MANAGERIAL INCENTIVES, OVERCONFIDENCE, RISK-TAKING, AND ACQUIRER SHAREHOLDER VALUE CREATION IN MERGERS AND ACQUISITIONS

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First draft: January 15, 2006
Last revised: March 15, 2006[2]

EFM Classification: 110, 120, 150, 160, 190

Keywords: executive compensation; behavioural corporate finance; risk-taking; mergers and acquisition; simultaneous equations model

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[2] We are grateful for valuable comments from seminar participants at Cranfield School of Management, University of Stirling, University of Edinburgh, and Cambridge University. Any remaining errors are ours.

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Abstract

This paper provides empirical evidence of strong relations among managerial incentives, risk-taking, and acquirer post-acquisition performance. Our analyses suggest that two primary measures of managerial incentives, the sensitivity of CEO wealth to stock price (Delta) and the sensitivity of CEO wealth to stock return volatility (Vega), affect managerial risk-taking propensity and acquirer acquisition performance differently. Generally, increase in Vega is associated with enhancement in acquirer shareholder value while increase Delta is related to reduction in shareholder value. Since Vega is solely related to stock option compensation while Delta originates mainly from restricted stock grant, these empirical results are consistent with the theoretical discussion of Lambert and Larcker (2004) that restricted stock grant is generally not the optimal contract form, and that stock option compensation possesses both efficiency and incentive advantage. In the analysis of acquisition-related risk change, our regression analyses support the hypotheses that increase in risk change is associated with increase in Vega while decrease in risk change is related to increase in Delta. However, even though increase in Vega is associated with increased risk due to acquisition and is directly related to acquirer post-acquisition performance, this impact does not vary with different levels of risk change. Similarly, the impact of Delta seems invariant to the level of risk change. Our analysis of managerial behavioral bias, overconfidence, is consistent with the hypothesis that managerial overconfidence provides an alternative solution to the underinvestment problem caused by managerial risk aversion. In addition to ordinary least squares regression, we employ simultaneous equations modelling to account for the endogeneity among managerial incentives, risk, and performance. To our best knowledge, our study is among the first to use the simultaneous equations model in investigating the impact of managerial incentives on shareholder value in the context of mergers and acquisitions.

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I. Introduction

The conflict between shareholders and corporate management arising from the separation of ownership and control in the publicly held corporation has been well recognized since Berle and Means (1932). Managers as agents of shareholders may make investment and financing decisions that serve their own interests to the detriment of those of shareholders. Since the seminal work of Jensen and Meckling (1976), the literature has focused on how managerial ownership and compensation contracting can help to align the interests of the managers with those of the shareholders.

This study focuses on the agency problem stemming from different risk preferences of shareholders and managers in making investment and financing decisions. Shareholders are considered risk-neutral since they can hold their wealth in well-diversified portfolios and thereby diversify away firm-specific risk. On the contrary, managers whose human capital is invested in their own firm hold undiversified portfolios. Additionally, when their money capital is invested in their company's stock[3], the degree of non-diversification is intensified. The undiversified portfolio exposes managers to a high level of both systematic and firm-specific risk, inducing managers to be risk averse. As a consequence, the risk-averse manager may behave opportunistically and pass up risky, but value-enhancing, investment opportunities, which is detrimental to shareholder value (Smith and Stulz, 1985; Guay, 1999).

An executive compensation package or equity ownership that enhances managers' wealth in line with increase in corporate performance or firm's stock value has generally been considered a solution to the agency problem (Baker et al, 1988). The past decade has witnessed an explosion in the grant of stock options to corporate top executives. An important characteristic of stock options is that they induce a convex relationship between pay and performance (Guay, 1999). Managers who hold company stock options are shielded from downside risk when the stock price falls

[3] This is mainly achieved by the grant of equity-based compensation.

below the strike price of the options but can reap enormous wealth gains when performance far exceeds that strike price. Stock options are thus intended to encourage managers to make high-risk investment and financing decisions, thereby offsetting managers' risk aversion to firm-specific risk (Smith and Stulz, 1985).

The recent development of behavioural agency theory marries the standard agency theory with the studies of various psychological biases, such as overconfidence and over-optimism (Wiseman and Gomez-Mejia, 1998). In our study, the relaxation of the assumption of rational behavior of corporate managers sheds a different light on the the relation between managerial incentives and firm performance. In contrast to most of the studies in behavioral finance that postulate the negative effect of managerial behavioral bias (Roll, 1986; Heaton, 2002; Malmendier and Tate, 2004), Gervais, Heaton, and Odean (2003) posit that overconfident managers are naturally more likely to take risks than less confident, risk-averse and rational managers and therefore fewer pay incentives are needed to motivate overconfident managers to undertake risky investment. Managerial overconfidence may actually provide an alternative remedy for the risk-related agency problem i.e. underinvestment.

In addition to the executive compensation package, other corporate governance mechanisms can, through their monitoring role, help to ensure the managers act in the best interests of shareholders in their corporate investment and financing decisions (Wright et al, 1996; Hermalin and Weisbach 2003). But, the corporate governance mechanism is a complex web of mutually interacting control mechanisms (Sudarsanam, 2000). So, in practice, the shareholders delegate the power to the board of directors to design the executive compensation contracts (Cyert et al, 2002). Therefore, the contracting process involves negotiation between the CEO and the board and is influenced by their relative bargaining powers.

Most extant studies, however, do not provide a picture that explains the relationships among executive compensation, risk-taking, corporate governance and firm performance in an integrated manner. Some studies link executive pay directly to firm performance (Jensen and Murphy, 1990; Bliss and Rosen, 2001; Datta et al., 2001; Palia, 2001) while others examine the relation between executive compensation and risk taking decisions (Rajgopal and Shevlin, 2002; Ryan and Wiggins, 2002; Coles, et al., 2005). The primary focus of this paper is to provide a more comprehensive

discussion of these relationships. We hypothesize that managerial compensation incentives motivate risky investment decisions and these decisions are shareholder value-enhancing. We focus our study on corporate acquisitions because they are major, influential, externally observable, and discretionary long-term investments that can alter the risk profile of acquires substantially and thereby exacerbate the potential risk-related conflict of interests between managers and shareholders.

Furthermore, we differentiate our study from most of the previous empirical studies of managerial incentive effects on corporate acquisition performance by arguing that managerial incentives, risk change, and acquisition performance are in fact jointly determined and are therefore endogenous variables. In the study of the pay-for-performance relation, it is possible that, rather than higher equity-based compensation producing better future performance, firms expecting better future performance grant more equity (Yermack, 1997). Our story is that even though managerial incentives may affect the performance of corporate acquisitions and the risk profiles of acquirers[4], the contemporaneous or anticipated change in corporate stock performance, risk profile, leverage, and size, due to the corporate acquisition, are likely to affect both the structure of managerial incentive compensation and the firm's compensation policy choices[5].

Based on a sample of 3069 acquisitions in the US during the period January 1, 1993 to December 31, 2004, we show that, equity-based compensation provides strong incentives for managers to conduct risky acquisitions. A high level of sensitivity of managers' wealth to firm stock return *volatility* renders managers less risk averse and more likely to conduct risky acquisitions. However, a high level of sensitivity of managers' wealth to stock return *change* intensifies managerial risk aversion. Managerial overconfidence induces managers to engage in risky acquisitions that consequently increase firm risk. Overall, we conclude that equity-based compensation is efficient in prompting managers to undertake risky acquisitions. Additionally, the

[4] Previous literature includes Datta, Iskandar-Datta and Raman (2001), which document a strong positive relation between acquiring firm's equity-based top executive compensation and post acquisition performance.

[5] Previous literature includes Bliss and Rosen (2001), which shows that CEO compensation and wealth increase after large bank mergers even when the acquirer's stock price declines. Grinstein and Hribar (2004) find that CEOs who have more power over the board receive significantly larger M&A bonus. More recently, Harford and Li (2005) study whether acquisitions improve or reduce CEO incentives. Their results consistently rebut the incentive alignment hypothesis by suggesting that the expected flow of new incentives following an acquisition can actually offset the effectiveness of the existing managerial incentives.

characteristics of the managers, i.e., managerial overconfidence appear to be an influential factor in inducing managers to make risky acquisitions.

Regarding post-acquisition performance, we find that, on average, US acquisitions during the period January 1, 1993 to December 31, 2001 bring value to acquirer shareholders up to three years after the acquisition consummation. Higher levels of managerial incentives, i.e., the sensitivity of managers' wealth to firm stock return *volatility* and the sensitivity of managers' wealth to stock price *change* are associated with better acquirer post-acquisition performance. Interestingly, managerial overconfidence appears a beneficent factor for good post-acquisition performance. Therefore, we find that managerial incentives, especially risk-taking incentives, motivate US acquirer managers during the merger wave of the 1990s to undertake risky acquisitions that enhance shareholder value. By being overconfident, the acquirer managers are actually able to deliver better post-acquisition performance. This is consistent with the theoretical prediction of Gervais et al (2003) that moderate levels of overconfidence tend to align the CEO risk-taking decisions with the interests of shareholders, increase firm value, and reduce the need for option compensation.

The contribution of this study is threefold. Firstly, the study is among the first to address the endogeneity among managerial incentives, risk change, and firm performance in the context of mergers and acquisitions. Secondly, this study explicitly examines the extent to which managerial incentives affect managerial risk-taking and how this risk-taking is, in turn, related to shareholder value, thereby bridging the gap in most of the extant studies in executive compensation which either solely investigate the relationship between managerial incentives and firm performance directly or only look at the association between managerial incentives and risk-taking. Finally, this study is among the first to empirically test the hypothesis that modest managerial behavioral bias can provide an alternative remedy to the agency problem arising from managerial risk aversion.

The remainder of the paper proceeds as follows. Section II further discusses the literature and hypotheses. Section III provides the details of the sample construction and the methodology. Section IV presents the sample characteristics and the empirical findings. Section V concludes with the discussion of limitations and further study.

II. Theoretical Framework and Hypotheses

In this section we develop a framework for analyzing the impact of executive compensation and other relevant factors on managerial risk-taking in acquisitions and the subsequent acquirer post-acquisition performance. We draw upon the standard agency model, the behaviourist extension of that model, the role of executive compensation contracts in aligning shareholders' and managers' interests and the corporate governance monitoring mechanisms that promote such alignment. Figure 1 illustrates our theoretical framework.

{Insert Figure 1 here}

A. A brief primer on executive compensation

Standard compensation contract contains four basic components: base salary, annual bonus, stock options, and long-term incentive plans (LTIPs) including restricted stock plans and multi-year accounting-based performance plans. Annual bonus, LTIPs (settled in cash or shares) are awarded to managers when they achieve pre-determined performance benchmarks over a pre-determined period. Even though an annual bonus plan provides incentives to increase firm profit, its incentive effect is tenuous compared with that of equity-based compensation. Hall and Liebman (1998) provide empirical evidence supporting the argument that pay-performance sensitivity is driven primarily by stock options and stock ownership, and not through other forms of compensation. Most employee stock options expire in ten years and are granted with an exercise price equal to the market price on the date of grant. Normally stock options cannot be exercised immediately after being granted. They can only be exercised after the vesting period (Hall and Muphy, 2002). Typically, in the US, the vesting period is five years after the grant of the stock option. Once the stock option is "vested" it can be exercised. Additionally, stock options are non-tradable, and are typically forfeited if the executive granted the options leaves the firm during the vesting period. When executive leave the firm after the vesting period, they forfeit options that are out of money and they have to exercise vested option that are in the money immediately.

B. Executive compensation, risk-taking, and firm performance

The common folklore of stock option compensation is that it shields the managers from downside risk since a stock option, in essence a call option on the firm's stock, only linearly relates to the stock price when the stock price exceeds the exercise price of the option contract (Feltham and Wu, 2001). Moreover, the convexity of payoff implies that the value of the stock option increases with the company's stock return volatility. Hence, stock option compensation is able to counter managerial risk aversion and prompt risk-averse managers to engage in risky investment projects including risky acquisitions (Guay, 1999; Datta et al., 2001 and Coles, Daniel and Naveen, 2005). Restricted stock, another form of equity-based compensation, is linearly related to the stock price. It offers an incentive for managers to improve firm performance. However, the linear payoff, by not limiting the downside risk, exposes managers' wealth to too much risk and thus increases managerial risk aversion (Smith and Stulz, 1985; Bryan, et al, 2000; Ryan and Wiggins, 2002). Bryan et al (2000) provide direct empirical evidence to support the argument that option-based compensation dominates stock-based compensation in inducing risk-averse managers to pursue risky, yet value-increasing, investment projects.

Nonetheless, other studies offer different views on stock option compensation. Meulbroek (2001) argues that as shareholders set constraints on a stock option award including a vesting period, undiversified risk-averse managers value the stock option they receive from the firm less than its cost to the shareholders since managers cannot trade or exercise the stock option freely. Hall and Murphy (2002) offer a similar argument concerning the divergence between the cost and the value of the stock option provision in executive compensation. They claim that the stock option is a particularly expensive way to award compensation. Ross (2004) argues that there exists no incentives contract that will make all expected utility maximizers less risk averse and more risk-prone. Their impact is likely to vary across individual decision makers.

In the context of mergers and acquisitions, Datta et al. (2001) provide direct empirical evidence to support the hypothesis that, for acquiring firms, providing stock option incentives to top executives can have a large positive impact on shareholder wealth. In the long run, managerial incentives can be effective in shaping long-term corporate investment policies and encourage managers to make decisions in the interests of

shareholders. The measure of managerial incentives used in Datta et al (2001), i.e., the sum of the value of new stock options granted to the top five executives as a percentage of total compensation paid to them, however, is an incomplete measure of managerial incentives. According to Core and Guay (2002) and Coles et al. (2005), it is at best a proxy for the direct measure of managerial incentives, i.e., Delta and Vega (see below for definitions of these terms).

The primary focus of this paper is to empirically investigate the relations among managerial incentives, risk, and firm performance. The study of Bloom and Milkovich (1998) is among the first to test the implications for agency theory of the relations among these variables. Their results suggest that organizations facing higher risk place less emphasis on short-term incentives than other organizations. Furthermore, higher-risk firms that rely on incentive pay exhibit poorer performance than higher-risk firms that do not emphasise incentive pay. However, Bloom and Milkovich (1998) only consider the annual bonus as the performance-contingent pay component, which cannot fully represent the incentive effect of executive compensation. Furthermore, Bloom and Milkovich (1998) do not allow for endogeneity among executive pay, risk, and performance. The extant literature that recognizes the endogenous relation between incentives and performance or between incentives and risk is discussed in the next section.

C. Simultaneous relations among managerial incentives, risk, and performance

Several papers have examined the endogeneity that exists among managerial incentives, risk, and firm performance, and its implications. Palia (2001) estimates a system of simultaneous equations in order to accurately identify the impact of managerial compensation on firm value by employing four instrumental variables, i.e., CEO experience, CEO education background, firm volatility, and CEO age that are expected to be related to executive compensation. Rajgopal and Shevlin (2002) treat stock option compensation and operating risk as endogenous variables and adopt a simultaneous equation approach. Similarly, Ryan and Wiggins (2002) model the compensation structure and the R&D investment decision as endogenous choices and test their relations by formulating a system of simultaneous equations. Brick, Palia and Wang (2005) study the endogeneity among three corporate governance mechanisms, namely executive compensation, firm leverage, and independent board

of directors. They subsequently link these three corporate governance mechanisms to shareholder value.

