SFAS 123 (R), Managerial Ownership, and the Sensitivity of Investment to Cash flow: A New Evidence

I. Introduction

Companies were allowed to employ intrinsic method to measure stock options, whereby compensation expense was determined as the excess of the stock price at the measurement date over the option exercise price. To further enhance financial reporting quality, Financial Accounting Standard Board (FASB) released the SFAS 123 (R), Share-Based Payment, in December 2004 and required all entities to adopt only the fair value method to account for stock options. However, this requirement brought considerable debates on accounting for stock options mainly because it led to substantially higher compensation costs during the vesting period (Schroeder and Schauer 2008). As displayed in Figure 1, a tendency towards unpopularity of rewarding executive stock option (ESOs) compensation scheme is floating following the birth of SFAS 123 (R), and alternative rewards such as cash bonus, salaries, and restrict stock units are becoming more welcome, which, as exhibited in Figure 2 and 3, is even more pronounced in financial service industry than other industries (Brown and Lee 2007; Kieso et al. 2011).

This shift in compensation mix may be attributed to the issuance of the SFAS 123 (R). Cash bonus provides an option for diversification while ESOs compensation packages do not. Undiversified managers receiving cash bonus can immediately diversify their portfolio, but those who receive stock options of their company have to wait for three to five years until the end of the vesting period. Therefore, there is no reason for firms to employ stock option compensation schemes in lieu of cash bonus unless favorable inducements being offered. One important inducement for granting ESOs is that it is cheap and cashless. Intrinsic value method allowed prior to the birth of SFAS 123 (R) provided lowest compensation cost, usually zero, for firms to attract, retain, and motivate their excellent executives for long term performance, but the fair value method required by the SFAS 123 (R) quenched this enticement. Recently, restrict stock units compensation scheme is gaining its popularity partly because its accounting treatment allows the firm’s income statement to be indemnified if the stock option contracts are expired without exercise or forfeited, comparing to the accounting for ESOs compensation packages under SFAS 123 (R). Consequently, it appears that the SFAS 123 (R) is impeding the ESOs compensation packages.
Despite that fewer grants of ESOs probably alleviate overinvestment problem, their impact on underinvestment remains unknown. A growing body of literatures documents the relation between ESOs and managers’ investment decisions based on agency theory. Notwithstanding controversies with respect to overinvestment and enlarging stock returns volatility, executive stock options (ESOs) provide incentives to risk-averse managers to invest in risky projects on behalf of risk-neutral shareholders. Rajgopal and Shevlin (2002) are the pioneers who provide direct evidence on the effect of ESOs on affect managers’ investment decisions with a sample of oil and gas firms. They argue that a positive association between ESO risk incentives and the coefficient of variation in future cash flows from exploration activity should be observed if ESOs mitigate the problem of risk-averse managers’ passing up positive but risky net present value (NPV) projects by motivating them to invest in riskier projects. Consistent with their argument, their main findings show that exploration risk is positively associated with the sensitivity of ESOs to stock return volatility after controlling possible endogeneity of ESO risk incentives and hedging, which is related to less hedging of oil and gas price risk exposure. However, the SFAS 123 (R) requires companies to use Black-Shole model or lattice model in determining the compensation cost, which may reduce the stock return volatility. One factor included in these models is stock volatility. Companies heavily relying on ESOs tend to be less willing to observe volatile share performance because higher stock volatility generates higher compensation costs that are disallowed to be indemnified as other gains in their income statement if the stock option contracts are expired without exercise or forfeited. Instead, they may seek to employ alternative non-option based compensations plans. In this case, overinvestment problem is expected to be alleviated as the risk-averse managers shed less light on the stock return volatility.

Under-investment behavior that arises from asymmetric information is likely to be exacerbated with higher demand for external funds, and the need for external funds is likely to be higher when growth is high or cash flow is low (Myers and Majluf, 1984). Figure 4 shows the mean ratios of debt components (total debuts, long-term debts, and current debts) to total equity for publicly held companies relying heavily on ESOs compensation schemes (above 50%) and that for all

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1 Please reference McConnell and Muscarella (1985); Anthony and Ramesh (1992); Bizjak et al. (1993); Malmendier et al. (2005a); Goel and Thakor (2008).

