design. The correlation between the *filtered* price and the raw stock return is .91 (Pearson) or .85 (Spearman). In addition, the correlations between various compensation items and the *filtered* price are similar to those between the compensation items and the raw stock return. These results suggest that the *filtered* price preserves key statistical features of the raw stock returns. Overall, evidence in Panel A supports the use of the estimated residual from Model (1) as a proxy for the *filtered* price.

Panel B of Table 3 reports results from regressions of CEO compensation on earnings and the *filtered* price. Panel C demonstrates the computation of the percentage changes and dollar changes in CEO compensation for a one-standard deviation movement in accounting earnings. First note that the independent variable in the compensation model, the *filtered* price, is the residual term from the return-earnings regression model. An endogeneity problem may be present if the residual term in the return-earnings model is correlated with the error term in the compensation model. Thus, I first perform the Hausman test for each compensation model. Based on the test results I cannot reject the null hypothesis that the *filtered* price is orthogonal to the error term of the compensation model. Therefore, the *filtered* price can be viewed as an exogenous variable in the compensation model and the OLS provides consistent estimates. The coefficient estimates are thus based on pooled cross-section OLS regressions with year

and industry indicators (two-digit SIC code) (omitted from the table). The t-statistics are based on Roger's standard errors which control for serial correlation and heteroscedasticity.

In the cash compensation model the coefficients on earnings and the *filtered* price are 0.43 and 0.20 respectively, and both are highly significant (p-value<0.001). Thus, for each dollar increase in EPS, CEO cash compensation will increase by 43%. Recall that the standard deviation of the change in EPS is 0.14 (Table 1, panel D). Therefore, a CEO whose firm improves its accounting performance by one standard deviation will see an increase in her cash compensation of 6.1%, or $85,000 ($59,000) at the mean (median) (see Panel C of Table 3 for the computation). These figures represent earnings' *direct* impact on CEO compensation. Consistent with my expectation, earnings coefficient in the cash compensation model in Table 3 is higher than that in the cash compensation model with raw stock return (.25 in Table 2, Model A). Panel B of Table 3 also reports the lower bound and upper bound of the coefficient estimate at 95% confidence level. The ranges are relatively narrow for all models except the equity grants model, suggesting that the inferences drawn from the point estimates are reasonably reliable.

The coefficients on accounting earnings and the *filtered* price in the equity grants model are .37 and .64, respectively. While they are statistically significant, the low R2 of the model (1.7%) implies that accounting earnings and stock returns are probably not

good explanatory variables for the value changes in equity grants.[13] The percentage change in the value of equity grants is 5.2%, or $146,000 ($41,000) at the mean (median) value for a one-standard-deviation movement in earnings. The earnings coefficient in the model of the value change in CEO equity holdings is 9.29 (p-values<0.001), which translates into a percentage change of 130% or a dollar change of $19.39 millions ($1.77 millions) at the mean (median), for a movement of one-standard-deviation in earnings. Theoretically, the *indirect* impact comes from both CEO equity grants and CEO equity holdings. Empirically however, equity holdings dominate equity grants in driving the value change in CEO compensation and are the main source of the *indirect* impact. Taking together the *indirect* impact of earnings amounts to $19.53 millions ($1.81 millions) at the mean (median).[14] Accounting earnings are also important to CEO total pay (.41, p-value<.001). A one-standard-deviation movement in earnings will change CEO total pay by 5.8%, or $271,000 ($127,000) starting from its mean (median) value. These results are in contrast to prior studies that find earnings insignificant in explaining CEO total pay. Finally, the impact of earnings on CEO total compensation is $19.62 millions ($1.87 millions) at the mean (median) for a one-standard-deviation movement in accounting earnings. Obviously, it is the *indirect* impact of earnings that makes earnings an important determinant of CEO total compensation.

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[13] For example, a firm may issue stock options when it has significant growth opportunities but has weak accounting performance and/or market performance at present. A firm may also issue grants when it experiences cash shortage. A more detailed discussion is in the next section.

[14] Alternatively, I could calculate the indirect impact based on the estimate of earnings coefficient in the total equity-based compensation model. I do not do so because earnings coefficient in the equity grants model differs dramatically from that in the equity holdings model, and a model that combines these two items provides poor estimate of the earnings coefficient. For the same reason, I calculate earnings' impact on CEO total compensation by summing up the direct impact and the indirect impact estimated from separate compensation models.

5.3. Empirical Test Results – Approach 2

The sample used in the second approach drops to 11,310 observations from 12,326 observations due to missing daily return data. In Panel A of Table 4, the mean *EA_RET* (*NON_EA_RET*) is 0.022 (0.162), indicating that *EA_RET* (*NON_EA_RET*) makes up 12% (88%) of total annual return. At the median these statistics are 16% and 84%, respectively. The proportion of *EA_RET* is high given that *EA_RET* represents stock return to 5% of all the trading days during an average year.[15] The distribution of *NON_EA_RET* is very similar to that of annual return and their correlation is between .94 and .96 (Panel B). Thus, *NON_EA_RET* seems to have preserved key features of annual stock returns. *EA_RET* is also positively correlated with annual return (Pearson correlation .20) although it is negatively correlated with *NON_EA_RET* (Pearson correlation -0.06).

Before conducting the formal tests I first run a variance ratio analysis in the same spirit as Core et al. (2003). The numerator and denominator of the ratio are the variance of CEO compensation explained by *EA_RET* and the variance explained by *NON_EA_RET*, respectively. The higher the ratio, the greater explanatory power *EA_RET* possesses relative to *NON_EA_RET*, and hence the more important earnings news is to CEO compensation. I conduct the ratio analysis by CEO and require at least four valid observations for each CEO. The new sample is consisted of 7,760 observations for about 1,300 CEOs. Panel C reports the distribution of the variance ratios. The median ratios for cash compensation, equity grants and total pay are

[15] The average number of trading days in a year is around 252 days.

above .80, indicating that the explanatory power of *EA_RET* is about 80% that of *NON_EA_RET*. The explanatory power of *EA_RET* in CEO equity holdings, CEO total equity-based compensation and CEO total compensation is about 20% that of *NON_EA_RET*. Overall, *EA_RET* explains a disproportionally large amount of CEO compensation variance compared to the 5% trading days it corresponds to.

Table 5 summarizes the results from the compensation regressions. As expected, *NON_EA_RET* is significantly positive in the univariate regression in all models. *EA_RET* is positive in CEO cash compensation in the univariate regression (.47, p-value<.001), and remains significant in the multivariate regression after controlling for *NON_EA_RET* (.52, p-value<.001). The incremental R2 of *EA_RET* is 2.3% (8.2% minus 5.9%). *EA_RET* and *NON_EA_RET* are also significant to CEO equity grants and CEO total pay, although the explanatory powers of these models are lower (R2 1.7% for the equity grants model and 4.1% for the total pay model). In the model of CEO equity holdings *EA_RET* has a large positive coefficient in both the univariate regression (8.32) and the multivariate regression (11.08), and including *EA_RET* in the compensation model increases the R2 by 5.9%. The coefficient on *EA_RET* is 7.07 in the total equity-based compensation model and 5.05 in the total compensation model and both coefficients are highly significant. The incremental R2s of *EA_RET* in these two models are 5.0% and 5.4%, respectively. Overall, results in Table 5 show that stock returns around earnings announcements are significant in explaining changes in CEO compensation conditional on stock returns on non-earnings announcement-days. Assuming that *EA_RET* is primarily driven by earnings news, these results support the

argument that accounting earnings are important to CEO equity-based compensation and CEO total compensation conditional on stock returns driven by non-earnings news.

Table 6 reports the computation of the compensation impact of earnings based on the short-window ERC. The sample is consisted of 45,240 quarterly observations corresponding to the 11,310 CEO-year observations in Table 5. In Panel A, the mean (median) quarterly change in EPS (ΔQE) is 0.003 (0.002). The standard deviation of ΔQE is .034, around one fourth of the standard deviation of changes in annual EPS. The reported short-window ERC is the average the 48 ERCs estimated from quarterly cross section regressions. The mean is around .17 and is highly significant (p-value <.001).

Panel B summarizes percentage and dollar changes of CEO compensation for a one-standard-deviation movement in earnings. Take the value change in CEO equity holdings for example, *CUM_RET* shifts by 0.006 (.17*.03446) in a quarter and .0235 in a year. Recall that the coefficient on *EA_RET* in the equity holdings model is 11.08 (Table 5). Thus, the value of CEO equity holdings changes by 26.0% (11.08*0.0235) for a one-standard-deviation movement in earnings. This percentage change translates into a dollar change of $3.88 millions (.35 million) at the mean (median). A one-standard-deviation movement in earnings shifts CEO cash compensation by 1.2%, or $17,000 ($12,000) at the mean (median). These figures represent the *direct* impact of earnings on CEO compensation and appear economically insignificant. A one-standard-deviation movement in earnings shifts CEO equity grants and CEO total pay by 1.7% and 1.3%, respectively. The *indirect* impact of earnings is $3.93 millions at the mean and $.37 million at the median with the majority impact coming from the value change in CEO

equity holdings. The impact of earnings on CEO *total* compensation amounts to $3.94 millions at the mean or $.38 million at the median. While these figures are less dramatic than those from the first approach, they still represent a large portion of CEO total compensation and appear economically significant.

5.4. Robustness Tests

5.4.1. Time-series, firm specific regression

The pooled cross sectional regression forces the coefficient on earnings to be constant across the sample and does not allow for firm specific effects. To address this issue I repeat all tests using time-series firm specific regressions. The results support the inferences based on pooled cross sectional regressions and are reported in Table 7 (Approach 1) and Table 8 (Approach 2). I require at least six valid observations for each firm which reduces the annual observations from 12,326 to 8,287 and the quarterly observations from 45,240 to 38,217. The number of firms drops from 2,376 to 911. Panel A of Table 7 reports the coefficient estimates of earnings and the *filtered* price. Earnings are significantly positive in all models except the equity grants model, in which case the coefficient is negative but insignificant (-10.86, p-value=.557). The R2s from the time series firm specific regressions are generally higher than those from the pooled regressions. Panel B and Panel C report the percentage changes and the dollar changes in CEO compensation for a movement of one standard deviation in earnings.[16] The mean percentage changes for all models except equity grants are higher than those in the

[16] Note that unlike the pooled regression in Table 3 in which the percentage and dollar changes in CEO compensation are based on coefficient estimates in the compensation model, the percentage and dollar changes in Panel B and C are directly estimated in the time series, by firm regressions. Therefore, even though the mean coefficient estimate in the equity grants model is insignificant, the estimates of the percentage and dollar changes are significantly positive.

pooled regressions. For example, the percentage change is 14% for cash compensation and 152% for the value change in CEO equity holdings, as compared to 6.1% and 130% in the pooled regressions. In Panel C, the mean dollar changes of CEO cash, equity grants and total pay are between $216,000 and $369,000, which are larger than their counterparts in Table 3 ($146,000 and $271,000, respectively). The median values in Panel C are also higher than those in Table 3 except for the equity grants model. Finally, the mean (median) dollar change of CEO equity holdings is $13.4 millions ($2.12 millions), smaller (larger) than the corresponding value in the pooled regressions ($19.39 millions and $1.77 millions).