Previous studies consider either the endogeneity between incentives and risk (Rajgopal and Shevlin, 2002; Rogers, 2002; Coles, Daniel and Naveen, 2005) or the endogeneity between incentives and firm performance (Palia, 2001; Brick, Palia, and Wang, 2005). Additionally, some early studies have recognized the contemporaneous relation between risk change and the sample period firm performance (Black, 1976) and this aspect needs to be empirically modelled and investigated. As a development from the extant studies, our study investigates the endogenous relations among incentives, risk, and shareholder value performance in the context of mergers and acquisitions.

D. Managerial biases and the behavioral agency model

Recent papers on behavioural agency models argue that managerial risk taking is not a mere deviation from the traditional agency assumption of rational risk aversion (March and Shapira, 1987; Kahneman and Lado 1993; Wiseman and Gomez-Mejia, 1998; Wright *et al*, 2001). These authors criticize the risk aversion assumption as being too restrictive and unrealistic about human behaviour. Instead, they argue that managers may be 'irrational' and, under psychological influences, exhibit different risk attitudes in different situations. "These managers *think* that they are maximizing firm value, even if in reality, they are not. Since they think that they are already doing the right thing, stock options or debt are unlikely to change their behaviour." (Barberis and Thaler, 2002, p. 58). Such a managerial attitude may be due less to fraudulent intent than to behavioural biases such as overconfidence, overoptimism and hubris. Existing literature has shown that such behavioral biases induce excessive managerial risk taking.

Researchers have found that managers, particularly senior managers are prone to display overconfidence (March and Shapira, 1987; Goel and Thakor, 2000). Managers who are overconfident may be particularly attracted to high risk acquisitions because they provide them with greater opportunities to demonstrate their capability in 'creating miracles', i.e., they can successfully complete high risk acquisitions and realize the great benefits embedded in the acquisitions (Kohers and Kohers, 2001). These studies argue that behavioral biases may compound the problem of valuation

risk associated with acquisitions leading to overpayment for targets and shareholder value losses to acquirer shareholders (Roll, 1986).

In contrast to most previous studies that focus on the "negative effect" of managerial overconfidence, our study emphasizes its "positive effect". Gervais et al (2003) argue that overconfidence, which is likely to characterize senior managers, provides an alternative solution to the traditional agency problem of managerial risk aversion. They state that whereas risk-averse rational managers tend to postpone new projects until precise information is known about them, overconfident managers hesitate less before making their decisions. A moderate level of overconfidence tends to align these risky decisions with the interests of shareholders, increase firm value, and reduce the need for option-based compensation while still motivating an optimal level of managerial risk taking.

Compensating overconfident managers with stock awards and stock options, as if they were unbiased, has two serious drawbacks for shareholders. Firstly, shareholder wealth may decrease because the managers are paid too much compared to an "optimal" contract that recognise the bias towards overconfidence and adjusts the monetary risk incentives accordingly. In other words, monetary risk incentive may be redundant in the presence of overconfidence and, if awarded, represents an opportunity cost to shareholders. Secondly, driven by steep payoff convexity, managers may decide to invest in excessively risky projects that are not in the shareholders' best interests. This may be termed the *agency cost of management's behavioural bias*.

E. Other Corporate Governance Mechanisms

Managerial compensation is an indirect lever for influencing managerial behaviour and decision making and ensuring shareholder value gains. We have seen from the previous discussion that certain compensation components can induce risk aversion while others can encourage risk seeking. Moreover, managerial biases that encourage managers to indulge in excessively risky investments may be reinforced by compensation elements such as stock options. Thus, risk incentives from compensation contracts coupled with managerial biases may result in inadequate risk or excessive risk taking by managers. Therefore, shareholders may need other levers to ensure that managers accept neither too little nor too much risk. The board of

directors is one of the key corporate control devices. In their empirical study, Hermalin and Weisbach (1998) proxy for the overall strength of the board vis-à-vis the CEO by using a measure based on CEO tenure. Harford and Li (2005) employ the same proxy for board strength and find that board strength is influential in determining the link between pay-performance sensitivity and corporate acquisition performance.

F. Proposed hypotheses

Our study is primarily designed to empirically test the incentive alignment hypothesis. We differentiate our study from most extant studies by proposing a joint test among managerial incentives, risk-taking, and its shareholder wealth effect in mergers and acquisitions. We investigate the extent to which two primary measures of managerial incentives, the sensitivity of CEO wealth to stock price (Delta) and the sensitivity of CEO wealth to stock return volatility (Vega), affect management's risky corporate acquisition decision and how this decision is related to acquirer's post-acquisition performance. Building upon the existing theory of behavioral corporate finance, our empirical study also sheds light on the impact of behavioral bias on the relationships among incentives, risk-taking, and performance.

We start by testing the relation between managerial incentives and acquiring firm post-acquisition performance. In conformance with standard agency theory, we hypothesize that managerial incentives can motivate managers to undertake mergers and acquisitions that are shareholder value-enhancing. Consequently, our first two hypotheses can be stated as:

Hypothesis 1a**:** *Improvement in acquirer acquisition performance is associated with increase in Vega.*

Hypothesis 1b**:** *Improvement in acquirer acquisition performance is associated with increase in Delta.*

Subsequently, we focus on testing the risk incentive. Following the earlier discussion of the previous literature, we hypothesize that the sensitivity of CEO wealth to stock return volatility (Vega) motivates executives to undertake investments that increase

firm risk. On the other hand, consistent with extant studies arguing that a stock grant actually renders managers more risk averse, we hypothesise that risk change is inversely related to the sensitivity of CEO wealth to stock price i.e. to Delta. Two hypotheses are proposed for these tests:

Hypothesis 2a**:** *High level of Vega is associated with a large increase in firm risk due to corporate acquisition.*

Hypothesis 2b**:** *High level of Delta is associated with a small increase in risk or risk reduction due to corporate acquisition.*

These hypotheses lead us to investigate whether any increase (decrease) in risk due to corporate acquisition is associated with shareholder value enhancement (destruction).

Hypothesis 3a: *Improvement in acquirer's acquisition-related performance is associated with increase in firm risk due to increase in Vega.*

Hypothesis 3b: *Decline in acquirer's acquisition-related performance is associated with decrease in firm risk due to increase in Delta.*

In addition to the empirical tests that investigate the risk incentive effect of executive compensation and, following the theoretical discussion of Gervais, Heaton, and Odean (2003), we test whether managerial overconfidence can alleviate the agency problem stemming from managerial risk aversion. One hypothesis is proposed for this purpose:

Hypothesis 4: *Managerial overconfidence enhances acquirer's acquisition-related performance.*

III. Data and methodology

A. Sample Formation and the Data Sources

We use the Securities Data Company's (SDC) on-line mergers database to obtain the sample of mergers and acquisitions made by U.S. companies during the period January 1, 1993 to December 31, 2004. We include the transactions that are:

(a) listed as completed with an announcement date and effective date that happen during our sample period;
(b) identified as a merger or an acquisition of majority interest (over 50%) by SDC;
(c) identified as tender offers for majority interest (over 50%) by SDC.

Additionally, an acquisition is included only if the executive compensation data is available in ExecuComp. Standard & Poor's ExecuComp database provides data on salary, bonus, and total compensation for the top five executives (ranked annually by salary and bonus) for firms in the S&P 500, S&P Midcap 400, and S&P Smallcap 600, for the period from 1993 to 2004. In our present analysis, we are interested in the executives who are identified as CEOs by Execucomp. Finally, we require that the stock return data and the accounting data of the acquirers be available from CRSP and Compustat, respectively.

Table 1 provides the details of the sampling process. The final sample consists of 3069 acquisitions with 2744 mergers and 325 tender offers. Using the traditional event study methodology, we study the announcement effect as well as the long-term effect of the corporate acquisitions on shareholder value. In the study of the acquisition announcement effect, we estimate 3-day cumulative abnormal returns (CARs) for the whole sample. In the long-term study, we estimate the 1-year and 3-year buy-and-hold abnormal returns (BHARs) of the sample firm. In the estimation of 1-year BHAR, we include only the deals done during January 1, 1993 to December 31, 2003. Similarly, we include only the deals during January 1, 1993 to December 31, 2001 in the sample when we estimate 3-year BHAR. Furthermore, in order to sustain the independence of the observations, in the one (three) year long term study, we include the sample firm's acquisition only if the firm has not consummated deals in the one (three) year(s) prior to the effective date of the corporate acquisition. The number of the observations of each sub-sample is provided in Table 1.

{Insert Table 1 here}

B. Variables Estimation

1. Corporate acquisition performance

We employ event study methodology to estimate corporate acquisition performance. The short term (announcement) effect and the long term post-acquisition performance are estimated as follows.

a) Announcement effect - cumulative abnormal return

Abnormal stock returns around corporate acquisition announcement are estimated using the market model and Scholes-Williams betas. The estimation period is from 200 days to 60 days prior to the acquisition announcement date (day 0). The event window is (-1, +1) days.

b) Long term effect - buy and hold abnormal return

BHAR-based event study has become the standard method of event study in estimating long-term abnormal returns (see Barber and Lyon 1997; Lyon et al 1999) albeit not free of criticism. We estimate both 1-year and 3-year BHARs. The basic idea of BHAR is that it measures the average multiyear (1 year or 3 years) returns from a strategy of investing in all firms that complete an event and selling at the end of a pre-specified holding period in excess of the returns to a comparable investment strategy using otherwise similar firms that do not undertake corporate acquisitions within a certain period[6]. The virtue of the BHAR is that it simulates the investor's actual experience. In our analyses, we employ the benchmark portfolio approach as well as the matched firm approach to estimate BHARs.

We construct benchmark portfolios based on firm size, book-to-market equity, and prior 12-month stock return to estimate BHARs. Following Mitchell and Stafford (2000), the benchmark portfolios exclude event firms, but otherwise we include all CRSP firms that can be assigned to a size-BM-momentum portfolio. Size is measured as the firm's market capitalization. The BM ratio is calculated by the formula: [stockholders' equity +deferred taxes + investment tax credit - preferred Stock] / market capitalization. For an event firm, the BM ratio is computed at the month-end

[6] In the estimation of 1-year (3-year) buy-and-hold abnormal return, the match firms are chosen from a pool that consists of the firms that do not undertake acquisition during the period from 1 year (3 years) before the deal effective date to 1 year (3 years) after the deal effective date.

preceding the effective date of the acquisitions. We measure the momentum as the 12-month pre-acquisition buy-and-hold return beginning 13 months prior to, and ending at the end of one month prior to, the effective date.

Following Daniel, Grinblatt, Titman, and Wermers (1997), we form 5×5×5 =125 passive portfolios. The portfolios are all value-weighted[7], buy-and-hold portfolios. The composition of each of the 125 portfolios is based on a triple-sort on each firm's market capitalization (proxying for size), book-to-market ratio, and momentum. At each formation date, the CRSP universe of common stocks is first sorted into quintiles based on each firm's market capitalization just prior to the formation date, which, in our case, is the last day of June each year. Even though NYSE, AMEX, and Nasdaq stocks are included in the analysis, the breakpoints for the firm's market capitalization are based on the NYSE firms only.

Subsequently, the firms within each size quintile are further sorted into quintiles based on their book-to-market ratio. The book-to-market ratio is the ratio of the book equity value at the end of the firm's fiscal year during the calendar year preceding the formation date to the market equity value at the end of the same calendar year preceding December. In order to ensure that the book value of the equity is publicly available when it is used to calculate the BM ratio to avoid the look-ahead bias, it is not used unless at least four months have elapsed after the end of the fiscal year as the annual report is not available up to four months after the fiscal year end.[8] Finally, the firms in each of the 25 size/BM portfolios are then further sorted into quintiles based on their preceding 12-month returns, which provides us with a total 125 portfolios.

The BHARs using the benchmark portfolio can then be calculated as:

$$BHAR_i = \left[\prod_{t=1}^{T}(1+\mathrm{Re}_{i,t})\right] - \left[\prod_{t=1}^{T}(1+Rmp_{i,t})\right] \qquad (1)$$

Where *Re* is stock return of event firm, and *Rmp* is the value-weighted stock return for the matched portfolio. The mean buy-and-hold abnormal return is the equally weighted average of the individual BHARs:

[7] Based on firm's market capitalization.

[8] This ensures that accounting data are publicly available on the date of computation of the BM ratio.

$$\overline{BHAR} = \frac{1}{N}\sum_{i=1}^{N} BHAR_i \quad (2)$$

We also calculate the value weighted average of the BHARs, which can be expressed as:

$$\overline{BHAR} = \sum_{i=1}^{N} \omega_i BHAR_i \quad (3)$$

Where ω_i is the weight of the sample firm *i* based on acquirer market capitalization.

2. Measuring managerial incentives

Following Guay (1999) and Core and Guay (2000), we define Delta as the change in the dollar value of the CEO's wealth for a 1% change in stock price and Vega as the change in dollar value of the CEO's wealth for a 1% change in the annualized standard deviation of stock returns. See appendix A for the details of the estimating procedure. In our OLS regression analysis, we use lagged values of both Delta and Vega. For instance, the lagged Vega and Delta values are estimated based on the compensation packages granted to executives immediate prior to the year during which the corporate acquisitions are announced. However, in line with Coles et al (2005), we use contemporaneous Delta and Vega value in the simultaneous equations model. Specifically, we estimate Delta and Vega for the same fiscal year during which the corporate acquisition is consummated. The rationale for these measures is that, from the CEO's perspective, even though the *expected* managerial incentives level is related to the *current* M&A decision, the *current* M&A decision can also have an impact on *contemporaneous* managerial incentives. Nevertheless, as a robustness test, we also estimate lagged Delta and Vega in the simultaneous equation model (SEM) analysis. From the shareholder's perspective, on the one hand, the executive compensation package is designed to motivate shareholder value creating M&A decisions; on the other hand, *expected* M&A performance influences *current* executive compensation.

3. Corporate governance

We measure the strength of the board vis-à-vis the CEO by a binary variable which takes the value one if CEO tenure is below ExecuComp median CEO tenure (this median of the CEO tenure is re-calculated each year). According to Harford and Li

(2005), this measure of board strength is robust and has been empirically supported by Hermalin and Weisbach (1998).

4. Behavioral measure

Following Malmendier and Tate (2005), we estimate Holder67 as the measure of CEO overconfidence. Holder67 uses the timing of the CEO option exercise to identify overconfidence. Under the standard assumption of managerial risk aversion and under-diversification of the manager's wealth portfolio, CEOs are expected to choose an early exercise of their option compensation. In the meanwhile, under-diversified CEOs should minimize their holding of company stock in order to reduce their exposure to firm specific risk. However, overconfidence of managers may induce them to postpone the exercise of the option compensation in order to benefit from expected future gains. In Malmendier and Tate (2005), Holder67 is obtained from the dataset used in Hall and Liebman (1998). In our study, we estimate this measure directly using the data from Execucomp.