2 Please reference (Jensen and Meckling (1976); Haugen and Senbet (1981); Lambert et al. (1991); Guay (1999); Hemmer et al. (1999)
industries over the period from 1989 to 2010\(^3\). The trend for the high-ESOs firms is similar to that for the whole industries. Both long-term and short-term debts, with an exception of the period between 2001 and 2003, maintained at a level around one point eight times of firms’ total equity prior to 2006 and rose thereafter. Taken together the trend with respect to stock options observed previously, Figure 4 is consistent with prior studies’ finding that ESOs are negatively related to firms’ leverage (Ryan Jr. and Wiggins III 2001; Duru et al. 2005). If Pecking Order Theory applies, Figure 4 depicts a firms’ tendency toward suboptimal preference of relying more on debts after the adoption of SFAS 123 (R). It appears that SFAS 123 (R) is running counter to the desire of the public because debt overhang can further depress corporate spending and investment, and even leads to underinvestment (Hennessy 2004; Nini et al. 2009; Occhino 2010). As economists contend, the weakness of financial reports is constraining business spending and investment, and, in turn, is impeding the growth and recovery of economy (Campello et al. 2010; Occhino 2010).

![Figure 4: Proportion of Debt Components to Equity](chart)

Prior studies investigate how managerial ownership affects the investment-cash flow sensitivity, and find that the alignment of interests between owners and managers alleviate the sensitivity of investment to cash flow in both under-investor and over-investor firms (Hadlock 1998; Pindado and Torre 2009). However, we find no study examining whether the investment problems vary with the interaction

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\(^3\) In Figure 4, TL\(_{OE1}\) refers to the mean ratio of total liabilities to total owners’ equity for all industries. LL\(_{OE1}\) refers to the mean ratio of long-term liabilities to total owners’ equity for all industries. CL\(_{OE1}\) refers to the mean ratio of current liabilities to total owners’ equity for all industries. TL\(_{OE\_ESO}\) refers to the mean ratio of total liabilities to total owners’ equity for firms heavily relying on ESOs. LL\(_{OE\_ESO}\) refers to the mean ratio of long-term liabilities to total owners’ equity for firms heavily relying on ESOs. CL\(_{OE\_ESO}\) refers to the mean ratio of current liabilities to total owners’ equity for firms heavily relying on ESOs.
between different levels of managerial ownership and the ESOs. Accordingly, we aim to shed light on this issue and argue that ESOs also play a crucial role in overinvestment and underinvestment problems. In addition, we investigate the effect of the SFAS 123 (R) on the sensitivity of investment to cash flow after controlling for possible effects caused by Sarbanes-Oxley Act of 2002 (SOX), and to what extent the effect could be. Specifically, we attempt to understand whether the issuance of the SFAS 123 (R) mitigates corporate overinvestment problem but deteriorates corporate underinvestment problem.

The findings show, first of all, that executives’ stock option compensation packages enhance the sensitivity of investment to cash flow preceding the SFAS 123 (R), but the issuance of the SFAS 123 (R) reduces the sensitivity of corporate investment to cash flow. In addition, for over-investor firms with higher level of ESOs grants under the SFAS 123 (R), the sensitivity of investment to cash flow is lower when there is a managerial entrenchment as compared to that under interest alignment, which suggests either an improvement of entrenched firms’ over-investment problem or a futile function of ESOs due to accounting standard change. When further dividing the sample into entrenchment subsample and alignment subsample under over-investment scenario and under-investment scenario, we find that the positive effect of ESOs grants on the sensitivity of investment to cash flow for firms facing over-investment problem disappears after the issuance of the SFAS 123 (R). Similar shift in the effects of ESOs grants on the sensitivity of investment to cash flow due to the accounting standard change also exists in the interest aligned firms under the under-investment scenario, which implies that expensing stock options, ceteris paribus, raises managers’ tendency to reject positive NPV projects when they are facing under-investment problems.