Table 8 reports the results of the second approach using time series data. The ERCs are estimated by firm and the mean (median) ERC is .51 (.17) with t-stat over 20 and mean R2 around 5% (not reported). Panel A of Table 8 reports the coefficient estimates of *EA_RET* and *NON_EA_RET*. The values of these coefficients are comparable to those in the pooled regressions (Table 6) except for models of equity grants and CEO total pay where *EA_RET* is insignificant. Panel B reports the percentage changes in CEO compensation for a movement of one-standard-deviation in earnings. The mean percentage changes range from 2% to 5% for CEO total pay and total pay components, which are higher than those in the pooled regressions. The mean percentage changes of other compensation components are lower than those in the pooled regressions but are nevertheless significant. For example, the percentage change in CEO equity holdings is 17% as compared with 26% in the pooled regression. In Panel C, the dollar change of CEO compensation is $20,000 for cash compensation, $121,000 for

equity grants and $100,000 for total pay. These amounts are larger than those from the pooled regressions ($17,000, $48,000 and $59,000, respectively). The value change in CEO equity holdings is about $2 millions, lower than its counterpart in the pooled regression ($3.88 millions). Overall, results using time series firm specific regressions confirm conclusions based on pooled cross sectional regressions that accounting earnings are an economically significant determinant of CEO equity-based compensation and CEO total compensation.

5.4.2. Inconsistent signs of earnings, changes in earnings and stock returns

The impact of earnings' valuation role on CEO compensation should be largely weakened when the direction of earnings news is inconsistent with that of stock returns. Specifically, when earnings news is negative it is unlikely to be informative about firms' future cash flows (which are expected to be non-negative) and hence about firm value. On the other hand, when earnings news is positive but stock returns are negative it probably implies that factors other than earnings news play a more significant role in the market's assessment of firm value. Empirical evidence consistent with the above expectation will provide additional support to the indirect impact argument in the paper. Thus, I include an indicator variable (SIGN) in the compensation model and interact it with accounting earnings:

$$\Delta Comp_{i,t} = f_1 + f_2 * \Delta E_{i,t} + f_3 * \Delta E_{i,t} * SIGN_{i,t} + f_4 * FP_{i,t} + u_{1i,t}$$

Where $\Delta Comp_{i,t}$ is the unexpected percentages in CEO compensation, ΔE is changes in EPS scaled by share price, *FP* is *filtered* price as estimated from Model (1), and *SIGN*=0 if $E>0$, $\Delta E>0$ and $FP>0$, or $E<0$, $\Delta E<0$ and $FP<0$. *SIGN*=1 in all other cases. Regression

results (not reported) show that f_2 is significantly positive and f_3 is significantly negative in all compensation models. Therefore, earnings' impact on CEO compensation is significantly lower when the direction of earnings news is opposite to that of stock returns. In addition, the absolute value of f_3 is comparable to that of f_2 for all compensation models except the equity holdings model in which case f_2 is 13.1 whereas f_3 is -7.8. These results suggest that accounting earnings do not play a significant role in CEO compensation when earnings' valuation role is deemed less important or non-existent.

5.4.3. Estimating the valuation role of earnings using both levels and changes of earnings

Model (1) and model (6) use changes in earnings as proxy for unexpected earnings news. However, prior literatures have shown that both levels and changes of earnings are relevant in estimating earnings' valuation role using a return-earnings regression model (see Easton and Harris, 1991; Ali and Zarowin, 1992a,b for empirical evidence and Ohlson, 1991; Ohlson, 1995; Ohlson and Shroff, 1992 for theoretical argument). Thus, I re-estimate model (1) and model (6) by adding the levels of earnings in addition to the changes in earnings, and re-examine the compensation impact of earnings. My conclusion regarding the indirect impact and overall impact of earnings on CEO compensation remains unchanged based on these alternative models.

5.4.4. Other measures of CEO compensation

It is common to use logarithm of compensation values in empirical tests to control for the potential non-linear relation between compensation and performance

measures. Using logarithm also reduces estimation errors resulting from the skewness of compensation variables. To check the robustness of the main results which are based on percentage changes in CEO compensation I redefine CEO cash compensation, equity grants and total pay as the logarithm of the dollar values of these compensation items and repeat the pooled regression tests. Results (not reported) show that while the magnitudes of the coefficient on earnings change, they all remain significantly positive after controlling for the filtered price, supporting the main conclusion that earnings are an significant determinant of CEO total compensation.

5.4.5. Other measures of accounting profitability

Studies such as Ittner, Larcker and Rajan (1997) and Murphy (1999) document that EPS and ROE are both popular performance measures used in CEO compensation contracts. I replicate all tests using the changes in ROE instead of the changes in EPS, and the conclusion remains unchanged.

5.5. By-Industry and By-Size Analysis of the Impact of Earnings on CEO Compensation

Prior literature has provided rich evidence that CEO compensation structure varies by industries. For example, high-tech firms use equity-based compensation more extensively than other firms (Bebchuk and Grinstein, 2005; Ittner, Lambert and Larcker,2003; Murphy, 1999, 2003) whereas utility firms use the least amount of equity-based compensation (Murphy, 1999). Firm size is another important determinant of CEO compensation structure. For example, Murphy (1999) shows that for CEOs of S&P 500 firms with above-median market cap, cash compensation and option grants represent 43% and 39% of CEO total pay, respectively, as compared to 60% and 31% for CEOs of

S&P 600 SmallCap. Therefore, I examine earnings' impact on CEO compensation by industry and by firm size.

5.5.1. By-industry analysis

Murphy (1999) documents the CEO compensation structures of firms in utility industry and firms in financial services differ from those of firms in other industries. Recent studies also document differential pay structure of high-tech firms or "new economy" firms as compared with firms in traditional industries (Ittner, Lambert and Larcker, 2003; Murphy, 2003). Following Francis and Schipper (1999) and similar to Ittner et al (2003) and Murphy (2003), I define high-tech firms as those operating in computer hardware and software, telecommunication, and semiconductors. Thus I form four industry groups: utility (SIC 49), high-tech (three-digit SIC code: 283, 357, 360-368, 481, 737, and 873), financial services (SIC 60-69) and others. Table 9 reports regression results of CEO compensation on earnings and *filtered* price for each of the four industry groups.

In the cash compensation model in Panel A, the earnings coefficient is highest for utility firms (1.70, p-value<.001) but lowest for high-tech firms (.19, p-value=0.02). Thus, accounting earnings play a more significant role in CEO cash compensation for utility firms than for high-tech firms. It is possible the high-tech firms rely more heavily on stock performance measures than on accounting profitability in designing their CEOs' compensation contract, but the relatively small coefficient on the *filtered* price (.14 as compared to .24 to .26 for the other three groups) provides no evidence of this argument. On the other hand, Bushman, Indjejikian and Smith (1996) find that the use of

performance measures other than accounting earnings and stock returns increases with firms' growth opportunities and product time horizon. Ittner, Larcker and Rajan (1997) also find that the use of non-financial performance measures (market share, efficiency/productivity, etc.) increases with the extent to which the firm follows an innovation-oriented strategy, the adoption of strategic quality initiatives and noise in financial measures. As innovation and long-term R&D investments are more critical to high-tech firms than to other firms, high-tech firms may rely more on non-financial performance measures than other firms do, resulting in the relatively low coefficients on earnings and stock returns. Furthermore, the standard deviation of earnings is the highest in the high-tech group (.19) but lowest in the utility group (0.06), consistent with firms assigning greater weight on earnings in CEO compensation when earnings are stable but less weight on earnings when earnings are volatile.

In the equity grants model earnings coefficient is only significant for "other" industries but insignificantly different from zero for firms in financial services, utility and high-tech industries. The R2s of the equity grants model are also relatively low compared with those from the cash compensation model. The lack of significance of accounting earnings in equity grants model is probably because firms issue stocks and options for reasons other than accounting profitability. The literature has identified a number of determinants of option grants. Firms may issue options to generate incentives (especially when firms have significant growth opportunities), relieve cash constraints, take advantage of tax rules, and attract and retain employees, or firms may issue options simply because the boards perceive options as a costless means of paying employees

(Ittner et al., 2003; Murphy, 2003; Core and Guay, 1999). This evidence indicates that equity grants may not be a pure compensation tool as salary and bonus and therefore we may not observe a significant association of accounting profitability and the value change in equity grants.[17]

In the model of value change of CEO beginning-of-the-year equity holdings, the utility group has the highest earnings coefficient (15.13, p-value<.001) and the financial services group has the lowest (5.14, p-value<.001). Recall that the value change of equity holdings is calculated as the (unexpected) returns on stocks and options multiplied by the number of stocks and options held by the CEO at the *beginning* of the year. Thus, unlike the value of equity grants, the actual changes in the numbers of stocks and options held by the CEO during the year do not play a role, and the differential magnitudes of earnings coefficient across industries are most likely due to differential valuation role of accounting earnings. That is, because accounting earnings may affect stock price differently across industries, earnings' impact on CEO equity holdings may also vary across industries. This assumption is reasonable given that factors affecting earnings' valuation role such as earnings' persistence, systematic risks, and growth opportunities may be more similar for firms in the same industry than for firms across industries (refer to Kormendi and Lipe, 1987; Collins and Kothari, 1989; and Easton and Zmijewski, 1989 for analysis of various determinants of the ERC, which proxies for the valuation role of earnings). I use the ERC estimated from model (1) as a proxy for

[17] The magnitude of earnings coefficient in the equity grants model is also related to the sensitivity of options to stock price. To the extent that option sensitivity to stock price may differ across industries, the relative weight on earnings may also vary across industries. But I am not aware of studies examining this issue and I leave it to future research.

earnings' valuation role. Consistent with this argument, the ERC (not reported) is highest for the utility group (1.35) and lowest for the financial services group (.45).