Holder67 captures the 'irrational' timing of CEO option exercises. Following Malmendier and Tate (2005), we take 67% of in-the-money option value as the threshold[9]. If the exercisable option is more than 67% in-the-money at the fiscal year end, a risk-averse CEO should have exercised part of the options he holds in his compensation package. For the previously granted stock options, we first compute the average exercise price for the portfolio of exercisable options. We divide the realisable value by the number of options, which gives the average of (stock price-exercise price). We then subtract the number from the stock price to obtain the average exercise price. The second step is to calculate the percentage of in-the-money option value by using the formula [(stock price-average exercise price) / average exercise price]. In addition, in order to ensure the CEO's demonstration of overconfidence is persistent, we define the CEO as overconfident if and only if he fails to exercise his stock option that is at least 67% in-the-money three times during the sample period.[10] The variable Holder67 equals 1 if the CEO is classified as

[9] According to Malmendier and Tate (2005), this threshold corresponds to a risk aversion of 3 in a constant relative risk-aversion (CRRA) utility specification and to a percentage of CEO wealth in company equity equal to 66%.

[10] However, our Holder67 measure may be criticised for a look-ahead bias as we may have counted the overconfident option exercising behavior of the CEO after the M&A deal. In order to tackle this potential bias, in the robustness test, we calibrate the Holder67 measure to only account for CEO

overconfident. For example, we classify Jerry Sanders, the CEO of AMD from May 1, 1969 to April 25, 2001, as overconfident since he failed to exercise his holding of vested stock options even though the portfolio of his stock option was 111.2% in-the-money in 1995 and he subsequently failed again in 1996, 1998, and 1999 when his portfolio of vested stock option was 204%, 75.9%, and 83.9% in-the-money, respectively.

5. Other variables

Managerial ownership is highly related to executive compensation. Preceding studies document that incentive effects of executive compensation may vary cross-sectionally with the level of managerial ownership (Morck, Shleifer, and Vishny, 1988; Ofek and Yermack, 2000). Additionally, according to Denis, Denis, and Sarin (1997), higher levels of managerial ownership reduce the effectiveness of internal monitoring mechanism in firms. Therefore, we include managerial ownership as an independent variable in the empirical analyses in order to control for the effect of different levels of managerial ownership. We measure managerial ownership as the sum of the previously granted/acquired common stock and restricted stock owned by CEO at the year-end prior to the acquisition announcement divided by the contemporary total number of shares outstanding.

Firm size is measured as the market capitalization of the acquiring firm at the month-end preceding the acquisition announcement. According to Murphy (1999) and many other studies in executive compensation, total value of executive compensation increases with firm size. In order to control for the difference between the size of the acquirer and that of the target, we include the variable, relative size, as the ratio of target market capitalization to the acquirer market capitalization. In our analysis, we use the ratio of transaction value to the acquirer market capitalization to proxy for relative size.

As Guay (1999) notes, the risk-related agency problem is likely to be most serious in firms with better investment opportunities. Consequently, the expected loss to the shareholder of any valuable investment project passed up is expected to be positively related to firm investment opportunities. In their study, we use the book-to-market

overconfident behavior before the corporate acquisition event. This robustness test is discussed in details in the robustness test section at the end of this paper.

ratio to capture the investment opportunities of the acquiring firm prior to the corporate acquisition. The book-to-market ratio is calculated by the formula [stockholders' equity+deferred taxes+investment tax credit-preferred stock] / market capitalization, which is computed at the end of the month preceding the month of the effective date of the acquisition.

We distinguish the means of payment by cash payment, stock payment, and mixed payment. The cash payment variable (dummy) equals 1 if the acquisition is financed 100% by cash and 0 otherwise. The stock payment variable equals 1 if the acquisition is financed 100% by issuing stock and 0 otherwise. Mixed payment is similarly defined. The means of payment has been shown to be a significant determinant of acquisition wealth effects (Loughran and Vijh, 1997). We also differentiate the type of acquisition by a binary variable which takes the value 1 if the acquisition is explicitly identified by SDC as tender offer and 0 otherwise. Past performance is the one-year pre-acquisition buy-and-hold-return for the sample firm.

We use CEO total cash compensation to proxy for the CEO's level of risk aversion. Berger et al (1997) argue that CEOs with high cash compensation are more likely to be entrenched and hence likely to avoid risk. In addition, CEOs who receive high cash compensation are more like debtholders as they cannot reap profit from any potential increase in the firm value while they suffer when the firm goes bankrupt. These CEOs are therefore more likely to avoid risk (Coles, et al., 2005). On the other hand, Guay (1999) posits that CEOs with higher total cash compensation are better diversified because they have more money to invest outside the firm and therefore are less risk-averse.

C. Data Analysis

1. Ordinary least squares (OLS) regression

To test our hypotheses, we initially employ OLS regression to estimate empirical models by assuming that all the explanatory variables are exogenous. In OLS regression analysis, we primarily investigate the effect of Delta and Vega on acquisition performance, both in the short run and in the long run. The basic performance model takes the following form:

$$Performance = \alpha_0 + \beta_1 Vega + \beta_2 Delta + \beta_3 Gov + \beta_4 Holder67 + \sum_{i=5}^{n} \beta_i Control_i + \varepsilon \quad (5)$$

where *Performance* is the 3-day CAR in the study of announcement and is the 1–year and 3-year BHARs in the study of long term performance. *Vega* and *Delta* are measures of managerial incentives, *Gov* is the measure of board strength. *Holder67* is a binary variable to account for the presence of managerial overconfidence. *Control* is a set of control variables which will be specified in the tables.

In order to account for the problem of skewness[11] and to control for the problem of outliers, we log transform all the continuous variables. Following Datta et al (2001), we define the long-term performance measures, i.e., 1-year or 3-year abnormal returns, as the natural logarithm of (1+ the sample firm's BHR) minus the natural logarithm of (1+ the corresponding portfolio's BHR). The transformation can be expressed in formula form as $Ln\ (1+BHR_e) - Ln\ (1+BHR_{mp})$[12].

Subsequently, in order to explicitly link shareholder value change with the risk change, we estimate 1-year BHAR and contemporaneous ΔRisk due to the acquisition. We first investigate whether managerial incentives can influence the risk change following corporate acquisitions. The empirical model takes the similar form to equation 5.

$$\Delta Risk = \alpha_0 + \beta_1 Vega + \beta_2 Delta + \beta_3 Gov + \beta_4 Holder67 + \sum_{i=5}^{n} \beta_i Control_i + \varepsilon \quad (6)$$

where $\Delta Risk$ is measured as the standard deviation of stock returns for the postacquisition period (11 days to 250 days following the effective day) minus the preacquisition period standard deviation (250 days to 11 days preceding the

[11] Please refer to table 5 for the descriptive statistics of the variables

[12] The major reason for taking the logarithmic transformation of sample firm's BHR and corresponding portfolio's BHR separately instead of computing the natural logarithm of (1+ the sample firm's BHR minus corresponding portfolio's BHR) is because the latter may generate negative values and therefore render the results of log transformation meaningless. However, one may argue that this long-term performance measure is not actually measuring the buy-and-hold abnormal return as $Ln\ (1+BHR_e) - Ln\ (1+BHR_{mp}) = Ln\ [(1+BHR_e)/(1+BHR_{mp})]$, which is obvious unequal to $Ln[(1+BHR_e)-(1+BHR_{mp})]$. In order to validate this transformation, using the 3-year event study results, we regress $Ln\ (1+BHR_e) - Ln\ (1+BHR_{mp})$ on the raw BHAR: (BHR_e-BHR_{mp}). The coefficient of the term $Ln\ (1+BHR_e) - Ln\ (1+BHR_{mp})$ is 0.82 with a t-statistic of 28.94. The adjusted R^2 is 0.445 indicating that our log transformation value is highly correlated with the raw BHAR. The regression results using the 1-year data are similar to that of the 3-year data reported above. The coefficient is 0.84 with a t-statistic of 57.41 and the adjusted R^2 0.666.

announcement date). *Vega*, *Delta, and Holder67* are the same as in equation 5. *Control* is a set of control variables which will be specified in the table.

We further examine whether this risk change is shareholder value-creating. In this regression, we introduce two interaction variables between risk and managerial incentives, namely (ΔRisk×Vega) and (ΔRisk×Delta). The empirical model takes the following form:

$$Performance = \begin{array}{l} \alpha_0 + \beta_1 Vega + \beta_2 Delta + \beta_3 \Delta risk \times Vega + \beta_4 \Delta risk \times Delta \\ + \beta_5 Gov + \beta_6 Holder67 + \sum_{i=7}^{n} \beta_i Control_i + \varepsilon \end{array} \quad (7)$$

Where *Vega* and *Delta* and *Holder67* are as defined earlier. The interaction variables are introduced to distinguish the interaction effect between the risk change and managerial incentives from the main effect of the managerial incentives. According to ***Hypothesis 3a***, the coefficient of the interaction variable (ΔRisk×Vega) is expected to be positive, indicating that at high level of ΔRisk, Vega has a positive effect on acquisition performance. Similarly, according to ***Hypothesis 3b***, the coefficient of the interaction variable (ΔRisk×Delta) is expected to be negative, indicating that with large risk increase, Delta has a more negative impact on acquirer acquisition performance. *Control* is a set of control variables, which will be specified in table 9. In all of our OLS regressions, the t-statistics for the significance of the coefficients are White's (1980) heteroskedastisity consistent t-statistics. We also conduct tests of multicollinearity by estimating the condition index. In all of our regressions, the highest value of the condition index is around 18. According to Belsey, Kuh, and Welsch (1980), this level of multicollinearity across the dependent variables is not strong enough to cause serious error[13].

2. Simultaneous equations model (SEM)

a) SEM estimating procedure

Our empirical models, up until now, implicitly assume that managerial incentives and risk change are exogenous. However, in the introduction to the paper, we theoretically justify the endogenous relations between performance, risk change, and managerial

[13] Belsey, Kuh, and Welsch (1980) suggest that, when this number is around 10, weak dependencies may be starting to affect the regression estimates. When this number is larger than 100, the estimates may have a fair amount of error.

incentives. We propose that that even though managerial incentives may affect corporate acquisitions, the contemporaneous change of corporate stock performance, risk profile, leverage, and size resulting from corporate acquisitions are likely to affect both the structure of the managerial incentive compensation and the compensation policy choices.

Technically, endogeneity exists when some of the independent variables in a regression equation are correlated with the error term in the equation (Larcker and Rusticus, 2005). In other words, the dependent variable, Y, is determined by the Xs, the independent variables, and some of the Xs are, in turn, determined by Y. In the OLS regression, the endogeneity renders estimated one-way or unidirectional cause-and-effect relationship not meaningful (Gujarati, 2003, pp717). The standard remedy for endogeneity is to use instrumental variables in a 2-stage least squares (2SLS) model. Instrumental variables, by definition, are correlated with the endogenous regressor but uncorrelated with the error in the structural equation. In our simultaneous equations system, we have four endogenous variables, Delta, Vega, risk change, and acquirer's post-acquisition performance. The reason to include both Delta and Vega as endogenous variables is that they are highly correlated with each other. Furthermore, according to Coles et al. (2005), in studying risk-taking incentives, it is important to keep in mind the substantial literature on the relation between firm risk and Delta emphasising the need to control for Delta.

The basic simultaneous equations model takes the following form.

$$Performance = f(delta, vega, \Delta risk, I_{Performance,}C, \varepsilon_1) \tag{8}$$

$$\Delta Risk = f(delta, vega, performance, I_{\Delta Risk,}C, \varepsilon_2) \tag{9}$$

$$Vega = f(delta, \Delta risk, performance, I_{Vega,}C, \varepsilon_3) \tag{10}$$

$$Delta = f(vega, \Delta risk, performance, I_{Delta,}C, \varepsilon_4) \tag{11}$$

where *Performance* is the 1-year BHAR of the acquiring firms, $\Delta Risk$ is measured as the standard deviation of stock returns for the postacquisition period (11 days to 250 days following the effective day) minus the preacquisition period standard deviation (250 days to 11 days preceding the announcement date), *Delta* is the dollar change in

the value of the CEO's stock and option portfolio for a 1% change in stock price, *Vega* is the dollar change in the value of the CEO's stock and option portfolio for a 1% change in standard deviation of stock returns. The I_i in each equation is the set of instrumental variables for the left-hand side endogenous variable *i*, and *C* represents the common control variables.

We calculate Hausman statistic to test for the existence of endogeneity and thus the appropriateness of using a SEM. To perform the Hausman's specification test, we first separately regress four potential endogenous variables: Performance, ΔRisk, Vega, and Delta. Then we include the residuals as additional regressors in the original OLS regressions. The null hypothesis is that if the other three endogenous variables, namely Risk, Vega, and Delta are exogenous to the determination of acquirer post-acquisition performance, their residuals from the reduced form regressions will be uncorrelated with the errors of the original acquirer acquisition performance equation 8.

We move on to the implementation of the SEM once the Hausman test validates the set of the instrumental variables and the appropriateness of using SEM. The SEM procedure consists of two stages of regressions to estimate an equation. The basic idea behind 2SLS is to "purify" the stochastic explanatory variable, i.e., the endogenous variable, of the influence of the stochastic disturbance of the original equation. This goal can be accomplished by two-stage OLS regression. In stage 1 we regress the endogenous variables on *all* the predetermined variables including the instrumental variables and control variables in the system to obtain the predicted value of the endogenous variables. In stage 2 we replace the endogenous variables in the original equations by their predicted values from the preceding regressions in stage 1 and then run the OLS regressions.

b) Instrumental variables in the system of equations

Simultaneous equations model depends crucially on the identification of strong and valid instrumental variables (Brick et at, 2005). We rely on method of payment and type of acquisition as the instrumental variables for acquirer acquisition performance. Previous studies suggest that abnormal performance is worse for the acquirer using stock payment method than for the acquirer avoiding using stock (Mitchell and Stafford, 2000). The type of acquisition, merger or tender offer, may also relate to the

performance of corporate acquisition while it can be regarded as exogenous to the risk change due to corporate acquisition, Vega, and Delta. We identify past performance as the instrumental variables for Δ Risk by arguing that managers in the firm with good past performance are prone to engage in risky investment project including corporate acquisition. We employ cash compensation and board strength as the instrumental variables for Vega. As discussed previously, we use CEO cash compensation as a proxy for the CEO's risk aversion, which is likely related to the needed intensity of risk-taking incentives. We include board strength as the instrument of Vega since the CEO may have more bargaining power against a weak board and hence choose the grant level of equity-based compensation to suit his/her own interests. Finally, firm size is treated as the instrumental variable for Delta as we expect that the larger the company, the larger the equity-based grant to the CEO, which results in a higher level of Delta. We validate the set of instrumental variables with the Sargan test before we proceed to implement Hauman specification test and to estimate the 2SLS.[14]

IV. Empirical Findings

A. Sample Characteristics

Figure 2 reports the change in the structure of the CEO compensation package of the sample firms across the sample period. Figure 2 indicates that equity-based compensation including stock and stock options represents around 50% percent of the total compensation received by CEO during the years 1992 to 1996. The total compensation increases dramatically from 1997 to 1998, which is mainly due to an increase in stock compensation. Even though the average total compensation in year 1999 is only slightly smaller than that of the year 1998, the percentage of restricted stock grant shrinks severely and is replaced by stock options. The trend persists for

[14] As already indicated above, instrumental variables must be independent of the error term in the structural equation. Since the true error term in the structural equation is unobservable, we correlate the instruments with the estimated error term in the second-stage regression to determine the appropriateness of the set of the instrumental variables. This validation can be done by performing Sargan test (Gujarati, 2003, p713). The test statistic can be obtained by regressing the second-stage residuals on *all* instrumental variables and control variables. The Sargan statistic is defined as $(n-k)R^2$ where n is the number of observation used in the regression; k is the number of the coefficients in the original regression equation. Particularly, $(n-k)R^2$ is distributed χ^2 with $(s-q)$ degrees of freedom, where s is number of the instruments and q is the number of the endogenous explanatory variables. The null hypothesis is that all instruments are valid. If the null hypothesis is rejected, we can conclude that at least one instrument is correlated with error term therefore the 2SLS (or Instrumental Variable estimates) based on the chosen instruments are not valid.

three years. The size of the total executive compensation shrinks by more than 30% in 2002 and 2003, which, as indicated in figure 1, is mainly due to the decrease in the stock option grant.

{Insert figures 2, 3, 4 here}

Figure 3 indicates the trend in the average dollar value of Delta across the sample period. The dollar value of Delta increases dramatically between 1996 and 1997. In 2000, the level of Delta decreases by about 60%. The Delta level increases in 2001 and 2002, but is followed by another dramatic decrease in 2003. In contrast to the dollar value of Delta that varies considerably across the sample period, the dollar value of Vega increases steadily throughout the sample period. However, as shown in figure 4, the average dollar value of Vega is generally much smaller than that of Delta.

Table 2 presents the descriptive statistics of our sample of 3069 completed acquisitions during the period January 1, 1993 to December 31, 2004. As shown in the panel A of Table 2, there is no temporal clustering of acquisitions in our sample. The mean (median) deal value increases steadily from $269.3 ($ 68.4) millions in 1993 to $1667.9 ($245.5) millions in 1999. The mean deal value then reduces to $702.7 millions in 2002 and rebounds to $1276.9 millions in 2004. These results are consistent with the recent merger wave trend, which further verifies that our sample is a subset of deals that can capture the general trend of merger and acquisition deals during the last decade. Moreover, we compare the numbers of the deals across the sample period of our sample (3069 observations) with that of the population (18444 observations) in Figure 5. Figure 5 indicates that our sample well represents the population of the acquisitions. Our sample captures the latest merger wave which peaks during the period from 1998 to 2001 and declines afterwards. Figure 6 reports the mean transaction value of our sample and that of the population classified by year.

{Insert Table 2 here}

It is shown in Figure 6 that even though the mean of our sample is mostly higher than that of the population, the trend is similar to that of the population. This comparison again confirms that our sub-sample represents the M&A population well.

{Insert Figure 5, 6 here}

As exhibited in panel B of Table 2, our findings confirm the findings in Datta et al (2001)[15] that a majority of tender offers (67.1%) are cash deals. However, the percentage of the mode of payment of the merger deals is different from theirs. Considering merger deals, the percentage of stock deals is 41.0 % and the percentage of mixed deals is 36.7% while the figures from Datta et al (2001) for these two categories are 56% and 29%, respectively. This suggests that during the period 1999 to 2004, the mixed payment method is more popular while the use of pure equity becomes less so. Panel C of Table 2 reports the characteristics of the acquirer and target as well as the acquisition premium. The average premium paid by the acquirer to the target shareholders is 49%. This is more than 10 percent higher than the number reported in Datta et al (2001), indicating the increase in premium during the period 1999 to 2004. Market capitalization is much higher than that of the target. The target's book-to-market equity is much higher than that of the acquirer suggesting that the acquirer's growth opportunities are greater than that of average target or the target is relatively undervalued.

The empirical findings so far suggest significantly different features of both the compensation structure and the M&A deals between the period 1993 to 1996 and the period 1997 to 2004. Furthermore, Moeller, Schlingemann, and Stulz (2005) provide empirical evidence that the acquisitions during the period 1998 to 2001 experienced a huge amount of loss. Therefore, in our subsequent statistical analyses, we divide the sample into two sub-samples by using 1997 as the break point. In the univariate analysis of announcement effect, however, we divide the sample into three sub-samples, i.e., 1993-1996, 1997-2001, and 2002-2004.

B. Univariate Analysis of Acquirer's Announcement Return

The results of the univariate analysis shown in Table 3 indicate that higher values of Delta and Vega are associated with worse announcement returns. Means of payment and mode of acquisition appear as influential determinants of the market reaction around the announcement of corporate acquisition. Tender offers experience higher announcement returns than mergers. Acquisitions that are financed by 100% cash

[15] The sample period of Datta et at (2001) is from 1993 to 1998.

greatly outperform other deals that are financed purely or partially by stock. If we divide the sample into three sub-samples, only the deals that are completed from the period during 1997 to 2001 experience significant negative abnormal announcement returns. This result is consistent with Moeller, Schlingemann, and Stulz (2005). As shown in panel D, the only CARs that fall into either high Delta or high Vega categories during the sample period from 1997 to 2001 are highly significantly negatives. This result indicates that, during the period 1997 to 2001, the market does not restrain acquirers whose CEOs hold a large amount of equity-based compensation from value destroying acquisitions.

{Insert Table 3 here}

C. Univariate Analysis of Acquirer's Post-acquisition Performance

Table 4 reports the 3-year BHARs for the acquirers and the BHARs categorized by level of Delta and Vega (higher than median or lower than median), event period (1993 to 1996 or 1997 to 2001), mode of acquisition (merger or tender). As shown in Panel A of Table 4, both the value weighted and equally weighted mean BHARs are positive and significant. The median BHARs, however, are negative and significant. These results suggest that during our sample period, there exist deals by large acquirers, which greatly outperform our benchmark, giving rise to outliers.

{Insert Table 4 here}

As Panel B indicates, even though the event firms with higher Delta value underperform those with lower Delta value and acquirers with higher Vega outperform those with lower Vega, these differences are not significant. We, therefore, further divide the sample into two subperiods, 1993 to 1996 and 1997 to 2001.

Panel C reports the BHARs by subperiod and by level of Delta and Vega. During the period 1993 to 1996, the mean value of the BHAR for the acquiring firms with Delta lower than the median is 17.9%, and significant. During the period 1997 to 2001, the mean BHAR for the acquiring firm with high Vega is 11.14%, also significant. These results suggest that Delta and Vega are important determinants of the acquirer's post-acquisition performance. However, the effect of Delta and Vega varies across

different event periods and is pronounced and significant during a period of high stock market valuation.

D. Multivariate Regression Analysis of Acquirer's Announcement Return

The descriptive statistics of the variables used in the regression are given in Table 5. As indicated in Panel A of Table 5, both long term performance measures, i.e., 1-year BHAR and 3-year BHAR have positive mean and negative median values and large standard deviations. This suggests that these returns are positively skewed. Hence, we employ a logarithmic transformation of BHARs to reduce the influence of outliers. To be consistent, we use the log transformation for all the continuous variables used in the regression. As shown in Panel B, more than 24% of our sample CEOs are classified as overconfident. About 56% of the sample CEO have a longer tenure than the median tenure of the ExecuComp universe.

{Insert Table 5, 6 here}

The multivariate regression of the three-day announcement return, as specified in equation 5, further confirms the aforementioned results from the univariate analyses. As indicated in Table 6, payment method, acquisition mode, and relative size measured by the ratio of the transaction value to the acquirer's market capitalization consistently appear to influence the acquirer's announcement period return. As for the managerial incentives, announcement return decreases with increasing Delta. Delta is significantly negative across different regression models. However, it is statistically significant and positive in model 3 with data from 1993-1996. This temporal variation in Delta's impact supports the univariate results. Managerial stock ownership is significant with a positive impact on acquirer announcement return. Relative size is consistently negative and statistically significant. This result is conforms to the common wisdom that the bigger the size of the target, the more severe is the loss to acquirer shareholders. Book-to-market ratio is significantly positive which is consistent with the hypothesis that "value" acquirers outperform "glamour" acquirers in acquisitions (Rau and Vermaelen, 1998; Sudarsanam and Mahate, 2003).

E. Multivariate Regression Analysis of Acquirer's Post-acquisition Performance

We now report the cross-sectional regression analyses of the impact of Delta and Vega on the post-acquisition performance of acquirers. Following Datta et al (2001), as already justified in footnote 12, we define the dependent variable BHAR as the natural logarithm of (1+ event firm's three-year BHR) minus the natural logarithm of (1+ benchmark portfolio's three-year BHR). Different from Datta et al, we include proxies for acquirer's corporate governance, board strength and managerial ownership, and its CEO's overconfidence in our models to estimate the impact of the agency relations and manager's behavioral bias. We also include typical control variables such as relative size, book-to-market value of equity, payment method, and acquisition mode. The empirical model are specified in equation 5 and the results are reported in Table 7.

{Insert Table 7 here}

Each model is estimated using the full sample and the two sub-samples (for 1993-1996 and 1997-2001). In contrast to the empirical results of Datta et al. (2001), the coefficient of Δ stock option, the value of the new stock options granted to the CEO as a percent of her total compensation, is significantly negative using model 3[16] At first glance, this result contradicts the incentive alignment hypothesis. This is probably due to two reasons. Firstly, our focal interest is the CEO compensation package while Datta et al (2001) study the compensation packages of the top five executives. Secondly, the Δ stock option variable just measures the percentage of the newly granted stock option, which cannot depict the whole range of managerial incentives. When we include our more comprehensive measures of incentives, i.e., Delta and Vega in model 3, even though the coefficient of Δ stock option is significantly negative, the coefficient of Vega is significantly positive, which indicates that the whole executive compensation package needs to be considered in evaluating incentives. The positive coefficients of Vega suggest that, ceteris paribus, increase in Vega is associated with enhanced post-acquisition shareholder value performance, thereby confirming ***Hypothesis 1b***.

[16] As reported in Datta et al (2001), the newly granted options convey the most significant incentives. We therefore include Δ stock option to account for it.

The coefficient of the Holder67 variable is significantly positive across different models and different event periods. This result validates ***Hypothesis 4***, which states that acquirer manager's overconfidence can lead to good post-acquisition performance.

The major conclusion from the regression of the three-year buy-and-hold abnormal returns is that Vega seems to be an important variable in determining the post-acquisition performance of the acquiring firm. This suggests that it is crucial to emphasize the risk seeking motivation in the design of an executive compensation package. Secondly, behavioral bias appears an important factor to be considered in examining the factors that affect post-acquisition performance. Moreover, our results suggest that managerial overconfidence may provide an alternative solution to the underinvestment problem arising from managerial risk aversion, conventionally tackled through compensation contracts.

F. Analyses of the Risk Change due to M&A

The significant impact of Vega warrants a closer look at the way the risk profile of the acquirer changes due to the acquisition. We measure risk change as the standard deviation of stock returns in the post-acquisition period (11 days to 250 days following the effective day) minus the pre-acquisition period standard deviation (250 days to 11 days preceding the announcement date. Table 8 reports the results of the regression of the risk change one year after the completion of the acquisition. The empirical model are specified in equation 6.

Table 8 shows the estimated coefficient of Vega is significantly positive while the coefficient of Delta is significantly negative. These results validate our ***Hypothesis 2a*** that increase in firm risk due to corporate acquisition is associated with increase in Vega. The results also confirm ***Hypothesis 2b*** that the decrease in firm risk due to corporate acquisition is associated with the increase in Delta, the sensitivity of CEO wealth to stock price. The coefficient of Holder67, the CEO overconfidence measure, is significantly positive which indicates that the overconfident executives are prone to undertake risky M&A.

{Insert Table 8 here}

G. Analyses of One-year BHARs with Respect to Risk Change

So far, we have investigated the effect of managerial incentives on both the post-acquisition performance and the one-year risk change of the acquiring firm. In this section, as indicated in equation 7, we employ the interaction terms to explicitly investigate the effect of the aforementioned variables on risk change and whether this risk change is associated with increase or decrease in the post-acquisition performance of the acquiring firm. We estimate the 1-year BHARs using the benchmark portfolio approach. The results are provided in Table 9.

{Insert Table 9 here}

Consistent with the results reported in Table 7, Vega is significantly positive while the coefficient of Δ Stock Option is significantly negative. Holder67 has a significant positive impact. Nonetheless, the coefficients of the two interaction variables are not statistically significant. If we take into account the results reported in Table 8, we can conclude that even though the increase in Vega is associated with increased risk due to the acquisition and is directly related to the acquirer post-acquisition performance, this impact does not vary with different levels of risk change. Similarly, the impact of Delta seems invariant to the level of risk change. In an unreported regression, we also include the $Vega^2$, $Delta^2$, and $Risk^2$ terms in the regression to further account for the non-linear impact of Delta, Vega, and ΔRisk. The coefficients of these variables are statistically insignificant. Thus the impact of Vega and Delta is linear rather than non-linear.

H. Simultaneous Equation Models

Table 10 reports the results of the simultaneous equation models (SEM). So far, we use the lagged value of Delta and Vega in the OLS regressions. In SEM, we mainly use the contemporaneous value of Delta and Vega. There are four endogenous variables in our empirical setting, i.e., post-acquisition performance, Δ Risk, Vega, and Delta. The SEM is specified in a equation system that comprises equations 8-10.

{Insert Table 10 here}

Before we proceed to estimate the coefficients with the simultaneous equation model, we validate the set of instruments we use and test for the endogeneity of BHAR, ΔRisk, Vega, and Delta as well as the appropriateness of using two-stage least squares as the estimating technique. The Sargan test and Hausman specification test[17] are performed. In our empirical setting, the Sargan statistic is 0.63. Since the critical value of χ^2 with 1 degree of freedom is 7.88, we cannot reject the null hypothesis that all instruments are valid. The Hausman statistic is 108.0 with a p-value less than 0.0001 which suggests that there exists endogeneity among the variables BHAR, ΔRisk, Vega, and Delta. Therefore, the two-stage least squares regression is an appropriate technique to obtain consistently unbiased coefficients.

Our focal interest is the determinants of the one-year buy-and-hold abnormal return. The coefficient of Delta is universally significantly positive whereas in the earlier OLS models it is most of the time insignificant. Thus the SEM procedure seems to cleanse the estimation bias caused by the endogeneity between BHAR and Delta and reports results that are consistent with standard incentive alignment hypothesis. In the estimation with the full sample, the coefficient of Holder67 is significantly positive while the coefficient of Vega is no longer significant.

In the full sample regression of the Δ Risk, the coefficient of Vega is significantly positive indicating that the CEO does respond to the incentive and undertake risky M&A deals. The coefficient of Delta, however, is significantly negative. These results further confirm ***Hypothesis 2a*** and ***Hypothesis 2b***. The coefficient of past performance in the regression is significantly positive suggesting that the propensity to undertake risky M&A increases with firm past performance.