Panel B of Table 9 demonstrates the calculation of the percentage change in CEO compensation for a one-standard deviation change in accounting earnings. The first two columns are the earnings coefficient estimated from Panel A and the standard deviation of annual accounting earnings. The third column represents the percentage change in CEO compensation for a one-standard deviation movement in earnings. The fourth column documents the proportion of each type of compensation in total compensation. The last column shows the weighted percentage change in each type of compensation due to a one-standard deviation shift in earnings. The last row in this column reports the overall percentage change in CEO total compensation. The results show that earnings have the greatest impact on CEO total compensation for high-tech firms and the lowest impact for utility firms. CEO total compensation changes by 147% for high-tech industry but only by 24% for utility firms for a one standard deviation movement in earnings. The results are primarily driven by the high proportion of equity holdings of CEOs of high-tech firms; while the value change in equity holdings is 89% of CEO total compensation for high-tech firms, it is only 19% for utility firms. The small compensation impact of earnings for utility firms is also related to the lack of volatility of earnings of the industry. While the standard deviation of earnings is .19 for high-tech firms, it is only .06 for utility firms. Thus, even though accounting earnings receive a relatively large weight in CEO equity holdings model for utility firms (15.13) as compared to other firms, the small proportion of equity-based compensation and the lack

of earnings volatility prevent earnings to have an otherwise greater impact on CEO total compensation. The "other" group has the second highest percentage change in CEO total compensation (98%), followed by the financial services group (39%). While equity-based compensation makes up 73% of CEO total compensation for firms in financial services, accounting earnings are relatively stable (standard deviation .10) and receive a relatively small weight (5.14) in the equity holdings compensation model. These two factors contribute to the relatively small impact of earnings on CEO total compensation for firms in financial services.

5.5.2. By-size analysis

Table 10 reports the regression results of CEO compensation on earnings and the *filtered* price from four sub-samples based on firm size. Following Murphy (1999), I form four sub-samples which are S&P SmallCap 600, ("SM"), S&P MidCap 400 ("MD"), S&P 500 below median market cap ("SPB") and S&P 500 above median market cap ("SPA"). The median market cap of the sub-samples is $397 millions, $1.4 billions, $3.6 billions and $13.7 billions, respectively (not reported). To check whether the by-size analysis overlaps with the by-industry analysis I examine the industry mix of each size sub-sample. The proportion of high-tech firms is similar across the size sub-samples. The SM group and SPA group have the lowest and highest percentage of financial services firms, respectively (8% vs. 22%), and the SM group and the MD group have the lowest and highest percentage of utility firms (5% vs. 10%). In the cash compensation model in Panel A, the earnings coefficient is smallest for SM (.26, p-value<.001) group but largest for MD group (1.31, p-value<.001). One potential cause of

the large (small) coefficient for MD (SM) group is probably the relatively high (low) proportion of utility firms in this group; as shown earlier, utility firms assign the highest weight on earnings in CEO cash compensation. Another explanation for the low earnings coefficient for small firms is that earnings are more volatile for small firms than for big firms, and therefore small firms rely less on earnings in designing their CEO's cash compensation in order to reduce the risks their CEO has to share. Consistent with this argument, the standard deviation of earnings is 0.21 for SM group but is between 0.07 and 0.09 for the other three groups. Finally, to the extent that small firms experience losses more frequently than large firms, it is possible that small firms use criteria other than accounting profitability to determine their CEO's compensation. Descriptive statistics (not reported) show supportive evidence; SM firms have relatively low ROE (median 0.106) and high incidence of losses (21%) as compared to other groups (average median ROE .164, and average loss incidence 9.4%).[18]

In the equity grants model accounting earnings are not significantly different from zero for all groups except the SPB group, which represent S&P 500 firms with below median market cap. As discussed earlier, several factors may cause earnings coefficient in the equity grants model to differ across sub-samples. These factors include decisions to grant options for reasons other than firms' financial performance (generating incentives, reserving cash, attracting and retaining employee, ignorance of the cost of issuing options, etc.), earnings' differential impact on stock price (which

[18] Agency theory predicts that firms rely more on market-based rather than accounting-based performance measures when facing significant growth opportunities, which is often the case in small firms. Therefore the small weight on earnings for small firms is possibly due to their more significant growth opportunities. However, the descriptive statistics show that the book-to-market ratio (proxy for growth opportunities) of small firms is at least as large as that of the other groups, which is inconsistent with the argument.

translates into differential impact of earnings on the value of CEO stock holdings and equity holdings), and the sensitivity of option value to stock price (footnote 15). My analysis indicates that the most likely reason that SPB group but not other groups have a significantly positive earnings coefficient in the equity grants model is that accounting earnings play a more important valuation role for SPB group. Using ERC as a measure of earning's valuation role, I find that the ERC is highest for the SPB group (1.264) whereas the ERC is between .45 and 1.0 for the other groups. The differential impact of earnings on stock price also appears to explain the different magnitudes of earnings coefficient in the model of value change in CEO beginning-of-the-year equity holdings; the ERC is lowest (.453) for the SPA group but highest for the SPB group (1.264), consistent with the smallest (largest) earnings coefficient estimated from the SPB (SPB) group (5.00 and 14.03, respectively).

Panel B of Table 10 reports the percentage change in CEO compensation for each individual compensation item and for CEO total compensation, for a one-standard-deviation movement in accounting earnings. First note that cash compensation contributes to around 10% of CEO total compensation for firms with all sizes. The proportion of equity grants is lowest in the SM group (1.5%) and highest in the SPB group (10%). The proportion of equity holdings varies between 68% and 77% across the sub-samples. A one-standard deviation movement in accounting earnings shifts CEO total compensation by 137% for SM group, 101% for SPB group, 74% for MD group and 25% for SPA groups. Thus, for a given change in accounting earnings, CEOs of small firms experience the largest percentage change whereas CEOs of the large S&P

firms see the smallest change in their total compensation. The relatively small (large) change in CEO compensation for SM (SPA) is probably due to two reasons. First, SM (SPA) group has the most (least) volatile earnings; the standard deviations of earnings in these two groups are .21 and .07, respective. Second, stock price is more sensitive to earnings news for small firms (ERC .852) than for SPA firms (ERC .453).

6. RE-EXAMINATION OF THE SENSITIVITY-PRECISION TRADE-OFF HYPOTHESIS

Up to this point, the study provides evidence that accounting earnings are an economically significant determinant of CEO total compensation. I am able to obtain such results by incorporating the effect of earnings' valuation role on CEO compensation. To demonstrate the potential usefulness of this methodology, I re-examine the classical trade-off hypothesis of agency theory. That is, in an optimal incentive contract, the weight on a performance measure increases with its relative "sensitivity" and its relative "precision". The "sensitivity" refers to the change in a performance measure for a change in managerial efforts, and the "precision" refers to the lack of noise in the performance measure. While the precision is relatively easy to measure, the measurement of "sensitivity" is much less straightforward because it is unobservable. Nevertheless, it is generally believed that stock returns are more sensitive to managerial actions than accounting earnings because returns are more capable of reflecting the long-term consequence of current actions, which is especially important to firms with significant growth opportunities. Therefore, a testable hypothesis is that firms with significant growth opportunities place more weight on stock returns and less weight on accounting earnings in CEO compensation. I test the sensitivity vs. precision hypothesis using the following model which is similar to Core et al. 2003 except that I use the *filtered* price instead of the raw stock returns in the model. [19]

[19] Core, Guay and Verrecchia (2003) focus on the "noise" hypothesis (which is the same as the precision hypothesis) and include a proxy for firm growth in order to control for the sensitivity of the performance measures which may correlate with the noise factor. Therefore, in essence, the tests in Core et al. provide evidence on the "sensitivity vs. precision hypothesis.

$$\Delta Comp_{i,t} = e_0 + e_1 \Delta E_{i,t} + e_2 FP_{i,t} + e_3 BM_{i,t} + e_4 \frac{Var(\Delta E_i)}{Var(FP_i)} + e_5 \Delta E_{i,t} * BM_{i,t} + e_6 FP_{i,t} * BM_{i,t} + e_7 \Delta E_{i,t} * \frac{Var(\Delta E_i)}{Var(FP_i)} + e_8 FP_{i,t} * \frac{Var(\Delta E_i)}{Var(FP_i)} + u_{i,t} \quad (8)$$

Where $\Delta Comp_{i,t}$ is changes various measurements of CEO compensation as before, ΔE is changes in EPS scaled by share price, *FP* is filtered price, the residual term from model (1), *BM* is book-to-market ratio, measured as book value of equity (Compustat Item #60) over market value of equity at the end of year t. $\frac{Var(\Delta E_i)}{Var(FP_i)}$ is the relative variance ratio, where $Var(\Delta E_i)$ is the time series variance of ΔE, and $Var(\Delta FP_i)$ is the time series variance of the *filtered* price.

The theory predicts earnings (stock return) to receive a lower (higher) weight when firms have significant growth opportunities, thus I expect e_5 (e_6) to be positive (negative), as a low *BM* implies more growth opportunities and hence less (more) weight on accounting earnings (stock returns). The theory predicts less (more) weight on earnings (stock returns) when the variance of earnings is large relative to the variance of stock returns. Thus, I expect e_7 (e_8) to be negative (positive). Results of Core et al. 2003 generally confirm these predictions for CEO cash compensation but not for CEO total pay or CEO total compensation. They find that in the cash compensation model, stock returns and accounting earnings are significantly positive. In addition, accounting earnings receive less weight for firms with high growth and for firms with more volatile earnings relative to returns. The interactions of returns and growth and of returns and noise are insignificant. In the total pay model, only stock returns are significant; the rest

variables are all insignificant. In the total compensation model, stock returns are significantly positive, and receive a higher weight for growth firms. However, stock returns receive less weight when firms have more noise in their accounting earnings relative to stock returns, which is inconsistent with the agency prediction. Finally, accounting earnings, earnings' interaction with book-to-market ratio, and earning's interaction with the noise ratio are all statistically insignificant in the total compensation model. Thus, Core et al. provide mixed evidence on the relative use of stock returns and no evidence on the relative use of accounting earnings for CEO total pay and total compensation.

Table 11 reports regression results of model (8). First note that accounting earnings and the *filtered* price are significantly positive in all six CEO compensation models. The interaction of accounting earnings and *BM* has the correct sign for all six models and is statistically significant for four of them (cash compensation, equity holdings, total equity-based compensation and total compensation). These results are consistent with accounting earnings receiving less (more) weight in CEO compensation when the firm has more (less) growth opportunities. The interaction of the *filtered* price and the *BM* ratio has the correct sign (negative) and is statistically significant in the equity grants model, the total pay model, and the total compensation model. The interaction term is positive in the cash compensation model and the equity holdings model, and is statistically insignificant in the total equity-based compensation model.