In the regression of Vega, the coefficient of ΔRisk is significantly positive. This result confirms that Vega increases as risk increases. In the meanwhile, in the regression of Delta, increase in ΔRisk is significantly related to decrease in Delta. These results indicate that, as predicted, risk change has dissimilar effects on Vega and Delta. Increase in firm risk increases the sensitivity of CEO wealth to stock return volatility while it decreases the sensitivity of CEO wealth to stock price. In addition, in the

[17] For details of the test, please refer to the Chapter 6 of Wooldridge (2002).

regression of Delta, improvement in firm acquisition performance is associated with increase in Delta even though this effect is rather trivial.

I. Robustness Tests

Alternative event study methodology

We alternatively use the three-year buy-and-hold abnormal returns calculated by employing the matched firm approach to re-run the regression. The results are qualitatively similar. The coefficients of Vega and Holder67 are significantly positive. The coefficients of Δ Stock Option are significantly negative.

We estimate the 1-year CARs using the market model and Scholes-Williams betas and re-run the analyses in Tables 9. The estimation period is from 200 days to 60 days prior to the announcements of the acquisitions. The results are qualitatively similar. As in the Table 9 regression using 1-year CARs, the coefficients of Vega and Holder67 are significantly positive while the coefficients of Delta and Δ Stock Option are significantly negative. The 1-year CARs are also used in the simultaneous equations models and the results are qualitatively similar. Delta has a significantly positive impact while that of Vega is insignificant. However, Holder67 is no longer significant.

Raw BHAR and winsorizing data

Instead of using natural logarithm transformation, we estimate the empirical model with raw 1-year and 3-year BHARs and winsorize our sample at 1% and 99%. We also use raw Vega and Delta in the regressions. The empirical results are qualitatively similar as Vega is significantly positive and Delta is significantly negative in their impact. Furthermore, the coefficient of Holder67 is positive.

3-year risk change measure

We also re-run regressions specified in Table 8 and Table 9 with 3-year risk change instead of 1-year risk change as the dependent variable. The results are again qualitatively similar as Vega has a significant positive effect while Delta has a significant negative effect on the 3-year acquisition-related risk change.

Varying the overconfidence proxy - Holder67

In order to account for the look-ahead bias[18] , in a robustness test, we amend the Holder67 measure by defining the CEO as overconfident if and only if he fails to exercise his stock option that is at least 67% in-the-money two times *before* the announcement date of the acquisition. In addition, following Malmendier and Tate (2005), we also require that the firm share price must appreciate high enough during the fiscal year, i.e., at least 67% more than the implied average exercise price of the exercisable options, to ensure that CEO does have the chance to exercise her stock options and reap considerable profit. The coefficients of the amended Holder67 measure are still significantly positive across all regression models. Furthermore, we use other thresholds such as 30%, 50%, 100% and 150% to define overconfidence. The empirical results are qualitatively similar.

Year Dummy

We employ year dummies instead of dividing the sample into two periods to control for different year effect. The regression results are qualitatively similar.

Lagged Vega and Delta in SEM

In the SEM, we also estimate the empirical model with lagged Delta and Vega values[19] . The results are qualitatively similar. One major difference is that the coefficient of Vega is statistically significant in the regression of 1-year BHAR while the coefficient of Delta is not significant. Nevertheless, both of the results are consistent with our hypothesis that Delta and Vega are generally beneficial to shareholder value creation.

[18] As noted in footnote 10 already, our Holder67 measures CEO's overconfident stock option exercising behaviour across the whole sample period and this may introduce a look-ahead bias as it is possible that CEO only behave overconfidently after the M&A deal.
[19] The results are presented in Table 11.

V. Conclusions

A. Summary of the Empirical Results

We document strong relations among managerial incentives, risk change, and post-acquisition performance of acquiring firm by investigating a sample of 3069 mergers and tender offers made by U.S firm during the period from January 1, 1993 to December 31, 2004. Two primary measures of managerial incentives are the sensitivity of CEO wealth to stock price (Delta) and the sensitivity of CEO wealth to stock return volatility (Vega). In addition to the OLS regression analyses, we also employ a simultaneous equations model by assuming the endogeneity among firm acquisition performance, risk change, Vega, and Delta. This assumption is validated in our tests.

Our analyses indicate that Delta and Vega affect the managerial risk-taking propensity and firm performance differently. Generally, both Delta and Vega are beneficial to shareholder value creation. In the analysis of the risk change due to corporate acquisition, our regression analyses confirm our hypotheses that the increase in firm risk due to corporate acquisition is associated with the increase in Vega while the decrease in firm risk due to corporate acquisition is associated with the increase in Delta. However, even though the increase in Vega is associated with increased risk due to the acquisition and is directly related to the acquirer post-acquisition performance, this impact does not vary with different levels of risk change. Similarly, the impact of Delta seems invariant to the level of risk change.

Since restricted stock grants are solely related to Delta while stock option grants are associated with both Delta and Vega, our results are consistent with the theoretical discussion of Lambert and Larcker (2004) that restricted stock grant is generally not the optimal contract form, and that stock option compensation possesses both efficiency and incentive advantage. These results are robust to using different measures of post-acquisition performance of the acquiring firm. In contrast to most of the prior studies in executive compensation, we take into account the managerial behavioral bias in our empirical model. Our analyses are consistent with the hypothesis that managerial overconfidence, to some extent, provides an alternative

solution to the underinvestment problem due to managerial risk aversion and makes risk incentive compensation to that extent redundant.

B. Limitations and Further Study

Despite the empirical results that generally support the hypotheses we propose in the paper, there are actually several points we need to address in the future. Firstly, the measures of the long term firm acquisition performance are noisy and they can vary due to different event study methodologies. Further tests are still needed in order to further validate the calculated 1-year and 3-year buy-and-hold abnormal returns. One of the corporate governance measures used in the study, board strength, is universally insignificant throughout the empirical analysis. More robust measures of corporate governance measures, i.e., the independence of the board, board size, board shareholding, CEO duality, and institutional ownership, are needed in order to control for the effect of corporate governance mechanisms on firm acquisition performance and executive compensation policy. Moreover, even though the measure of overconfidence, Holder67, is generally robust across our empirical models, more proxies for CEO overconfidence are needed in order to ensure that managerial overconfidence has a consistent impact independent of the proxy employed.

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Appendix A: Calculation of Vega and Delta measures

In the appendix, we follow the methodology discussed in Core and Guay (2002), Guay (1999), and Coles, Daniel, and Naveen (2005) to show how the Delta and Vega measures used in our study are calculated.

Estimating Delta and Vega of a single option

We calculate the option value based on Black-Scholes European option pricing formula (Black and Scholes, 1973), as modified by Merton (1973) to account for dividend payouts.

Option value= $Se^{-dT}N(d_1) - Xe^{-rT}N(d_2)$

Where $d_1 = \dfrac{\ln(S_0 / X) + (r - d + \sigma^2 / 2)T}{\sigma\sqrt{T}}$

$d_2 = \dfrac{\ln(S_0 / X) + (r - d - \sigma^2 / 2)T}{\sigma\sqrt{T}}$

S = price of the underlying stock
X = exercise price of the option
T = time to maturity
R = ln (1+ risk-free rate)
D = ln (1+ dividend rate), where the expected dividend rate is the per-share dividends
σ = annualised volatility
N ( ) = cumulative probability function for the normal distribution

Delta = the sensitivity of the option value with respect to a 1% change in stock price
= [∂ (option value) / ∂ (stock price)] $\times$ (stock price/100)
= $e^{-dT}N(d_1) \times (S/100)$

Vega = the sensitivity of the option value with respect to a 0.01 change in stock volatility
= [∂ (option value) / ∂ (stock volatility)] $\times$ 0.01
= $e^{-dT}N'(d_1) \times S\sqrt{T} \times 0.01$

Where $N'(d_1)$ is the normal density function. We multiply the sensitivity and Delta by the number of options to obtain the total dollar values of the change in CEO's wealth that will result from a 1% change in stock price and 0.01 changes in stock volatility.

Estimating Delta and Vega of portfolio of options

We calculate fiscal year end value and sensitivities of executives' option portfolios using the Core and Guay (2002) approximation method. Regarding US data, we use ExecuComp data, which gives the realisable value, i.e., the potential gains from exercising all options on the fiscal year end price, and the number of options separately for both exercisable and unexercisable options and also details of the current year's option grant.

- For the current year's grant, we compute the Black-Scholes value and sensitivities using the above formulae.
- For previously granted options, we compute the Black-Scholes value and sensitivities (Delta and Vega) separately for exercisable and unexercisable options.

- We compute the average exercise price separately for the portfolio of exercisable options and unexercisable options. First, we divide the realisable value by the number of options, which gives the average of (stock price-exercise price). We then subtract the number from the stock price to obtain the average exercise price.
- For exercisable options, we set the time to maturity as three years less than the time to maturity of the current year's options grants, or 6 years if no grant was made in the current year.
- For unexercisable options, we set the time to maturity equal to one year less than the time to maturity of the current year's options grants, or 9 years if no grant was made in the current year.
- We then calculate the Black-Scholes option value, Delta, and Vega using the average exercise price and time to maturity.

- We compute the Delta of the CEO's portfolio of stocks and options by adding the Delta of restricted stock and shares held by the CEO to the Delta of his options portfolio. We do not estimate the Vega of restricted stock and share as Guay (1999) finds that this value is trivial compared to the Vega of options.
  The Delta of stock = the fractional shareholding * 0.01 * stock price
  The Vega of the manager's portfolio of stock and options = Vega of new options granted +Vega of all exercisable option held + Vega of all unexercisable options held.

Figure 1

Illustration of simultaneous relations among executive compensation, firm risk, and firm performance

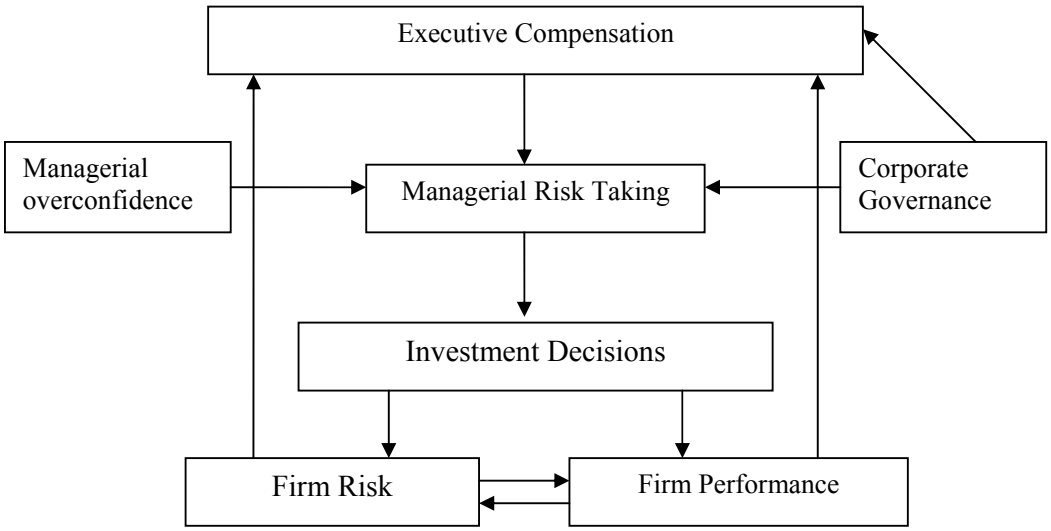

Figure 2

Executive compensation consists of cash compensation, restricted stock granted, stock options (using modified Black-Scholes method), LTIP, and other annual compensation.

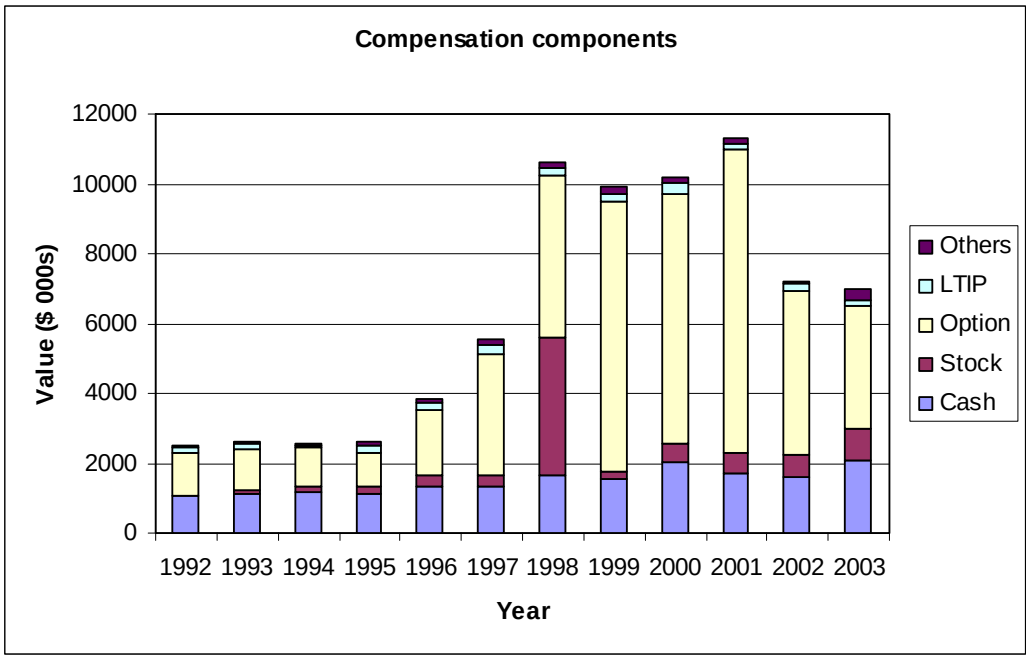

Figure 3

Delta is the dollar change in the value of the CEO's stock and option portfolio for a 1% change in stock price.

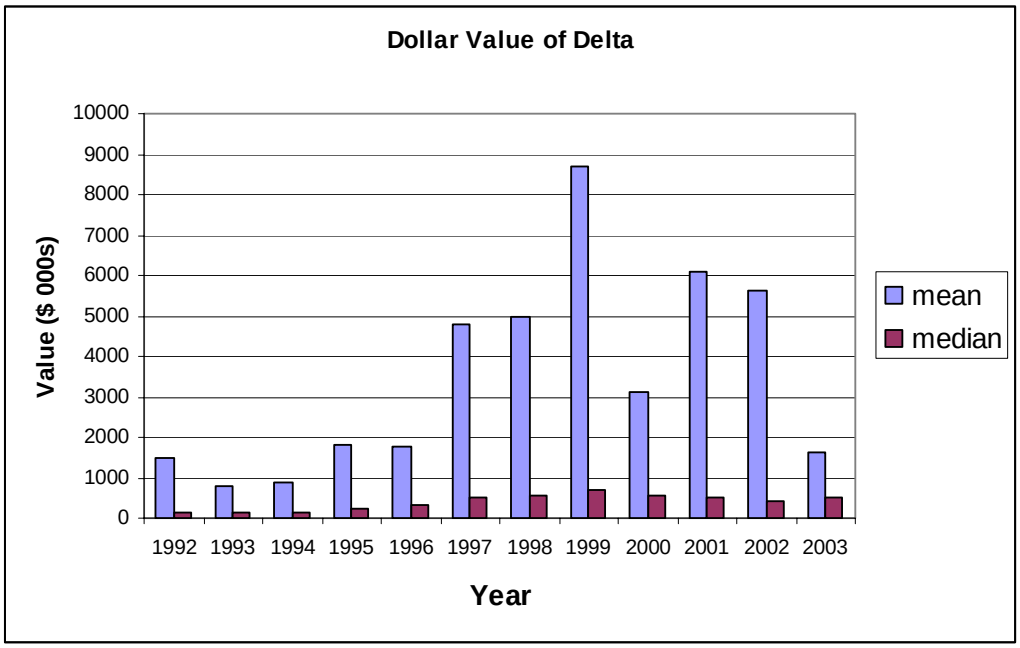

Figure 4

Vega is the dollar change in the value of the CEO's stock and option portfolio for a 0.01 change in standard deviation of stock returns.

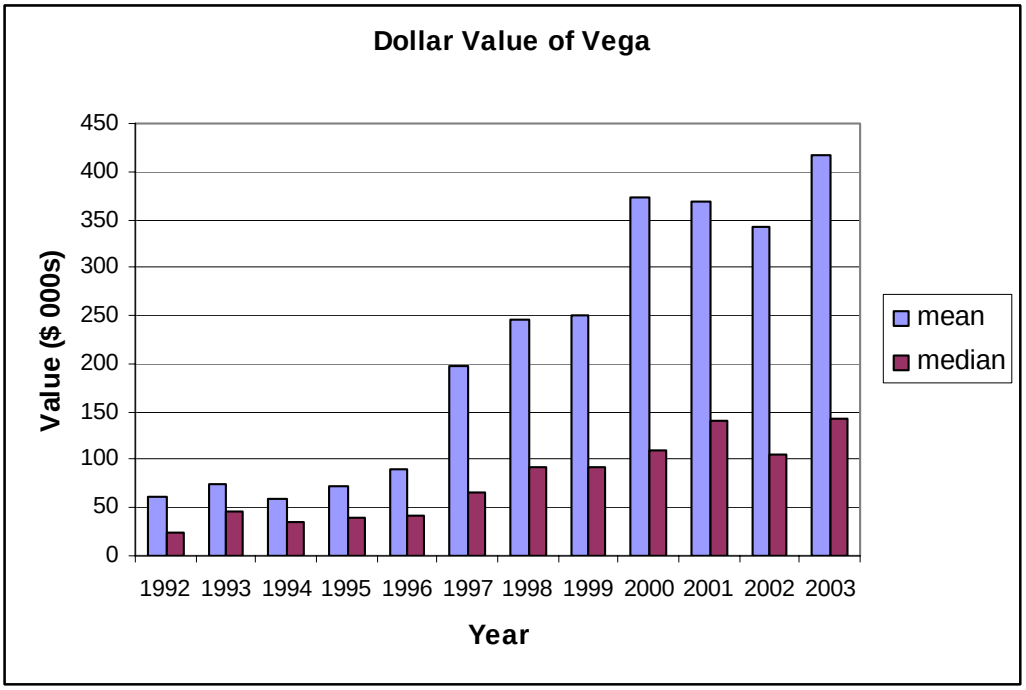

Figure 5 Numbers of Deals across the Sample Period

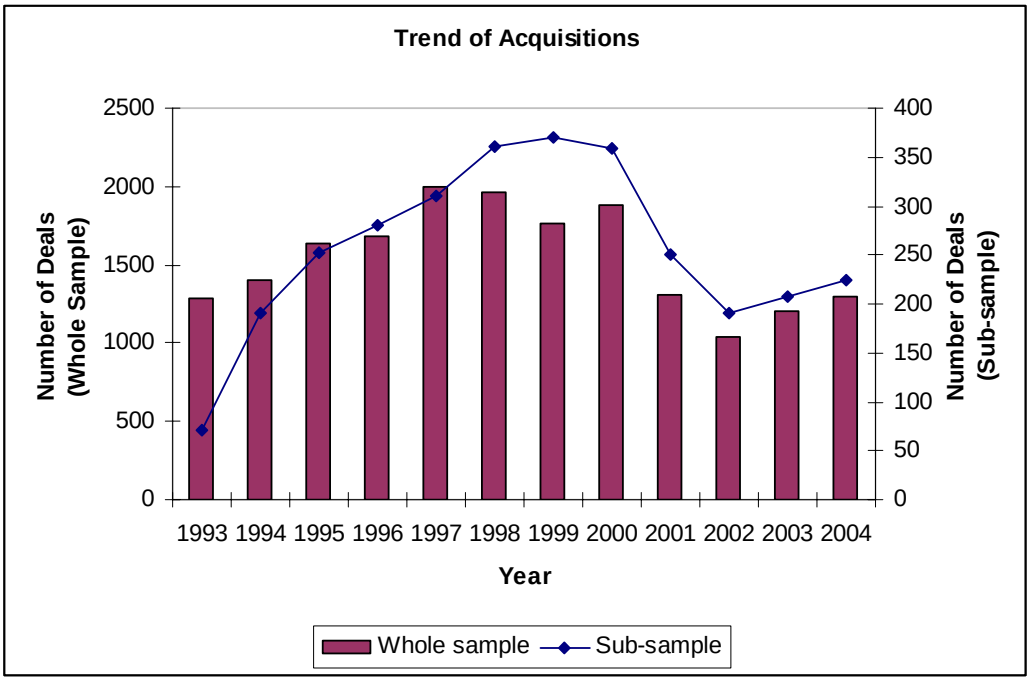

Figure 6 Mean Transaction Value Categorized by Year

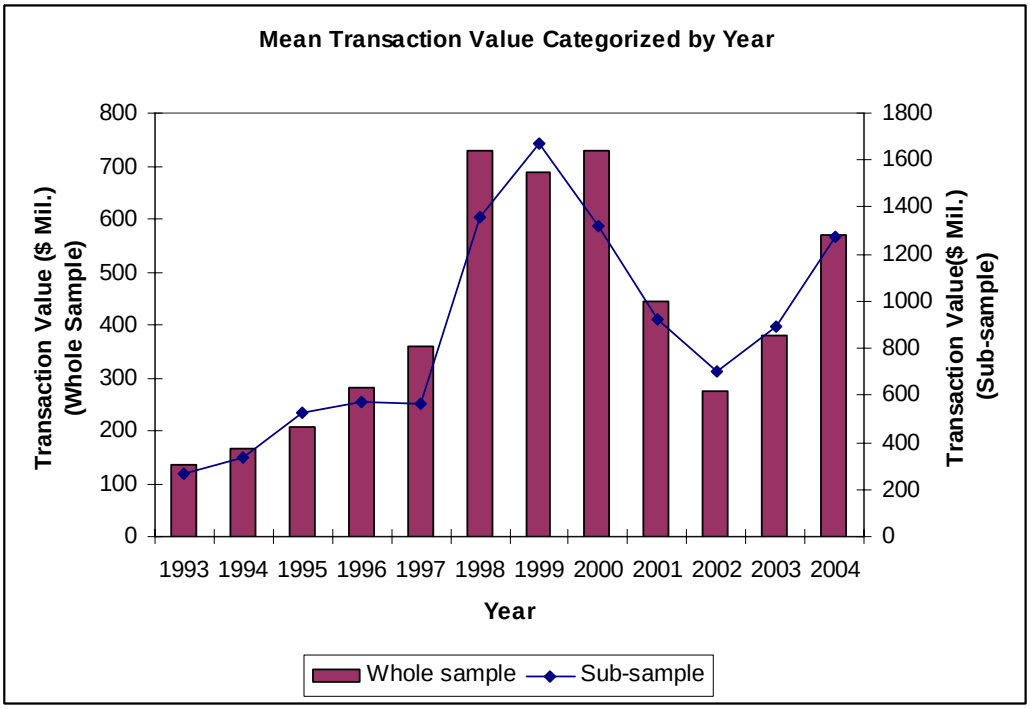

Table 1
Description of the sampling process

The final sample consists of 3069 acquisitions with 2744 mergers and 325 tender offers completed during the period from January 1, 1993 to December 31, 2004. In the long term study, we estimate one year and three years abnormal returns of the sample firm. In the estimation of one-year abnormal return, we include the deals completed during the period from January 1, 1993 to December 31, 2003. Similarly, we include the deals completed during the period from January 1, 1993 to December 31, 2001 when we estimate three-year abnormal return. In order to sustain the independence of the observations, in the one (three) years long term study, we include the sample firm only if the firm does not have consummated deals that meet our inclusion criteria one (three) years prior to the effective date of the corporate acquisition.

Panel A: Sampling Process

Data sources	Description	Observation
SDC	Mergers and acquisitions data	18444
ExecuComp	CEO compensation data	3092
CRSP	Stock return data	3076
CompuStat	Accounting data	3069

Panel B: Sample for regression analysis

Study type	Event Window	Sample size
Announcement effect	(-1 day,+1 day)	3069
1 year abnormal return	(0, 1 year)	1682
3 year abnormal return	(0, 3 year)	1046

Table 2
Distribution and Descriptive Statistics of Corporate Acquisitions, 1993-2004

The sample consists of 3069 completed acquisitions during the period January 1, 1993, to December 31, 2004. The firms are listed in the Securities Data Company's (SDC) on-line Mergers and Corporate Transactions database and have executive compensation data in Standard and Poor's ExecuComp database. In addition, company stock returns data and company accounting data are obtained from CRSP and CompuStat, respectively. Transaction value is the total value of consideration paid by the acquiror, excluding fees and expenses. The dollar value includes the amount paid for all common stock, common stock equivalents, preferred stock, debt, options, assets, warrants, and stake purchases made within six months of the announcement date of the transaction. Mergers are transactions that are identified as a merger or an acquisition of majority interest by SDC. Tender offers are transactions explicitly identified by SDC as tender offers. Cash refers to acquisitions financed with 100% cash. Equity refers to acquisitions financed with 100% equity securities. Mixed refers to all the other deals. Market capitalization is measured at the month-end prior to the announcement of the deals using CRSP. Book-to-market equity is calculated by the formula [stockholders' equity+deferred taxes+investment tax credit-Preferred Stock] / market capitalization, which is computed at the end of the month preceding the month of the effective date of the acquisition. Acquisition premium offered is the difference between the highest price paid per share and the target share price four weeks prior to the announcement date as a percentage of the target share price four weeks prior to the announcement date. Both of these two variables are identified by SDC.

Panel A: Distributions of Mergers and Tender Offers by Year

Year	Number of acquisitions	% of sample	Mean Transaction Value ($ Millions)	Median Transaction Value ($ Millions)
1993	71	2.31	269.26	68.40
1994	191	6.22	337.49	91.76
1995	253	8.24	522.65	88.35
1996	281	9.16	574.90	94.11
1997	311	10.13	562.84	148.83
1998	361	11.76	1358.18	150.98
1999	371	12.09	1667.90	245.48
2000	358	11.67	1317.66	260.00
2001	250	8.15	925.97	127.52
2002	190	6.19	702.65	111.53
2003	208	6.78	895.03	135.20
2004	224	7.30	1276.94	163.45
Total	3069	100	867.62	140.47

Panel B: Distributions of Medium of Payment of Mergers and Tender Offers

	Mergers		Tender Offers	
Model of Payment	Number of Acquisitions	% of Subsample	Number of Acquisitions	% of Subsample
Cash	610	22.23	218	67.08
Equity	1126	41.03	17	5.23
Mixed	1008	36.73	90	27.69
Total	2744	100	325	100

Panel C: Descriptive Statistics of the Sample firm

Variable	Observations	Mean	Median
Acquirer Market Capitalization ($ Mil.)	3069	15489.97	2730.38
Target Market Capitalization ($ Mil.)	968	1137.02	216.73
Acquirer Book-to-market equity	2967	0.40	0.32
Target Book-to-market equity	250	0.62	0.50
Acquisition premium (%)	1185	48.86	39.08

Table 3

Three-day (-1, +1) Cumulative Abnormal Returns for Acquirers at Acquisition Announcements

The sample consists of 3069 completed acquisitions during the period January 1, 1993, to December 31, 2004. The three-day (-1, +1) cumulative abnormal returns (CARs) are computed using the market model and the Scholes-Williams betas. The estimation period is from 200 days to 60 days preceding the announcement date. All compensation data are recorded at the year-end prior to the acquisition announcement. Delta is the dollar change in the value of the CEO's stock and option portfolio for a 1% change in stock price. Vega is the dollar change in the value of the CEO's stock and option portfolio for a 0.01 change in standard deviation of stock returns. High Delta refers to firms whose Delta value is above the median Delta value of the sample. Low Delta refers to firms whose Delta value is at or below the median Delta value of the sample. High Vega refers to firms whose Vega value is above the median Vega value of the sample. Low Vega refers to firms whose Vega value is at or below the median Vega value of the sample. Mergers are transactions that are identified as a merger or an acquisition of majority interest by SDC. Tender offers are transactions explicitly identified by SDC as tender offers. The mean and median values of CARs are presented in percentage. T-statistics in panel A and panel B are reported for the parametric tests of the group mean difference and t-statistics in panel C is the test of the significance of the CARs of different periods. Z-statistics in panel A and panel B are reported for the non-parametric tests of the difference of the group median.

Panel A: Three day (-1, +1) cumulative abnormal return categorized by Delta and Vega

Attribute	Full Sample	High Delta	Low Delta	t/z statistic	High Vega	Low Vega	t/z - statistic
Mean (%)	-0.45	-0.90	-0.02	-3.37[a]	-0.74	-0.16	-2.40[b]
Median (%)	-0.35	-0.42	-0.26	6.29[a]	-0.46	-0.19	5.61[a]
N	3069	1534	1535		1535	1534	

Panel B: CARs Categorized by Mode of Acquisition and Method of Payment

Attribute	Mergers	Tender offer	t/z statistic	Cash	Non cash	t/z-statistic
Mean (%)	-0.52	0.14	-1.49	0.39	-0.76	4.22[a]
Median (%)	-0.38	-0.01	2.01[b]	0.12	-0.53	19.77[a]
N	2744	325		828	2241	

Panel C: CARs Categorized by Event periods

Attribute	1993-1996	1997-2001	2002-2004
Mean (%)	-0.07	-0.70	-0.28
Median (%)	-0.18	-0.47	-0.16
N	796	1648	622
t-statistic	-0.38	-3.39[a]	-1.13

Panel D: 3-day CARs categorized by event period, Delta, and Vega

Event period	Delta category	Observation	Mean (%)	Median (%)	t-statistic
1993-1996	High Delta	364	0.07	0.07	0.24
	Low Delta	743	-0.04	-0.26	-0.2
1997-2001	High Delta	813	-1.52	-0.93	-4.56[a]
	Low Delta	524	0.05	-0.43	0.15
2002-2004	High Delta	354	-0.42	-0.29	-1.51
	Low Delta	268	-0.10	0.13	-0.21
	Vega category	Observation	Mean (%)	Median (%)	t-statistic
1993-1996	High Vega	363	-0.22	-0.22	-0.93
	Low Vega	744	0.10	-0.09	0.56
1997-2001	High Vega	776	-1.21	-0.96	-4.52[a]
	Low Vega	561	-0.48	-0.41	-1.04
2002-2004	High Vega	394	-0.30	-0.10	-1.02
	Low Vega	228	-0.26	-0.38	-0.55

[a], [b], and [c] indicate significance at 1 percent, 5 percent, and 10 percent levels, respectively.