The interaction of earnings and the relative variance ratio is significantly negative in all models except in the equity holdings model where the coefficient is

insignificantly different from zero. Thus, as predicted by agency theory, firms assign a lower weight on accounting earnings in CEO compensation when the volatility of accounting earnings is high relative to stock returns. The interaction of the *filtered* price and the relative variance ratio is negative in all models except in the cash compensation model and the total pay model where the coefficient is insignificantly different from zero. The negative association means that firms assign less weight on stock returns when earnings are more volatile relative to stock returns. These results are against the prediction of agency theory but are consistent with the results of Core et al (Table 3, pp 971). I perform an additional test to seek potential explanations to this negative association. Note that the least negative association occurs to cash compensation which does not include any equity-based compensation. The equity-based compensation is roughly the annual return multiplied by the number of shares held by the CEO.[20] Thus, it is possible that the negative association between compensation and the variation ratio is due to the positive correlation of stock return and return variance. This correlation is plausible because firms with high stock returns are assumed to be more risky than firms with low stock returns, and the variance of stock returns can be viewed as a noisy proxy for the level of risks. As the return variance appears in the denominator of the relative variance ratio, it might cause a negative correlation between CEO compensation and the interaction of the filtered price and the relative noise ratio. Consistent with this argument, the Pearson correlation of stock return and its variance are significantly positive, and the relative noise ratio is negatively associated with the dependent variable in three out of

[20] The value of equity grants is based on Black-Scholes model. But the majority of the indirect impact comes from equity holdings so here the analysis focuses on determinants of the value of equity holdings.

the six models. However, adding return variance or other proxy of the firm's risk level (firm's beta as provided by CRSP) in model (8) does not change the results. I also repeat the analysis using realized growth in assets and realized growth in sales instead of the book-to-market ratio and the results remain unchanged. Therefore, the negative association remains a puzzle in this study and deserves future research.

Overall, results in Table 11 provide strong evidence that firms rely less on accounting earnings when earnings are relatively more volatile and when firms have more growth opportunities. However, the results are weak and mixed regarding the use of stock returns. While there is some evidence that firms with significant growth opportunities assign more weight on stock returns, firms also appear to assign less weight on stock returns when earnings have high volatility relative to stock returns.

7. CONCLUSION

A substantial accounting literature has empirically examined the relative use of accounting earnings and stock returns in CEO compensation. However, the literature has largely focused on CEO cash compensation but ignored CEO equity-based compensation. As a result of the explosion of equity-based compensation in the past several decades, the variation in cash compensation has become minimal compared to the variation in equity-based compensation. This implies that no matter how important accounting earnings are to CEO cash compensation, its impact on CEO total compensation is unlikely to be significant. Consistent with this implication, studies find little association of earnings and CEO total pay or total compensation conditional on stock returns. The insignificant result makes it difficult to further test how the use of earnings and stock returns varies with hypothesized factors in the context of CEO total compensation. However, such tests are theoretically more relevant than tests based on cash compensation because agency theory identifies managerial wealth, not annual compensation as the key variable of concern to managers, and total compensation is used as a common proxy for CEO wealth in the finance and economics literatures. Unlike prior studies that attribute all variance in CEO equity-based compensation to price-based performance measures, the current paper argues that a portion of the price impact on compensation is attributable to accounting earnings because earnings news affects stock price (earnings' valuation role). The paper investigates the impact of accounting earnings on CEO *total* compensation by measuring the joint effect of earnings' contracting role and valuation role. It demonstrates that accounting earnings not only

have a direct impact on CEO cash compensation which has been traditionally viewed as earnings' contracting role, but also an indirect impact on CEO equity-based compensation due to earnings' valuation role. The paper shows that it is the *indirect* impact that makes accounting earnings an important determinant of CEO total compensation. To demonstrate the importance of incorporating the indirect impact, I re-examine the classical sensitivity vs. precision hypothesis in CEO *total* compensation and provide evidence that firms assign less weight on accounting earnings when earnings are more volatile relative to stock returns and when firms have significant growth opportunities. I find little evidence that firms use stock returns in a manner consistent with the sensitivity vs. precision hypothesis.

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APPENDIX

Table 1
Descriptive Statistics of CEO Compensation and Other Selected Variables

		Mean	Std	Min	Q1	Median	Q3	Max
Panel A: Levels of Equity Holdings ($ millions)								
stock holdings		128.93	1,432.37	0.00	2.12	7.86	28.76	70,982.97
option holdings		20.15	67.17	0.00	1.72	5.70	16.79	2,403.52
Panel B: Total Compensation = Total Pay + Value Change in CEO Beginning-of-the-Year Equity Holdings ($ millions)								
Cash compensation	A	1.41	1.87	0.00	0.60	0.98	1.65	102.45
Grants of options	B	2.37	9.86	0.00	0.04	0.62	2.03	600.35
Grants of restricted stocks	C	0.46	6.17	(0.00)	0.00	0.00	0.00	650.81
Equity grants	D=B+C	2.83	11.79	0.00	0.14	0.80	2.45	650.81
Total pay	**E=A+D**	**4.65**	**12.52**	**0.00**	**1.09**	**2.18**	**4.71**	**655.45**
Changes in stock holdings	F	23.47	629.12	(7,117.51)	(0.35)	0.28	3.12	39,322.51
Changes in option holdings	G	(0.95)	39.07	(1,597.28)	(1.59)	0.00	1.94	766.58
Total value change in CEO beginning-of-the-year equity holdings	**H=F+G**	**22.52**	**637.26**	**(7,117.51)**	**(2.72)**	**0.58**	**7.25**	**40,089.09**
Total equity-based compensation	**I=D+H**	**25.35**	**638.35**	**(7,117.51)**	**(1.35)**	**1.59**	**9.73**	**40,265.13**
Total compensation	**J=E+H**	**27.16**	**638.37**	**(7,117.43)**	**(0.33)**	**2.94**	**11.80**	**40,265.36**

Table 1 Continued,

	Mean	Std	Min	Q1	Median	Q3	Max
Panel C: Unexpected CEO Compensation (Percentage)							
ΔCash	0.16	0.47	(0.95)	(0.04)	0.08	0.26	5.05
ΔGrants	0.66	3.12	(1.00)	(0.42)	0.05	0.64	61.28
ΔEquity-holdings	0.65	6.35	(15.62)	(3.14)	(0.14)	3.12	52.35
ΔTotal_pay	0.42	1.45	(0.98)	(0.16)	0.11	0.49	26.85
ΔTotal_equity	0.69	4.45	(9.70)	(1.70)	0.00	2.14	42.63
ΔTotal_comp	0.38	3.04	(8.95)	(1.10)	0.05	1.36	26.54
Panel D: Other Selected Variables							
EPS	1.07	1.84	(18.30)	0.39	1.03	1.78	13.10
ΔE	0.01	0.14	(1.20)	(0.01)	0.01	0.02	2.63
ROE	0.10	0.36	(4.29)	0.06	0.13	0.18	3.58
RET	0.18	0.53	(0.89)	(0.11)	0.12	0.38	5.17
MKT ($ millions)	6,676	21,796	5	533	1,464	4,510	508,329
BM	0.50	0.38	(1.14)	0.27	0.43	0.64	4.54

Panel E: Pearson Correlation (upper) and Spearman Correlation (lower)

	ΔCash	ΔGrants	ΔEquity_holdings	ΔTotal_pay	ΔTotal_equity	ΔTotal_comp	ΔE	RET
ΔCash		0.03	0.23	0.21	0.21	0.24	0.40	0.33
ΔGrants	0.09		0.08	0.84	0.23	0.23	0.07	0.10
ΔEquity-holdings	0.31	0.08		0.19	0.86	0.92	0.31	0.92
ΔTotal_pay	0.38	0.64	0.13		0.29	0.29	0.20	0.21
ΔTotal_equity	0.30	0.23	0.93	0.32		0.97	0.31	0.88
ΔTotal_comp	0.34	0.18	0.85	0.34	0.92		0.32	0.88
ΔE	0.14	0.01	0.21	0.03	0.16	0.14		0.24
RET	0.24	0.10	0.91	0.16	0.82	0.84	0.34	

Table 1 Continued,

The sample consists of 12,326 CEO-year observations (2,376 firms) in ExecuComp database from 1993 to 2004. **The Levels of Equity holdings** include CEO stock holdings and CEO option holdings. Stock holdings (option holdings) are measured as the number of shares of stocks (options) held by the CEO at the end of year *t* multiplied by the year-end stock price (option value). **Cash compensation** is the sum of salary and bonus. **Equity Grants** is the sum of the value of restricted stocks (rstkgrnt) and the Black-Scholes value (blk_valu) of stock options granted to the CEO during year t. **Total pay** is the sum of cash compensation, equity grants, long term incentive pay and other annual compensation. **The value change in CEO beginning-of-the-year equity holdings** includes the value change in CEO stocks holdings and option holdings. **The value change in CEO stock holdings** (*stock holdings*) is measured as the number of shares held by the CEO at the beginning of year *t* multiplied by the annual buy-and-hold stock return calculated from the monthly stock returns in CRSP. **The value change in CEO option holdings** (*option holdings*) is measured as the number of options held by the CEO at the beginning of year *t* multiplied by an estimate of the change in the option value during the year. **Total equity-based compensation** is the sum of equity grants and the value change in CEO beginning-of-the-year equity holdings. **Total compensation** is the sum of total pay and the value change in CEO beginning-of-the-year equity holdings and all other compensation.

Unexpected percentage change in Cash compensation $\Delta Cash_t = (Cash_t - Cash_{t-1})/ Cash_{t-1}$;
Unexpected percentage change in CEO equity grants in year t: $\Delta Grants_t = (Grants_t - Grants_{t-1})/Grants_{t-1}$;
Unexpected percentage change in CEO total pay: $\Delta Total\_pay_t = (Total\ Pay_t - Total\ Pay_{t-1})/Total\ Pay_{t-1}$;

Unexpected percentage change in the value of CEO beginning-of-the-year equity holdings

$$\Delta Equity\_holdings_{i,t} = \frac{chg\_stk_{i,t} + chg\_opt_{i,t}}{10\% * (stock\_holdings_{i,t-1} + option\_holdings_{i,t-1})} - 1$$

Unexpected percentage change in CEO total equity-based compensation:

$$\Delta Total\_equity_{i,t} = \frac{chg\_stk_{i,t} + chg\_opt_{i,t} + Equity\_grant_{i,t}}{10\% * (stock\_holdings_{i,t-1} + option\_holdings_{i,t-1}) + blk\_valu_{i,t-1} + rstkgrnt_{i,t-1}} - 1$$

Unexpected percentage change in CEO total compensation

$$\Delta Total\_comp_{i,t} = \frac{Total\_pay_{i,t} + chg\_stk_{i,t} + chg\_opt_{i,t}}{Total\_pay_{i,t-1} + 10\% * (stock\_holdings_{i,t-1} + option\_holdings_{i,t-1})} - 1$$

where *chg_stk* and *chg_opt* are the value changes in stocks and options held by the CEO at the beginning of year *t*, respectively.