Table 4
Three-year Buy-and-Hold-Returns of Acquiring Firms Categorized by Levels of Delta and Vega and Event Period

The sample consists of 1046 completed acquisitions during the period January 1, 1993, to December 31, 2001. The long term performance of the acquiring firm is measured by buy-and-hold-returns using the benchmark portfolio approach. Delta is the dollar change in the value of the CEO's stock and option portfolio for a 1% change in stock price. Vega is the dollar change in the value of the CEO's stock and option portfolio for a 0.01 change in standard deviation of stock returns. High Delta refers to firms whose Delta value is above the median Delta value of the sample. Low Delta refers to firms whose Delta value is at or below the median Delta value of the sample. High Vega refers to firms whose Vega value is above the median Vega value of the sample. Low Vega refers to firms whose Vega value is at or below the median Vega value of the sample.

Panel A: Equally weighted and Value weighted 3-year BHAR

Attribute	3-year BHAR	t/z-statistic	p-value
Equally weighted mean (%)	5.95[c]	1.87	0.06
Value weighted mean (%)	9.56[a]	3.29	0.001
Median (%)	-7.44[b]	-23255	0.02
Observation	1046		

Panel B: 3-year BHARs categorized by Delta and Vega

Attribute	High Delta	Low Delta	t/z statistic for group difference	High Vega	Low Vega	t/z statistic for group difference
Mean (%)	2.46	9.46	-1.1	10.01	1.89	1.27
Median (%)	-8.57	-5.67	1.35	-5.83	-9.06	-0.82
Observation	524	522		523	523	

Panel C: 3-year BHARs categorized by event period, Delta, and Vega

Event period	Delta category	Observation	Mean (%)	Median (%)	t-statistic
1993-1996	High Delta	142	-3.33	-19.86	-0.36
	Low Delta	240	17.90[b]	-2.21	2.39
1997-2001	High Delta	382	4.62	-6.83	0.88
	Low Delta	282	2.27	-12.29	0.44
	Vega category	Observation	Mean (%)	Median (%)	t-statistic
1993-1996	High Vega	157	7.39	-13.55	0.81
	Low Vega	225	11.83	-0.54	1.55
1997-2001	High Vega	366	11.14[b]	-3.89	1.99
	Low Vega	298	-5.61	-15.61	-1.22

[a], [b], and [c] indicate significance at 1 percent, 5 percent, and 10 percent levels, respectively.

Table 5
Summary Statistics of the Variables in the Multivariate Regressions

The sample consists of 3069 completed acquisitions during the period January 1, 1993, to December 31, 2004. CAR is the three-day (-1, +1) cumulative abnormal returns (CARs) computed using the market model and the Scholes-Williams betas. BHAR is the buy-and-hold abnormal returns calculated using benchmark portfolio event study approach. *Delta* is the dollar change in the value of the CEO's stock and option portfolio for a 1% change in stock price. *Vega* is the dollar change in the value of the CEO's stock and option portfolio for a 0.01 change in standard deviation of stock returns. Δ Stock Option is the value of the new stock options (using modified Black-Scholes method) granted to the CEO as a percent of her total compensation. Cash compensation is the sum of salary and annual bonus. Total compensation is the sum of cash compensation, restricted stock granted, stock options (using modified Black-Scholes method), LTIP, and other annual compensation. *Ownership* is the sum of the previously granted/acquired common stock and restricted stock owned by CEO at the year-end prior to the acquisition announcement divided by the contemporary total number of shares outstanding. *Book-to-market* equity is calculated by the formula [stockholders' equity+deferred taxes+investment tax credit-Preferred Stock] / market capitalization, which is computed at the end of the month preceding the month of the effective date of the acquisition. *Past performance* is the 12-month BHR of the acquirer prior to the effective date of the acquisition. *Relative size* is the ratio of the transaction value to acquirer market capitalization at the month-end preceding acquisition announcement. *Board strength* is a binary variable, which takes the value 1 if the CEO tenure is less than the median CEO tenure of the ExecuComp universe (this variable is re-calculated every year). *Holder67* is a binary variable equals to one if the CEO fails to exercise vested option that is at least 67% in-the-money, provided that he subsequently fails again at least twice. *Equity Payment* is a binary variable equals to 1 if the acquisition is financed by 100% stock and 0 otherwise. *Cash Payment* is a binary variable equals to 1 if the acquisition is financed by 100% cash and 0 otherwise. *Tender* is a binary variable equals to 1 if the acquisition is explicitly identified by SDC as tender offer and 0 otherwise.

Panel A: Continuous variables

Variable	Observation	Mean	Median	Standard Deviation
3-day CAR (%)	3066	-0.45	-0.35	7.23
1-year BHAR (%)	1655	1.21	-2.72	47.49
3-year BHAR (%)	1046	5.95	-7.44	103.11
Vega ($ 000s)	3069	215.92	61.38	486.82
Delta ($ 000s)	3069	3808.42	386.25	29847.99
Δ Stock Option (%)	3050	38.98	36.31	31.26
Cash Compensation ($ 000s)	3069	1500.25	988.72	1847.76
Ownership (%)	3031	2.76	0.32	6.58
Book-to-market	2967	0.40	0.32	0.48
Past Performance (%)	1630	31.25	16.69	89.41
Relative Size	2631	0.13	0.05	0.20

Panel B: Dummy variable

Variable	Observation	Proportion (%)
Board Strength	2809	43.82
Holder67	3069	24.47
Equity Payment	3069	37.24
Cash Payment	3069	26.98
Tender	3069	10.59

Table 6

Multivariate Regressions Explaining the Three-day (-1, +1) Cumulative Abnormal Returns to Acquiring Shareholders around Acquisitions Announcement

The sample consists of 3069 completed acquisitions during the period January 1, 1993, to December 31, 2004. The dependent variable is 100 × (the natural logarithm of 1+ three-day (-1, +1) announcement period CAR). *Vega* is the natural logarithm of dollar change in the value of the CEO's stock and option portfolio for a 0.01 change in standard deviation of stock returns. *Delta* is the natural logarithm of 1+ the dollar change in the value of the CEO's stock and option portfolio for a 1% change in stock price. Δ*Stock Option* is the natural logarithm of 1+ the value of the new stock options (using modified Black-Scholes method) granted to the CEO as a percent of her total compensation. *Ownership* is the natural logarithm of 1+ sum of the previously granted/acquired common stock and restricted stock owned by CEO at the year-end prior to the acquisition announcement divided by the contemporary total number of shares outstanding. *Board strength* is a binary variable, which takes the value 1 if the CEO tenure is less than the median CEO tenure of the ExecuComp universe (this variable is re-calculated every year). *Holder67* is a binary variable equals to one if the CEO fails to exercise vested option that is at least 67% in-the-money, provided that he subsequently does it again at least twice. *Equity Payment* is a binary variable equals to 1 if the acquisition is financed by 100% stock and 0 otherwise. *Cash Payment* is a binary variable equals to 1 if the acquisition is financed by 100% cash and 0 otherwise. *Tender* is a binary variable equals to 1 if the acquisition is explicitly identified by SDC as tender offer and 0 otherwise. *Relative size* is the natural logarithm of 1+ ratio of the transaction value to acquirer market capitalization at the month-end preceding acquisition announcement. t-statistics for the significance of the coefficients are White's (1980) heteroskedasticity consistent t-statistics. The basic empirical model used in table 6 is equation 5. The condition index in collinearity diagnostics test ranges from 10 to 20, which is not strong enough to cause a fair amount of error.

	Full Sample			**1993-1996**			**1997-2004**		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Intercept	-0.50	1.17	1.05	-0.31	-1.81	-2.15	-0.62	1.51	1.33
Vega		0.01	0.05		-0.30	-0.38		0.09	0.13
Delta		-0.34[a]	-0.34[b]		0.40	0.51[c]		-0.46[a]	-0.46[a]
Δ*Stock Option*	-1.08		-0.66	-1.14		-0.78	-0.78		-0.34
Ownership	0.30	0.64[b]	0.70[b]	0.14	-0.41	-0.46	0.38	0.89[a]	0.97[a]
Board Strength			0.09			0.00			0.12
Holder67			0.28			0.68			0.11
Book-to-market	2.03[b]	1.40[c]	1.66[b]	2.56[c]	3.73[c]	4.33[a]	1.74[c]	0.89	1.16
Equity Payment	-0.79[b]	-0.84[b]	-0.78[c]	-0.74	-0.63	-0.63	-0.92[c]	-0.90[c]	-0.83[c]
Cash Payment	0.44	0.48	0.39	0.11	0.04	0.24	0.50	0.60	0.45
Tender	0.47	0.42	0.78[c]	0.80	0.88	0.86	0.40	0.30	0.75
Relative Size	-4.31[a]	-4.55[a]	-5.15[a]	-3.45[c]	-3.24	-3.84[c]	-4.49[a]	-4.82[a]	-5.42[a]
Adjusted R^2	0.024	0.026	0.031	0.021	0.022	0.033	0.022	0.027	0.030
F-statistics	9.67	9.38	7.52	2.97	2.81	2.72	7.09	7.52	5.8
P-value	<.0001	<.0001	<.0001	0.0045	0.0046	0.002	<.0001	<.0001	<.0001
Observation	2494	2507	2275	631	634	552	1863	1873	1723

[a], [b], and [c] indicate significance at 1 percent, 5 percent, and 10 percent levels, respectively.

Table 7

Multivariate Regression Explaining Three-year Buy-and-Hold-Returns for Acquiring Firms

The sample consists of 1046 completed acquisitions during the period January 1, 1993, to December 31, 2001. The dependent variable is 100 × (the natural logarithm of 1 + acquiring firm BHR minus the natural logarithm of 1+ match firm BHR). *Vega* is the natural logarithm of dollar change in the value of the CEO's stock and option portfolio for a 0.01 change in standard deviation of stock returns. *Delta* is the natural logarithm of 1+ the dollar change in the value of the CEO's stock and option portfolio for a 1% change in stock price. Δ*Stock Option* is the natural logarithm of 1+ the value of the new stock options (using modified Black-Scholes method) granted to the CEO as a percent of her total compensation. *Ownership* is the natural logarithm of 1+ sum of the previously granted/acquired common stock and restricted stock owned by CEO at the year-end prior to the acquisition announcement divided by the contemporary total number of shares outstanding. Board strength is a binary variable, which takes the value 1 if the CEO tenure is less than the median CEO tenure of the ExecuComp universe (this variable is re-calculated every year). *Holder67* is a binary variable equals to one if the CEO fails to exercise vested option that is at least 67% in-the-money, provided that he subsequently does it again at least twice. *Equity Payment* is a binary variable equals to 1 if the acquisition is financed by 100% stock and 0 otherwise. *Cash Payment* is a binary variable equals to 1 if the acquisition is financed by 100% cash and 0 otherwise. *Tender* is a binary variable equals to 1 if the acquisition is explicitly identified by SDC as tender offer and 0 otherwise. *Relative size* is the natural logarithm of 1+ ratio of the transaction value to acquirer market capitalization at the month-end preceding acquisition announcement. t-statistics for the significance of the coefficients are White's (1980) heteroskedasticity consistent t-statistics. The basic empirical model used in table 7 is equation 5. The condition index in collinearity diagnostics test ranges from 10 to 20, which is not strong enough to cause a fair amount of error.

	Full Sample			**1993-1996**			**1997-2001**		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Intercept	10.05	-12.75	-12.10	10.68	17.78	13.47	9.06	-30.90[c]	-26.47
Vega		4.72[c]	8.71[a]		6.42[c]	8.65[b]		3.01	7.10[c]
Delta		-0.49	-1.44		-7.24[c]	-6.80		3.96	2.37
Δ*Stock Option*	-11.48		-50.31[a]	-12.86		-32.39	-8.71		-50.03[b]
Ownership	-9.67[a]	-9.18[c]	-8.00	0.20	6.80	6.61	-15.03[a]	-18.46[b]	-16.66[b]
Board Strength		1.40	1.30		1.15	1.61		3.49	2.76
Holder67		24.15[a]	22.79[a]		18.06[c]	18.10[c]		28.40[a]	26.09[a]
Book-to-market	18.89[a]	17.96[a]	14.79[a]	11.08[b]	11.05[b]	9.63[c]	19.86[a]	20.34[a]	16.87[c]
Equity Payment	7.73	5.07	5.97	-6.93	-11.60	-10.56	12.03	9.62	10.57
Cash Payment	11.83	11.31	12.07[c]	4.97	-1.20	0.64	12.90	14.72	14.99[c]
Tender	-1.15	-4.50	-6.28	-15.57[c]	-11.53	-14.11	3.74	-0.28	-1.82
Relsize	-17.71	-12.82	-14.23	-7.12	-20.22	-18.33	-20.81	-7.80	-11.12
Adjusted R^2	0.069	0.089	0.097	0.019	0.029	0.026	0.076	0.103	0.110
F-statistics	9.81	8.48	8.49	1.8	1.8	1.64	7.33	6.8	6.62
P-value	<.0001	<.0001	<.0001	0.0863	0.0617	0.0878	<.0001	<.0001	<.0001
Observation	838	770	765	297	265	264	541	505	501

[a], [b], and [c] indicate significance at 1 percent, 5 percent, and 10 percent levels, respectively.

Table 8
Multivariate Regression Coefficients Explaining Risk Change One Year after the Completion of Acquisitions

The sample consists of 1682 completed acquisitions during the period January, 1993 to December, 2003. The dependent variable is 100 × (the natural logarithm of 1+ Δ risk, which is measured as the standard deviation of stock returns for the postacquisition period (11 days to 250 days following the effective day) minus the preacquisition period standard deviation (250 days to 11 days preceding the announcement date)). *Vega* is the natural logarithm of dollar change in the value of the CEO's stock and option portfolio for a 0.01 change in standard deviation of stock returns. *Delta* is the natural logarithm of 1+ the dollar change in the value of the CEO's stock and option portfolio for a 1% change in stock price. Δ*Stock Option* is the natural logarithm of 1+ the value of the new stock options (using modified Black-Scholes method) granted to the CEO as a percent of her total compensation. *Ownership* is the natural logarithm of 1+ sum of the previously granted/acquired common stock and restricted stock owned by CEO at the year-end prior to the acquisition announcement divided by the contemporary total number of shares outstanding. Board strength is a binary variable, which takes the value 1 if the CEO tenure is less than the median CEO tenure of the ExecuComp universe (this variable is re-calculated every year). *Holder67* is a binary variable equals to one if the CEO fails to exercise vested option that is at least 67% in-the-money, provided that he subsequently does it again at least twice. *Equity Payment* is a binary variable equals to 1 if the acquisition is financed by 100% stock and 0 otherwise. *Cash Payment* is a binary variable equals to 1 if the acquisition is financed by 100% cash and 0 otherwise. *Tender* is a binary variable equals to 1 if the acquisition is explicitly identified by SDC as tender offer and 0 otherwise. *Relative size* is the natural logarithm of 1+ ratio of the transaction value to acquirer market capitalization at the month-end preceding acquisition announcement. t-statistics for the significance of the coefficients are White's (1980) heteroskedasticity consistent t-statistics. The basic empirical model used in table 8 is equation 6. The condition index in collinearity diagnostics test ranges from 10 to 20, which is not strong enough to cause a fair amount of error.