Earnings Per Share (EPS) is measured as basic EPS excluding extraordinary items (Compustat annual data item 58). **Changes in EPS (**ΔE**)** are measured as EPS in *t* minus EPS in *t-1*, scaled by share price at the end of *t-1*. EPS and the stock price are adjusted for stock dividends and stock splits.

Table 1 Continued,

The **Return of Equity** (*ROE*) is measured as income before extraordinary items (Compustat annual data item 18) divided by book value of equity (Compustat annual data item 60). **Stock return** (*RET*) is the raw annual buy-and-hold return calculated from the monthly stock returns in CRSP database. If the stock is delisted during a year, the delisted return is used as return of that month and the stock is assumed to earn a market return for the remaining months of the fiscal year. The **market value** (*MKT*) of the firm is the share price multiplied by the number of common shares outstanding at each fiscal year end. The **book-to-market ratio** (*BM*) is measured as book value of equity (Compustat annual data item 60) divided by the market value of the firm at each fiscal year end.
All variables are winsorized at 0.5% and 99.5% to control for outliers.

Table 2
Regression of CEO Compensation on Changes in EPS and Raw Stock Returns

		Coefficient	t-stat	p-value		adj_R2
Cash Compensation						
	Intercept	0.06	0.96	0.337		8.0 %
	ΔE	0.25	3.87	0.000	***	
	RET	0.21	16.68	0.000	***	
Equity Grants						
	Intercept	(0.37)	(1.51)	0.132		1.8%
	ΔE	(0.23)	(1.31)	0.190		
	RET	0.67	7.16	0.000	***	
Value Change in CEO Beginning-of-the-year Equity Holdings						
	Intercept	(1.66)	(1.83)	0.067	**	83.3%
	ΔE	(0.43)	(1.03)	0.304		
	RET	10.82	82.78	0.000	***	
Total Pay						
	Intercept	(0.04)	(0.20)	0.840		4.2%
	ΔE	0.00	0.00	0.998		
	RET	0.46	9.82	0.000	***	
Total Equity-based Compensation						
	Intercept	(1.43)	(2.50)	0.012	**	67.7%
	ΔE	(1.33)	(2.95)	0.003	***	
	RET	6.94	52.26	0.000	***	
Total Compensation						
	Intercept	(1.23)	(2.54)	0.011	**	71.2%
	ΔE	(1.39)	(4.54)	0.000	***	
	RET	4.91	50.80	0.000	***	

Table 2 reports regression results of CEO compensation on the changes in EPS and raw stock returns. The sample consists of 12,326 CEO-year observations in ExecuComp database from 1993 to 2004. The regression model is:

$$\Delta Comp_{i,t} = \alpha + \beta \Delta E_{i,t} + \gamma RET_{i,t} + u$$

where Δ*comp* is defined as cash compensation, equity grants, value change in CEO equity holdings, total pay, CEO total equity-based compensation and CEO total compensation, respectively. Δ*E* is the changes in EPS, and *RET* is annual stock returns (see Table 1 for definition of all variables).
The regressions are pooled cross sectional regressions with year and SIC two digit industry indicators (not reported). The t-statistics and p-values are based on Roger's standard errors which control for serial correlation and heteroscedasticity.
All variables are winsorized at the top and the bottom 0.5 percentiles to control for outliers.
***, ** and * indicate significance (two-tailed *t* test) at 1, 5 and 10 percent, respectively.

Table 3
Regression of CEO Compensation on Changes in EPS and Filtered Price and Estimates of the Impact of Earnings on CEO Compensation

Panel A: Descriptive statistics of filtered price and its correlation with selected variables

(I) Distribution of the filtered price

Mean	Std	Min	Q1	Median	Q3	Max
0.00	0.49	(2.49)	(0.26)	(0.05)	0.17	4.36

(II) Correlation with other variables

variable	Pearson		Spearman	
	Filtered Price	RET	Filtered Price	RET
ΔE	0.00	0.24	0.18	0.34
filtered price	1	0.91	1	0.85
RET	0.91	1	0.85	1
ΔCash	0.21	0.24	0.29	0.33
ΔGrants	0.10	0.10	0.11	0.10
ΔEquity-holdings	0.83	0.91	0.77	0.92
ΔTotal_pay	0.15	0.16	0.19	0.21
ΔTotal_equity	0.76	0.82	0.75	0.88
ΔTotal_comp	0.78	0.84	0.75	0.88

Table 3 Continued,

Panel B: Regression of CEO compensation on the changes in EPS and filtered price

	Coefficient	t-stat	P-value		Lower bound	Upper bound	adj_R2
Cash Compensation							
intercept	0.09	1.38	0.167	***	(0.07)	0.26	7.5%
ΔE	0.43	6.68	0.000	***	0.38	0.49	
filtered price	0.20	15.49	0.000	***	0.18	0.21	
Equity grants							
intercept	(0.25)	(1.01)	0.312	***	(1.67)	1.17	1.7%
ΔE	0.37	2.22	0.026	**	(0.06)	0.79	
filtered price	0.64	6.91	0.000	***	0.52	0.77	
Value Change in CEO Beginning-of-the-year Equity Holdings							
intercept	(0.02)	(0.02)	0.984		(1.02)	0.98	81.9%
ΔE	9.29	16.62	0.000	***	8.94	9.63	
filtered price	10.81	77.94	0.000	***	10.71	10.91	
Total Pay							
intercept	0.03	0.15	0.877	***	(0.50)	0.56	4.1%
ΔE	0.42	4.00	0.000	***	0.23	0.60	
filtered price	0.46	9.52	0.000	***	0.40	0.51	
Total Equity-based Compensation							
intercept	(0.37)	(0.66)	0.510	***	(1.33)	0.58	69.7%
ΔE	4.90	9.39	0.000	***	4.57	5.23	
filtered price	6.93	49.92	0.000	***	6.83	7.02	
Total Compensation							
intercept	(0.49)	(0.95)	0.341	***	(1.11)	0.13	70.8%
ΔE	3.02	8.78	0.000	***	2.80	3.23	
filtered price	4.90	47.26	0.000	***	4.84	4.96	

Table 3 Continued,

Panel C: Estimates of the impact of earnings on CEO compensation –
Percentage and dollar change in CEO compensation for a one-standard-deviation movement in earnings

Coef on ΔE	STD of ΔE	Percent Change in Compensation	Expected compensation ($millions)		Dollar change in CEO Compensation ($millions)			
			Mean	Median	Mean		Median	
(1)	(2)	(3)=(1)*(2)	(4)	(5)	(6)=(3)*(4)		(7)=(3)*(5)	
Cash Compensation								
0.43	0.14	6.1%	1.41	0.98	0.085	a	0.059	
Equity Grants								
0.37	0.14	5.2%	2.83	0.80	0.146	b	0.041	
Value Change in CEO Equity Holdings								
9.29	0.14	130.0%	14.91	1.36	19.39	c	1.77	
CEO Total Pay								
0.42	0.14	5.8%	4.65	2.18	0.271		0.127	
Total Equity-based Compensation								
4.90	0.14			b+c	19.53		1.81	
Total Compensation								
3.02	0.14			a+b+c	19.62		1.87	

The sample consists of 12,326 CEO-year observations in ExecuComp database from 1993 to 2004.
Panel A reports descriptive statistics of the filtered price and its correlation with other key variables. The filtered price is the residual term ($e_{i,t}$) from the following return-earnings model

$$RET_{i,t} = a_0 + a_1 \Delta E_{i,t} + e_{i,t} \quad \text{Model (1)}$$

Panel B reports results from regressions of CEO compensation components on the changes in EPS and the filtered price.

$$\Delta Comp_{i,t} = b_0 + b_1 \Delta E_{i,t} + b_2 e_{i,t} + u_{i,t} \quad \text{Model (2)}$$

where $e_{i,t}$ is the residual term from Model (1), and $\Delta comp$ is defined as cash compensation, equity grants, value change in CEO equity holdings, total pay, CEO total equity-based compensation and CEO total compensation, respectively.
The regressions in Panel A and Panel B are pooled cross sectional regressions with year indicators and SIC two digit code industry indicators (coefficients on which are not reported). The t-statistics and p-values are based on Roger's standard errors which control for serial correlation and heteroscedasticity. The lower and upper bounds are based on 95% confidence interval.
Panel C reports the percentage and dollar change in CEO compensation for a one-standard deviation movement in earnings. Column (1) is copied from Panel B of Table 3. Column (2) is copied from Panel D of Table 1. Columns (4) and (5) are copied from Panel B of Table 1.
All variables are winsorized at the top and the bottom 0.5 percentiles to control for outliers. All variables are as defined in Table 1.
***, ** and * indicate significance (two tailed t-test) at 1, 5 and 10 percent respectively.

Table 4
Descriptive Statistics of Earnings-Announcement-Day Return and Non-Earnings-Announcement-Day Return and Analysis of Variance Ratios

Panel A: Descriptive statistics of return components

	N	Mean	Std	Min	Q1	Median	Q3	Max
EA_RET	11,310	0.022	0.140	(1.204)	(0.047)	0.020	0.094	0.797
NON_EA_RET	11,310	0.162	0.517	(1.397)	(0.121)	0.109	0.352	5.489

Panel B: Pearson and spearman correlations of return components

	NON_EA_RET	EA_RET	RET
NON_EA_RET		(0.06)	0.96
EA_RET	(0.07)		0.20
RET	0.94	0.21	

Panel C: Variance ratios for CEO compensation components

STAT	ΔCash	ΔGrants	ΔEquity_holdings	ΔTotal_pay	ΔTotal_equity	ΔTotal_comp
N	1294	1158	1300	1298	1300	1300
P10	0.028	0.028	0.007	0.031	0.009	0.010
Q1	0.21	0.20	0.05	0.19	0.06	0.06
MEDIAN	**0.85**	**0.84**	**0.21**	**0.79**	**0.23**	**0.24**
Q3	3.50	4.00	0.51	3.54	0.61	0.59
P90	22.37	26.92	0.87	22.78	1.10	1.02

The sample in Panel A and Panel B consists of 11,310 CEO-year observations from the original sample that have valid daily return data around earnings announcements. **CUM _RET** is the three day (-1,0,1) cumulative raw stock returns around each earnings announcement as reported by CRSP. **EA_RET** is the sum of all CUM_RET during a firm's fiscal year. That is $EA\_RET_{i,t} = \sum_{j=1}^{4} CUM\_RET_{i,t,j}$ Model (5), where j represents quarters.

NON_EA_RET is the difference between annual stock return and the *EA_RET*. i.e. *NON_EA_RET = RET - EA_RET*

The sample in Panel C is consisted of 7,760 observations representing about 1,300 CEOs. Each CEO must have at least four valid continuous observations to be included in the sample.

The numerator of the variance ratio is the variance of the predicted compensation from the following regression run for each CEO

$\Delta Comp_{i,t} = d_0 + d_2 * EA\_RET_{i,t} + u_{i,t}$ Model (4a)

The denominator of the variance ratio is the predicted compensation from the following regression run for each CEO

$\Delta Comp_{i,t} = d_0 + d_1 * NON\_EA\_RET_{i,t} + u_{i,t}$ Model (4b)

where Δ*comp* is defined as cash compensation, equity grants, value change in CEO equity holdings, total pay, CEO total equity-based compensation and CEO total compensation, respectively.

All variables are winsorized at the top and the bottom 0.5 percentiles to control for outliers.

All variables are as defined in Table 1. ***, ** and * indicate significance (two tailed t-test) at 1, 5 and 10 percent respectively.

Table 5
Regression of CEO Compensation on Earnings-Announcement-Day Return and Non-Earnings-Announcement-Day Return

Independent Variable		Coef	t-stat	p-value		R2	Incremental R2
Cash Compensation							
Intercept		(0.02)	(0.27)	0.788		5.9%	
NON_EA_RET	d11	0.19	15.92	0.000	***		
Intercept		0.01	0.10	0.918		3.6%	2.3%
EA_RET	d12	0.47	12.31	0.000	***		
Intercept		(0.02)	(0.26)	0.797		8.2%	
NON_EA_RET	d13	0.21	16.70	0.000	***		
EA_RET	d14	0.52	14.12	0.000	***		
Equity Grants							
Intercept		(0.53)	(1.83)	0.067	*	1.6%	
NON_EA_RET	d21	0.63	6.73	0.000	***		
Intercept		(0.38)	(1.40)	0.162		0.7%	0.1%
EA_RET	d22	0.53	2.03	0.043	**		
Intercept		(0.53)	(1.87)	0.062	*	1.7%	
NON_EA_RET	d23	0.64	6.82	0.000	***		
EA_RET	d24	0.72	2.70	0.007	***		
Value Change in CEO beginning-of-the-year Equity Holdings							
Intercept		(1.62)	(3.35)	0.001	***	77.3%	
NON_EA_RET	d31	10.61	70.63	0.000	***		
Intercept		(0.21)	(0.21)	0.833		12.0%	5.9%
EA_RET	d32	8.32	15.53	0.000	***		
Intercept		(1.56)	(2.34)	0.020	**	83.2%	
NON_EA_RET	d33	10.83	72.13	0.000	***		
EA_RET	d34	11.08	47.26	0.000	***		

Table 5 Continued,

Independent Variable		Coef	t-stat	p-value		Adj_R2	Incremental R2
Total Pay							
Intercept		(0.30)	(3.50)	0.000	***	3.9%	
NON_EA_RET	d41	0.45	9.02	0.000	***		
Intercept		(0.24)	(2.25)	0.025	***	1.7%	0.2%
EA_RET	d42	0.42	3.55	0.001	***		
Intercept		(0.30)	(3.71)	0.001	***	4.1%	
NON_EA_RET	d43	0.46	9.27	0.000	***		
EA_RET	d44	0.54	4.57	0.000	***		
Total Equity-based Compensation							
Intercept		(1.54)	(3.31)	0.000	***	62.8%	
NON_EA_RET	d51	6.68	43.77	0.000	***		
Intercept		(0.65)	(0.74)	0.458		9.1%	5.0%
EA_RET	d52	5.33	14.04	0.000	***		
Intercept		(1.51)	(3.19)	0.000	***	67.8%	
NON_EA_RET	d53	6.82	44.82	0.000	***		
EA_RET	d54	7.07	32.83	0.000	***		
CEO Total Compensation							
Intercept		(1.27)	(2.65)	0.008	***	65.7%	
NON_EA_RET	d61	4.74	42.06	0.000	***		
Intercept		(0.64)	(0.79)	0.427		9.2%	5.4%
EA_RET	d62	3.82	13.90	0.000	***		
Intercept		(1.24)	(2.56)	0.010	***	71.1%	
NON_EA_RET	d63	4.85	42.76	0.000	***		
EA_RET	d64	5.05	32.39	0.000	***		

The sample is consisted of 11,310 observations from the original sample that have valid daily return data around earnings announcements. Table 5 reports results from regression of CEO compensation on earnings-announcement-day return and non-earnings-announcement-day return.

$\Delta Comp_{i,t} = d_0 + d_1 * NON\_EA\_RET_{i,t} + u_{i,t}$ Model (4a)
$\Delta Comp_{i,t} = d_0 + d_2 * EA\_RET_{i,t} + u_{i,t}$ Model (4b)
$\Delta Comp_{i,t} = d_0 + d_3 * NON\_EA\_RET_{i,t} + d_4 * EA\_RET_{i,t} + u_{i,t}$ Model (4c)

Table 5 Continued,

where Δ*comp* is defined as cash compensation, equity grants, value change in CEO equity holdings, total pay, CEO total equity-based compensation and CEO total compensation, respectively.

CUM_RET is the three day (-1,0,1) cumulative raw stock returns around each earnings announcement as reported by CRSP. **EA_RET** is the sum of all CUM_RET during a firm's fiscal year. That is,

$$EA\_RET_{i,t} = \sum_{j=1}^{4} CUM\_RET_{i,t,j} \qquad \text{Model (5)}$$

NON_EA_RET is the difference between annual stock return and the EA_RET. i.e. *NON_EA_RET = RET - EA_RET*
The incremental R2 is calculated as the difference between the R2 of Model (4c) and Model (4a).

The regressions are pooled cross sectional regressions with year and industry (SIC two digit code) indicators (coefficient estimates of which are not reported). The t-statistics and p-values are based on Roger's standard errors which control for serial correlation and heteroscedasticity.

All variables are winsorized at the top and the bottom 0.5 percentiles to control for outliers.
All variables are as defined in Table 1.
***, ** and * indicate significance (two tailed t-test) at 1, 5 and 10 percent respectively.

Table 6
Impacts of Earnings on CEO Compensation Estimated from Short-Window ERC

Panel A: Descriptive statistics of ΔQE and the short widow ERC estimate

Descriptive Statistics of quarterly ΔQE

N	MEAN	STD	MIN	Q1	MEDEAN	Q3	MAX
45,240	0.003	0.03446	(0.316)	(0.002)	0.002	0.006	0.525
		STD					

Short-window ERC estimate

	coef	t-stat	p-value	adj_R2
Intercept	0.005	5.05	0.000	1%
ΔQE	0.1704	7.40	0.000	
	ERC			

Panel B: Impact of earnings on CEO compensation - for one standard deviation of quarterly ΔQE

		Percentage change	Value change ($ millions)		
Cash Compensation					
effect of earnings on returns, per quarter	A=ERC*STD	0.006	mean		median
effect of earnings on returns, annual	B=A*4	0.0235			
impact of earnings on cash compensation	C=B*d14	**1.2%**	**0.017**	**a**	**0.012**
Equity Grants					
effect of earnings on returns, per quarter	A=ERC*STD	0.006			
effect of earnings on returns, annual	B=A*4	0.0235			
impact of earnings on new grants	C=B*d24	**1.7%**	**0.048**	**b**	**0.013**
Value Change in CEO Equity-holdings					
effect of earnings on returns, per quarter	A=ERC*STD	0.006			
effect of earnings on returns, annual	B=A*4	0.0235			
impact of earnings on equity holdings	C=B*d34	**26.0%**	**3.88**	**c**	**0.35**
Total Pay					
effect of earnings on returns, per quarter	A=ERC*STD	0.006			
effect of earnings on returns, annual	B=A*4	0.0235			
impact of earnings on total pay	C=B*d44	**1.3%**	**0.059**		**0.028**
Total Equity-based Compensation					
effect of earnings on returns, per quarter	A=ERC*STD				
effect of earnings on returns, annual	B=A*4				
impact of earnings on total equity-based compensation	C=B*d54	**b+c**	**3.93**		**0.37**
Total Compensation					
effect of earnings on returns, per quarter	A=ERC*STD				
effect of earnings on returns, annual	B=A*4				
impact of earnings on total compensation	C=B*d64	**a+b+c**	**3.94**		**0.38**

Table 6 Continued,

The sample is consisted of 45,240 quarterly observations corresponding to the 11,310 annual observations in Table 5. Table 6 demonstrates the computation of the compensation impact of earnings for a one-standard deviation of accounting earnings based on coefficients estimates in Table 5 as well as on estimate of a short window ERC.

Panel A reports the descriptive statistics of the changes in quarterly EPS (ΔQE) and the short window ERC estimated from the following model:

$$CUM\_RET_{i,t,j} = a_0 + a_1 \Delta QE_{i,t,j} + e_{i,t,j} \qquad \text{Model (6)}$$

where $CUM\_RET_{i,t,j}$ is defined as the three day (-1,0,1) cumulative raw stock returns around the j^{th} quarter earnings announcement for firm i in year t, and $\Delta QE_{i,t,j}$ is firm i's j^{th} quarter EPS (Compustat quarterly data item 19) in year t minus the EPS of the same quarter in year $t-1$, scaled by stock price at the end of the earlier quarter. The quarterly EPS and the stock price are adjusted for stock dividends and stock splits.

The short-window ERC is based on quarterly cross sectional regressions. The reported ERC is the mean of the 48 quarterly ERCs, and the t-stat is calculated using the Fama-Macbeth method (Fama and Macbeth, 1973).

Panel B demonstrates the computation of the compensation impact of earnings using the ERC reported in Panel A and the coefficient estimates on EA_RET in Table 5 ("d14" through "d64"). The compensation impact is presented in terms of the percentage and dollar changes in CEO compensation for a one-standard-deviation movement in earnings.