	Full Sample		**1993-1996**		**1997-2003**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Intercept	0.30[b]	0.34[b]	0.20	0.27	0.37[b]	0.38[c]
Vega	0.07[b]	0.05[b]	0.01	-0.01	0.08[b]	0.06[b]
Delta	-0.11[a]	-0.11[a]	-0.07[c]	-0.07[c]	-0.12[a]	-0.12[a]
Δ*Stock Option*	-0.27		-0.06		-0.35	
Ownership	0.08	0.06	0.03	-0.01	0.10	0.08
Board Strength		-0.04		-0.06		-0.04
Holder67	0.15[c]	0.10	0.10	0.13	0.16	0.10
Book-to-market	-0.15[b]	-0.14[c]	-0.22[a]	-0.23[a]	-0.13	-0.12
Equity Payment	0.05	0.08	-0.02	-0.01	0.10	0.13
Cash Payment	-0.14[c]	-0.09	-0.02	0.03	-0.17[c]	-0.12
Tender	0.14	0.14	-0.03	-0.10	0.18	0.19
Relsize	-0.28[c]	-0.30[c]	-0.18	-0.19	-0.32	-0.33
Adjusted R^2	0.014	0.014	0.023	0.031	0.013	0.012
F-statistics	2.99	2.82	1.79	1.96	2.34	2.21
P-value	0.001	0.002	0.061	0.038	0.010	0.016
Observation	1391	1291	336	300	1055	991

[a], [b], and [c] indicate significance at 1 percent, 5 percent, and 10 percent levels, respective

Table 9
Multivariate Regression Explaining One-year Buy-and-Hold-Return for Acquiring Firms with Respect to the Risk Change

The sample consists of 1682 completed acquisitions during the period January, 1993 to December, 2003. The dependent variable is 100× (the natural logarithm of 1 + acquiring firm one-year BHR minus the natural logarithm of 1+ match firm one-year BHR). ΔRisk is 100 × (the natural logarithm of 1+ risk change, which is measured as the standard deviation of stock returns for the postacquisition period (11 days to 250 days following the effective day) minus the preacquisition period standard deviation (250 days to 11 days preceding the announcement date)). Two interaction variables are the products of *Risk* with *Delta* and *Vega*, respectively. *Vega* is the natural logarithm of dollar change in the value of the CEO's stock and option portfolio for a 0.01 change in standard deviation of stock returns. *Delta* is the natural logarithm of 1+ the dollar change in the value of the CEO's stock and option portfolio for a 1% change in stock price. Δ*Stock Option* is the natural logarithm of 1+ the value of the new stock options (using modified Black-Scholes method) granted to the CEO as a percent of her total compensation. *Ownership* is the natural logarithm of 1+ sum of the previously granted/acquired common stock and restricted stock owned by CEO at the year-end prior to the acquisition announcement divided by the contemporary total number of shares outstanding. Board strength is a binary variable, which takes the value 1 if the CEO tenure is less than the median CEO tenure of the ExecuComp universe (this variable is re-calculated every year). *Holder67* is a binary variable equals to one if the CEO fails to exercise vested option that is at least 67% in-the-money, provided that he subsequently does it again at least twice. *Equity Payment* is a binary variable equals to 1 if the acquisition is financed by 100% stock and 0 otherwise. *Cash Payment* is a binary variable equals to 1 if the acquisition is financed by 100% cash and 0 otherwise. *Tender* is a binary variable equals to 1 if the acquisition is explicitly identified by SDC as tender offer and 0 otherwise. *Relative size* is the natural logarithm of 1+ ratio of the transaction value to acquirer market capitalization at the month-end preceding acquisition announcement. t-statistics for the significance of the coefficients are White's (1980) heteroskedasticity consistent t-statistics. The basic empirical model used in table 9 is equation 7. The basic empirical model used in table 8 is equation 6. The condition index in collinearity diagnostics test ranges from 10 to 20, which is not strong enough to cause a fair amount of error.

	Full sample	**1993-1996**	**1997-2003**
Intercept	-8.34	-6.10	-8.56
Vega	3.99[a]	0.92	4.19[a]
Delta	-0.23	-0.08	0.09
Δ *Stock Option*	-22.20[a]	-10.92	-23.62[b]
Δ*Risk*	9.20[c]	0.79	9.73[c]
Δ*Risk*Vega*	-0.67	0.55	-0.70
Δ*Risk*Delta*	-1.24	-0.99	-1.29
Ownership	-0.06	-0.55	-0.77
Board Strength	-3.54	-0.90	-4.24
Holder67	9.18[a]	7.63	9.50[a]
Book-to-market	8.17[a]	-0.18	9.72[a]
Equity Payment	8.20[b]	0.23	10.39[b]
Cash Payment	7.69[a]	8.61[c]	6.77[c]
Tender	0.01	-5.55	0.79
Relsize	-12.10[c]	-2.16	-14.78[c]
Adjusted R	0.066	-0.016	0.077
F-statistics	7.45	0.67	6.81
P-value	<.0001	0.8051	<.0001
Observation	1272	297	975

[a], [b], and [c] indicate significance at 1 percent, 5 percent, and 10 percent levels, respectively.

Table 10

Simultaneous Equations Model Explaining One-year Buy-and-Hold-Returns for Acquiring Firms

The sample consists of 1682 completed acquisitions during the period January, 1993 to December, 2003. BHAR is 100× (the natural logarithm of 1 + acquiring firm one-year BHR minus the natural logarithm of 1+ match firm one-year BHR). Risk is 100 × (the natural logarithm of 1+ risk change, which is measured as the standard deviation of stock returns for the postacquisition period (11 days to 250 days following the effective day) minus the preacquisition period standard deviation (250 days to 11 days preceding the announcement date)). *Vega* is natural logarithm of 1+ the dollar change in the value of the CEO's stock and option portfolio for a 0.01 change in standard deviation of stock returns. *Delta* is the natural logarithm of 1+ the dollar change in the value of the CEO's stock and option portfolio for a 1% change in stock price. Both Vega and Delta are computed at the year the acquisitions are consummated. *Ownership* is the natural logarithm of 1+ sum of the previously granted/acquired common stock and restricted stock owned by CEO at the year-end prior to the acquisition announcement divided by the contemporary total number of shares outstanding. Board strength is a binary variable, which takes the value 1 if the CEO tenure is less than the median CEO tenure of the ExecuComp universe (this variable is re-calculated every year). *Holder67* is a binary variable equals to one if the CEO fails to exercise vested option that is at least 67% in-the-money, provided that he subsequently does it again at least twice. *Size* is the natural logarithm of 1+ market capitalization of the acquiring firm at the month-end preceding the acquisition announcement. *Book-to-market* value is calculated by the formula [stockholders' equity+deferred taxes+investment tax credit-Preferred Stock], which is computed at the end of the month preceding the month of the effective date of the acquisition. *Equity Payment* is a binary variable equals to 1 if the acquisition is financed by 100% stock and 0 otherwise. *Cash Payment* is a binary variable equals to 1 if the acquisition is financed by 100% cash and 0 otherwise. *Tender* is a binary variable equals to one if the acquisition is explicitly identified by SDC as tender offer. *Past performance* is the 12-month pre-acquisition (12 months prior to the month of effective date) buy-and-hold-returns for the acquiring firm. *Relative size* is the natural logarithm of 1+ ratio of the transaction value to acquirer market capitalization at the month-end preceding acquisition announcement. The basic empirical model used in table 10 is equation 8, 9, 10, 11.

	Full Sample				**1993-1996**				**1997-2003**			
	BHAR	ΔRisk	Vega	Delta	BHAR	ΔRisk	Vega	Delta	BHAR	ΔRisk	Vega	Delta
Intercept	-29.38[a]	0.32[c]	-1.07[a]	1.04[a]	-20.77[a]	0.09	-0.13	1.61[a]	-32.44[a]	0.40[b]	-1.17[a]	0.96[a]
BHAR		0.00	0.00	0.00[a]		0.00	0.00	0.00		0.00	0.00	0.00[a]
ΔRisk	0.00		0.05[c]	-0.06[c]	-3.44		0.14	-0.04	0.20		0.04	-0.06[c]
Vega	0.69	0.05[b]		0.15[a]	-0.09	0.03		0.08	0.80	0.05[b]		0.16[a]
Delta	5.63[a]	-0.09[a]	0.66[a]		3.19[b]	-0.07[b]	0.60[a]		6.24[a]	-0.10[a]	0.66[a]	
Cash Compensation			0.30[a]				0.17[c]				0.33[a]	
Ownership			-1.11[a]				-1.03[a]				-1.12[a]	
Board Strength			-0.04				-0.03				-0.06	
Holder67	5.78[b]	0.10	-0.01	0.83[a]	5.29	0.11	0.06	0.97[a]	6.08[c]	0.10	-0.02	0.78[a]
Size				0.53[a]				0.47[a]				0.54[a]
Book-to-market	12.49[a]	-0.08[c]			2.89	-0.15[b]			13.87[a]	-0.06		
Payment	3.87				8.36[b]				2.42			
Tender	-1.35				-5.90				-0.51			
Past Performance		0.41[a]				0.47[a]				0.42[a]		
Relsize	-11.81[b]	-0.21			-1.94	-0.17			-13.62[b]	-0.23		
Adjusted R^2	0.083	0.035	0.451	0.403	0.023	0.079	0.365	0.285	0.095	0.031	0.458	0.421
F-statistics	15.23	7.46	148.08	170.04	1.83	4.54	24.73	24.09	13.58	5.33	117.13	140.71
P-value	<.0001	<.0001	<.0001	<.0001	0.071	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Observation	1252	1252	1252	1252	290	290	290	290	962	962	962	962

[a], [b], and [c] indicate significance at 1 percent, 5 percent, and 10 percent levels, respectively.

Table 11

Simultaneous Equations Model Explaining One-year Buy-and-Hold-Returns for Acquiring Firms with Respect to the Risk Change (using lagged Delta and Vega)

The sample consists of 1682 completed acquisitions during the period January, 1993 to December, 2003. BHAR is 100× (the natural logarithm of 1 + acquiring firm one-year BHR minus the natural logarithm of 1+ match firm one-year BHR). Risk is 100 × (the natural logarithm of 1+ risk change, which is measured as the standard deviation of stock returns for the postacquisition period (11 days to 250 days following the effective day) minus the preacquisition period standard deviation (250 days to 11 days preceding the announcement date)). *Vega* is natural logarithm of 1+ the dollar change in the value of the CEO's stock and option portfolio for a 0.01 change in standard deviation of stock returns. *Delta* is the natural logarithm of 1+ the dollar change in the value of the CEO's stock and option portfolio for a 1% change in stock price. *Ownership* is the natural logarithm of 1+ sum of the previously granted/acquired common stock and restricted stock owned by CEO at the year-end prior to the acquisition announcement divided by the contemporary total number of shares outstanding. Board strength is a binary variable, which takes the value 1 if the CEO tenure is less than the median CEO tenure of the ExecuComp universe (this variable is re-calculated every year). *Holder67* is a binary variable equals to one if the CEO fails to exercise vested option that is at least 67% in-the-money, provided that he subsequently does it again at least twice. *Size* is the natural logarithm of 1+ market capitalization of the acquiring firm at the month-end preceding the acquisition announcement. *Book-to-market* value is calculated by the formula [stockholders' equity+deferred taxes+investment tax credit-Preferred Stock], which is computed at the end of the month preceding the month of the effective date of the acquisition. *Equity Payment* is a binary variable equals to 1 if the acquisition is financed by 100% stock and 0 otherwise. *Cash Payment* is a binary variable equals to 1 if the acquisition is financed by 100% cash and 0 otherwise. *Tender* is a binary variable equals to one if the acquisition is explicitly identified by SDC as tender offer. *Past performance* is the 12-month pre-acquisition (12 months prior to the month of effective date) buy-and-hold-returns for the acquiring firm. *Relative size* is the natural logarithm of 1+ ratio of the transaction value to acquirer market capitalization at the month-end preceding acquisition announcement. The basic empirical model used in table 10 is equation 8, 9, 10, 11.

	Full Sample				**1993-1996**				**1997-2003**			
	BHAR	Risk	Vega	Delta	BHAR	Risk	Vega	Delta	BHAR	Risk	Vega	Delta
Intercept	-6.88	0.24[c]	-1.07[a]	0.86[a]	-5.72	0.12	-0.59	1.09[a]	-8.78	0.31[c]	-1.18[a]	0.95[a]
BHAR		0.00	0.00[a]	0.00[a]		0.00	0.00	0.00		0.00	0.00[a]	0.00[b]
Risk	-0.52		0.04	-0.06[c]	-4.13		-0.01	-0.08	-0.34		0.04	-0.06[c]
Vega	2.00[a]	0.04[b]		0.16[a]	0.06	0.00		0.20[a]	2.32[a]	0.05[b]		0.15[a]
Delta	0.35	-0.08[a]	0.71[a]		-0.11	-0.06[b]	0.73[a]		0.66	-0.09[a]	0.70[a]	
Cash Compensation			0.24[a]				0.15				0.26[a]	
Ownership			-1.26[a]				-1.14[a]				-1.30[a]	
Board Strength			0.01				-0.11				0.05	
Holder67	9.32[a]	0.09	0.06	0.76[a]	7.59[c]	0.11	-0.10	0.95[a]	9.69[a]	0.08	0.12	0.69[a]
Size				0.53[a]				0.44[a]				0.54[a]
Book-to-market	9.06[a]	-0.08[c]			0.33	-0.16[a]			10.36[a]	-0.07		
Payment	3.57				7.88[c]				2.33			
Tender	-0.46				-4.53				0.22			
Past Performance		0.37[a]				0.40[a]				0.38[a]		
Relsize	-14.90[b]	-0.22			-3.45	-0.20			-17.11[b]	-0.23		
Adjusted R-sqr	0.048	0.032	0.475	0.376	0.003	0.075	0.459	0.292	0.056	0.028	0.469	0.379
F-statistics	8.92	6.83	162.98	151.86	1.12	4.34	36.02	24.88	8.17	4.92	122.44	118.48
P-value	<.0001	<.0001	<.0001	<.0001	0.3526	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Observation	1252	1252	1252	1252	290	290	290	290	962	962	962	962

[a], [b], and [c] indicate significance at 1 percent, 5 percent, and 10 percent levels, respectively.