All variables are winsorized at the top and the bottom 0.5 percent to control for outliers.
All variables are as defined in Table 1
***, ** and * indicate significance (two tailed t-tests) at 1, 5 and 10 percent, respectively.

Table 7
Regression of CEO Compensation on Changes in EPS and Filtered Price and Estimates of Earnings' Impact on CEO Compensation (Firm Specific)

Panel A: Summary of Statistics of Earnings coefficient in the regression of CEO compensation on the changes in EPS and the filtered price - by firm

	Coef (mean)	t_stat	prob		Coef (median)	R2
Cash	5.02	13.68	0.000	***	3.11	44%
Equity Grants	(10.86)	(0.59)	0.557		0.97	43%
Value Change in CEO Beginning-of-the-year-Equity Holdings	72.87	11.99	0.000	***	33.83	89%
Total Pay	4.28	2.38	0.017	**	2.61	38%
Total Equity-based Compensation	51.46	11.45	0.000	***	19.95	82%
Total Compensation	39.50	10.58	0.000	***	13.20	82%

Panel B: Mean/median percentage change in CEO compensation for a one-standard-deviation movement in earnings - estimated from by firm

	mean	t_stat	prob		median
Cash	14%	23.29	0.000	***	11%
Equity Grants	14%	3.67	0.000	***	3%
Value Change in CEO Beginning-of-the-Year Equity Holdings	152%	20.32	0.000	***	132%
Total Pay	10%	8.41	0.000	***	11%
Total Equity-based Compensation	98%	19.53	0.000	***	83%
Total Compensation	69%	20.29	0.000	***	55%

Panel C: Mean/median value change in CEO compensation for a one-standard-deviation movement in earnings – estimated by firm ($ millions)

	mean		t_stat	prob		median
Cash	0.216	a	16.05	0.000	***	0.118
New Equity Grants	0.354	b	2.86	0.004	***	0.013
Value Change in CEO Beginning-of-the-Year Equity Holdings	13.43	c	7.63	0.000	***	2.12
Total Pay	0.369		4.86	0.000	***	0.222
Total Equity-based Compensation	13.78	b+c	7.67			2.36
Total Compensation	13.80	a+b+c	7.62			2.58

Table 7 Continued,

The sample consists of 8,782 CEO-year observations representing 911 firms in ExecuComp database from 1993 to 2004. Each firm in the sample has at least six continuous firm-year observations.

Panel A reports results from time series firm specific regressions of CEO compensation components on the change in EPS and the filtered price.

$$\Delta Comp_{i,t} = b_0 + b_1 \Delta E_{i,t} + b_2 e_{i,t} + u_{i,t} \qquad \text{Model (2)}$$

where $e_{i,t}$ is the residual term from Model (1): $RET_{i,t} = a_0 + a_1 \Delta E_{i,t} + e_{i,t}$,
and $\Delta comp$ is defined as cash compensation, equity grants, value change in CEO equity holdings, total pay, CEO total equity-based compensation and CEO total compensation, respectively.

Panel B and Panel C report the percentage and dollar changes in CEO compensation for a one-standard deviation movement in earnings based on time series firm specific regression. The t-statistics and p-values are based on the distribution of the 911 by-firm estimates.

All variables are winsorized at the top and the bottom 0.5 percentiles to control for outliers.
All variables are as defined in Table 1.
***, ** and * indicate significance at 1, 5 and 10 percent (two tailed t-test), respectively.

Table 8
Regression of CEO Compensation on Earnings-Announcement-Day Return and Non-Earnings-Announcement-Day Return and Estimates of Earnings' Impact on CEO Compensation (Firm Specific)

Panel A: Time series firm-specific regression of CEO compensation on earnings-announcement-day return and non-earnings-announcement-day return

	Dep. Var.	mean	t_stat	Prob.	median	R2
Cash	EA_RET	0.57	7.22	0.000	0.46	37%
	NON_EA_RET	0.29	12.42	0.000	0.21	
Equity Grants	EA_RET	(1.61)	(0.65)	0.519	0.11	42%
	NON_EA_RET	0.63	2.62	0.009	0.12	
Value Change in CEO Equity Holdings	EA_RET	12.09	34.43	0.000	11.54	89%
	NON_EA_RET	12.30	86.77	0.000	11.57	
Total Pay	EA_RET	0.31	1.34	0.182	0.56	82%
	NON_EA_RET	0.34	5.16	0.000	0.28	
Total Equity-based Compensation	EA_RET	7.93	21.75	0.000	8.42	81%
	NON_EA_RET	7.76	63.92	0.000	7.94	
Total Compensation	EA_RET	5.17	27.33	0.000	5.35	34%
	NON_EA_RET	5.18	60.32	0.000	4.94	

Panel B: Mean/median percentage change in CEO compensation for a one-standard-deviation movement in earnings – estimated by firm

	mean	t_stat	probt		median
Cash	2%	6.48	0.000	***	1%
Equity Grants	5%	2.23	0.026	**	12%
Value Change in CEO Beginning-of-the-Year Equity Holdings	17%	7.25	0.000	***	0%
Total Pay	2%	2.64	0.008	***	1%
Total Equity-based Compensation	14%	7.91	0.000	***	7%
Total Compensation	10%	8.34	0.000	***	4%

Panel C: Mean/median value change in CEO compensation for a one-standard deviation movement in earnings – estimated by firm ($millions)

	mean	t_stat	probt		median
Cash	.020 a	4.58	0.000	***	.005
Equity Grants	.121 b	1.56	0.118		.002
Value Change in CEO Beginning-of-the-Year Equity Holdings	1.99 c	4.94	0.000	***	.169
Total Pay	.100	1.51	0.132		.009
Total Equity-based Compensation	2.11 b+c				.169
Total Compensation	2.13 a+b+c				.174

Table 8 Continued,

The sample is consisted of 38,217 quarterly observations representing 911 firms that have at least six continuous firm-year observations from 1993 to 2004. Panel A reports results from by-firm regressions of CEO compensation on earnings-announcement-day return and non-earnings-announcement-day return.

$\Delta Comp_{i,t} = d_0 + d_1 * NON\_EA\_RET_{i,t} + u_{i,t}$ Model (4a)
$\Delta Comp_{i,t} = d_0 + d_2 * EA\_RET_{i,t} + u_{i,t}$ Model (4b)
$\Delta Comp_{i,t} = d_0 + d_3 * NON\_EA\_RET_{i,t} + d_4 * EA\_RET_{i,t} + u_{i,t}$ Model (4c)

where $\Delta comp$ is defined as cash compensation, equity grants, value change in CEO equity holdings, total pay, CEO total equity-based compensation and CEO total compensation, respectively.

CUM_RET is the three day (-1,0,1) cumulative raw stock returns around each earnings announcement. **EA_RET** is the sum of all CUM_RET during a firm's fiscal year. That is,

$$EA\_RET_{i,t} = \sum_{j=1}^{4} CUM\_RET_{i,t,j} \quad \text{Model (5)}$$

NON_EA_RET is the difference between annual stock return and the EA_RET. i.e. *NON_EA_RET = RET - EA_RET*

Panel B and Panel C report the percentage and dollar changes in CEO compensation for a one-standard deviation movement in earnings based on time series firm specific regression. The t-statistics and p-values are based on the distribution of the 911 by-firm estimates.

All variables are winsorized at the top and the bottom 0.5 percentiles to control for outliers.
All variables are as defined in Table 1.
***, ** and * indicate significance at 1, 5 and 10 percent (two tailed t-test), respectively.

Table 9
Regression of CEO Compensation on Changes in EPS and Filtered Price
- by Industry Analysis

Panel A: Regression of CEO Compensation on the Changes in Earnings and Filtered Price

		ΔCash			ΔEquity Grants			ΔEquity Holdings		
		coef	t-stat		coef	t-stat		coef	t-stat	
Financial Services										
	ΔE	0.69	1.75	*	(0.15)	(0.32)		5.14	2.43	**
	FP	0.24	4.41	***	0.98	2.79	***	10.43	16.07	***
	R2	5.0%			0.9%			76.7%		
High-Tech										
	ΔE	0.19	2.30	**	0.07	0.25		8.56	8.17	***
	FP	0.14	6.95	***	0.56	4.25	***	10.35	56.51	***
	R2	5.9%			2.1%			85.0%		
Other										
	ΔE	0.52	5.65	***	0.58	2.69	***	9.88	16.98	***
	FP	0.26	15.50	***	0.66	4.59	***	11.27	54.75	***
	R2	10.3%			1.3%			82.1%		
Utility										
	ΔE	1.70	7.04	***	1.24	0.82		15.13	6.51	***
	FP	0.26	3.66	***	1.90	2.52	***	10.24	5.08	***
	R2	14.0%			5.8%			63.0%		

Panel B: Percentage Change in CEO Compensation for a One-Standard-Deviation Movement in Earnings

		Coef on ΔE	STD	% change for one STD shift in Earnings	Proportion in CEO total compensation	% change in CEO total compensation
		(1)	(2)	(3)=(1)*(2)	(4)	(5)=(3)*(4)
Fin. Serv.	Cash	0.69	0.10	6.9%	11.2%	0.8%
	Equity Grants	(0.15)	0.10	-1.5%	6.9%	-0.1%
	Equity Holdings	5.14	0.10	51.9%	73.4%	38.1%
						38.8%
High-tech	Cash	0.19	0.19	3.6%	3.0%	0.1%
	Equity Grants	0.07	0.19	1.4%	2.7%	0.0%
	Equity Holdings	8.56	0.19	164.6%	89.3%	146.9%
						147.1%
Other	Cash	0.52	0.13	7.0%	11.3%	0.8%
	Equity Grants	0.58	0.13	7.7%	5.4%	0.4%
	Equity Holdings	9.88	0.13	132.7%	72.9%	96.8%
					98.0%	**98.0%**
Utility	Cash	1.70	0.06	10.6%	48.3%	5.1%
	Equity Grants	1.24	0.06	7.7%	10.1%	0.8%
	Equity Holdings	15.13	0.06	94.3%	18.9%	17.8%
						23.7%

Table 9 Continued,

The sample consists of 12,326 CEO-year observations in ExecuComp database from 1993 to 2004.

Panel A reports results from regressions of CEO compensation components on the changes in EPS and the filtered price.

$$\Delta Comp_{i,t} = b_0 + b_1 \Delta E_{i,t} + b_2 e_{i,t} + u_{i,t} \qquad \text{Model (2)}$$

where $e_{i,t}$, the proxy of filtered price, is the residual term from Model (1): $RET_{i,t} = a_0 + a_1 \Delta E_{i,t} + e_{i,t}$ and $\Delta comp$ is defined as cash compensation, equity grants, value change in CEO equity holdings, total pay, CEO total equity-based compensation and CEO total compensation, respectively. RET and ΔE are annual raw stock returns and changes in annual earnings. For detailed description of the variables refer to Table 1.

The regressions are run separately for four sub-samples based on industry. These are **utility** group (two digit SIC code = 49), **high tech** group (three-digit SIC code including 283 Drugs, 357 Computer and Office Equipment, 360 Electrical Machinery and Equipment, Excluding Computers, 361 Electrical Transmissions and distribution Equipment, 362 Electrical Industrial Apparatus, 363 Household Appliances, 364 Electrical Lighting and Wiring Equipment, 365 Household Audio, Video Equipment, Audio Receiving, 366 Communication Equipment, 367 Electronic Components, Semiconductors 368 Computer Hardware (Including Mini, Micro, Mainframes, Terminals, Discs, Tape Drives, Scanners, Graphics Systems, Peripherals, and Equipment), 481 Telephone Communications, 737 Computer Programming, Software, Data Processing 873 Research, Development, Testing Services), **financial services** group (one digit SIC code=6), and **others** group (firms not belonging to any of the first three groups).

The regressions are pooled cross sectional regressions with year indicators and SIC two digit code industry indicators (coefficients on which are not reported). The t-statistics and p-values are based on Roger's standard errors which control for serial correlation and heteroscedasticity.

Panel C reports the percentage and dollar change in CEO compensation for a one-standard deviation movement in earnings. Column (1) is copied from Panel A. Column (2) reports the standard deviation of earnings for each sub-sample. Column (4) reports the proportion of each type of compensation in CEO total compensation. The reported percentage is the mean value calculated from each sub-sample. Column (5) reports the weighted percentage change in each type of compensation for a one-standard deviation movement in earnings.

All variables are winsorized at the top and the bottom 0.5 percentiles to control for outliers.
All variables are as defined in Table 1.
***, ** and * indicate significance (two tailed t-test) at 1, 5 and 10 percent respectively.

Table 10
Regression of CEO Compensation on Changes in EPS and Filtered Price
- by Size Analysis

Panel A: Regression of CEO Compensation on the Changes in Earnings and Filtered Price

		ΔCash			ΔEquity Grants			ΔEquity Holdings		
	stat	coef	t-stat		coef	t-stat		coef	t-stat	
S&P 600 SmallCap										
	ΔE	0.26	4.60	***	0.20	1.17		8.46	13.14	***
	FP	0.17	10.31	***	0.69	4.63		10.98	57.05	***
	R2	7.8%			1.4%			87.1%		
S&P 400 MidCap										
	ΔE	1.31	5.72	***	0.42	0.64		12.09	10.15	***
	FP	0.21	9.77	***	0.50	3.89	***	11.05	52.98	***
	R2	11.5%			0.5%			80.7%		
S&P 500 - below median										
	ΔE	0.99	4.15	***	1.31	1.99		14.03	11.87	***
	FP	0.23	7.33	***	0.93	3.75	***	10.22	26.90	***
	R2	10.4%			4.7%			78.6%		
S&P 500 - above median										
	ΔE	0.75	1.41		(0.11)	(0.20)		5.00	1.40	
	FP	0.23	5.71	***	0.32	1.11		10.13	24.53	***
	R2	5.2%			2.8%			66.9%		

Panel B: Percentage Change in CEO Compensation for a One-Standard-Deviation Movement in Earnings

		Coef on ΔE	STD	% change for one STD shift in Earnings	Proportion in CEO total compensation	% change in CEO total compensation
		(1)	(2)	(3)=(1)*(2)	(4)	(5)=(3)*(4)
S&P 600	Cash	0.26	0.21	5.5%	11.2%	0.6%
SmallCap	Equity Grants	0.20	0.21	4.3%	1.5%	0.1%
	Equity Holdings	8.46	0.21	176.9%	76.8%	135.9%
						136.6%
S&P 400	Cash	1.31	0.08	10.6%	11.3%	1.2%
MidCap	Equity Grants	0.42	0.08	3.5%	5.4%	0.2%
	Equity Holdings	12.09	0.08	98.4%	73.3%	72.1%
						73.5%
S&P 500	cash	0.99	0.10	9.7%	10.1%	1.0%
Below median	equity	1.31	0.10	12.9%	8.7%	1.1%
	holding	14.03	0.10	137.8%	71.7%	98.8%
						100.9%
S&P 500	Cash	0.75	0.07	5.3%	9.4%	0.5%
- above median	Equity Grants	(0.11)	0.07	-0.8%	10.0%	-0.1%
	Equity Holdings	5.00	0.07	35.3%	69.5%	24.5%
						24.9%

Table 10 Continued,

The sample consists of 12,326 CEO-year observations in ExecuComp database from 1993 to 2004.

Panel A reports results from regressions of CEO compensation components on the changes in EPS and the filtered price.

$$\Delta Comp_{i,t} = b_0 + b_1 \Delta E_{i,t} + b_2 e_{i,t} + u_{i,t} \qquad \text{Model (2)}$$

where $e_{i,t}$, the proxy of filtered price, is the residual term from Model (1): $RET_{i,t} = a_0 + a_1 \Delta E_{i,t} + e_{i,t}$ and $\Delta comp$ is defined as cash compensation, equity grants, value change in CEO equity holdings, total pay, CEO total equity-based compensation and CEO total compensation, respectively. RET and ΔE are annual raw stock returns and changes in annual earnings. For detailed description of the variables refer to Table 1.

The regressions are run separately for four sub-samples based on firm size. These are S&P 600 SmallCap firms **(SM)** S&P 400 MidCap firms **(MD)**, S&P 500 with market cap below the median (**SPB)** and S&P 500 with market cap above the median (**SPA**).
The regressions are pooled cross sectional regressions with year indicators and SIC two digit code industry indicators (coefficients on which are not reported). The t-statistics and p-values are based on Roger's standard errors which control for serial correlation and heteroscedasticity.

Panel C reports the percentage and dollar change in CEO compensation for a one-standard deviation movement in earnings. Column (1) is copied from Panel A. Column (2) reports the standard deviation of earnings for each sub-sample. Column (4) reports the proportion of each type of compensation in CEO total compensation. The reported percentage is the mean value calculated from each sub-sample. Column (5) reports the weighted percentage change in each type of compensation for a one-standard deviation movement in earnings.

All variables are winsorized at the top and the bottom 0.5 percentiles to control for outliers.
All variables are as defined in Table 1.
***, ** and * indicate significance (two tailed t-test) at 1, 5 and 10 percent respectively.

Table 11
Regression of CEO Compensation on Changes in EPS, Filtered Price, and Hypothesized Determinants

	ΔE		FP		BM		VAR		ΔE *BM		FP *BM		ΔE *VAR		FP *VAR		R2
Predicted Sign	+		+		?		?		+		-		-		+		
Cash Compensation																	
Coef	0.80		0.15		0.03		0.01		0.30		0.13		(0.23)		(0.02)		9.1%
t-stat	5.98		8.55		1.61		0.59		2.64		3.31		(2.93)		(0.74)		
p-value	.000	***	.000	***	.107		.553		.008	***	.001	***	.003	***	.458		
Equity Grants																	
Coef	0.78		0.98		(0.28)		0.02		0.01		(0.76)		(0.30)		(0.36)		2.1%
t-stat	1.95		6.06		(2.51)		0.40		0.03		(3.29)		(2.22)		(4.37)		
p-value	.051	**	.000	***	.012	**	.692		.976		.001	***	.027	**	.000	#	
Value Change in CEO Beginning-of-the-year Equity Holdings																	
Coef	10.93		10.42		1.07		(0.24)		4.26		2.16		(0.96)		(0.75)		81.1%
t-stat	7.97		44.40		6.85		(3.74)		3.97		5.49		(1.09)		(3.09)		
p-value	.000	***	.000	***	.000	***	.000	***	.000	***	.000	***	.276		.002	#	
Total Pay																	
Coef	0.47		0.65		(0.27)		0.03		0.12		(0.45)		(0.17)		(0.14)		5.1%
t-stat	1.97		7.55		(5.23)		0.99		0.66		(3.88)		(1.66)		(1.60)		
p-value	.049	**	.000	***	.000	***	.323		.506		.000	***	.096	*	.109		
Total Equity-based Compensation																	
Coef	6.27		7.04		0.49		(0.12)		2.73		0.68		(1.43)		(0.83)		66.6%
t-stat	6.33		32.06		2.74		(2.10)		3.51		1.46		(1.94)		(2.31)		
p-value	.000	***	.000	***	.006	***	.036	**	.000	***	.144		.052	**	.021	#	
Total Compensation																	
Coef	4.18		5.28		(0.05)		(0.08)		1.21		(0.58)		(0.94)		(0.75)		70.0%
t-stat	6.27		32.52		(0.50)		(2.14)		2.29		(2.06)		(2.23)		(4.37)		
p-value	.000	***	.000	***	.619		.033	**	.022	**	.040	**	.026	**	.000	#	

Table 11 Continued,

The sample is based on 10,655 observations from the original sample that have valid data to calculate book-to-market ratio and the relative noise ratio. The ratio is measured as the time-series variance of ΔE scaled by the time-series variance of FP (filtered price). The ratio is calculated for each firm based on the most recent10 years (8 years minimum) data of stock returns and EPS. Table 8 presents results of Model (8)

$$\Delta Comp_{i,t} = e_0 + e_1 \Delta E_{i,t} + e_2 FP_{i,t} + e_3 BM_{i,t} + e_4 \frac{Var(\Delta E_i)}{Var(FP_i)} + e_5 \Delta E_{i,t} * BM_{i,t} + e_6 FP_{i,t} * BM_{i,t} + e_7 \Delta E_{i,t} * \frac{Var(\Delta E_i)}{Var(FP_i)} + e_8 FP_{i,t} * \frac{Var(\Delta E_i)}{Var(FP_i)} + u_{i,t}$$

where Δ*comp* is defined as cash compensation, equity grants, value change in CEO equity holdings, total pay, CEO total equity-based compensation and CEO total compensation, respectively. The regressions are pooled cross sectional regressions with year and industry (SIC two digit) indicators (coefficients on which are not reported). The t-statistics and p-values are based on Roger's standard errors which control for serial correlation and heteroscedasticity.

All variables are winsorized at the top and the bottom 0.5 percentiles to control for outliers.
All other variables are as defined in Table 1.
***, ** and * indicate significance (two tailed t-test) at 1, 5 and 10 percent, respectively.
#: significantly different from the predicted sign.

VITA

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