We expect to contribute literatures in several ways. First of all, we find no study explore whether over- and under- investment problems vary with the interaction between different levels of managerial ownership and the ESOs. Secondly, to our knowledge, there is no extant study examining the relation between the issuance SFAS 123 (R) and managers’ inefficient investments. Finally, we expect the findings to be conducive to re-examining possible economic consequence caused by SFAS 123 (R).

The next section provides literature review. Section 3 describes hypotheses development and research design. Section 4 discusses our empirical design and data. Section 5 provides our empirical results. Section 6 provides our conclusion.
II. Literature Review

Accounting for ESOs and Its Historical Controversy

Accounting for executives stock options was governed by Accounting Principles Board (APB) Opinion 25 prior to 1995, which required firms to measure stock options based on the intrinsic value method, whereby compensation expense was determined as the excess of the stock price at the measurement date over the option exercise price. Intrinsic value method possesses many drawbacks. For example, it fails to involve the possibility that future share price would exceed the exercise price. Furthermore, little compensation expense was recognized because most of the stock options had exercise prices nearly equal to current market prices.

To reflect the reality of stock-option value, FASB issued SFAS 123 in 1995 and proposed an alternative approach called fair value method which required entities to estimate the fair value of stock option value based upon using Black-Scholes or Lattice option-pricing models and to recognize total compensation expense based upon the fair value of the options expected to vest on the grant date. No adjustments would be made after the grant date in response to subsequent changes in the stock price. However, SFAS 123 did not require but encouraged companies to employ the fair value method due to massive opposition by industries making significant use of stock options, particularly in the high-technology sector (Schroeder and Schauer 2008). They argued that expensing stock options would make disastrous impact on their income statement and would impair the stock price.

The climate changed around 2001 and 2002 as the occurrence of financial scandals of big companies such as Enron and WorldCom. In response to a growing vocal of improving financial reporting quality, FASB released the SFAS 123 (R) in December 2004 and required companies to recognize stock-based compensation in their income statements starting in 2006. This requirement is also consistent with the requirement by International Financial Reporting Standards (IFRS) 2 issued by the International Accounting Standard Board (IASB) in February 2004.

From the accounting perspectives, the main debate on the SFAS 123(R) is whether compensation expense should be recognized for stock options and the periods over which it is allocated (Apostolou and Crumbley 2005). Fair value method under SFAS 123 (R) require public held companies to determine total compensation expense based on the fair value of the options expected to vest the date they grant the options to the employees by using an option-pricing model with some adjustment for the unique factors of employee share options, and no adjustment is needed after the grant date. The compensation cost is then allocated during the vesting or service period. Adjustment journal entries of debiting
compensation expense and crediting share premium-share options are made over the
vesting period. If the executives exercise all of the stock options, the company
records a journal entry of debiting “cash” and “share premium-share options” and
crediting “share capital” and corresponding “share premium” at the date of exercise.
If the executives fail to exercise the stock options prior to expiry, the company
transfers the balance in the “share premium-share options” account to a more
properly titled “share premium” at the date of expiration. Accordingly, fair value
method substantially reduces the firms’ current net income during the vesting period
comparing to the intrinsic value method which requires firms to recognize the
difference between the market price of the shares and the exercise price of the
options at the grant date as compensation expense. Furthermore, transferring the
equivalent amount of unexercised compensation cost into share premium account at
the date of expiration makes companies burden “irrecoverable losses” that can not
be recouped and redistributed to shareholders and employees. Consequently, SFAS
123 (R) appears, to some extent, to create an unfair game that benefits executives at
the expense of shareholders and lower-level employees.

Alignment, Entrenchment, and ESOs

Executive Stock Options (ESOs) are designed for reducing agency problems
and aligning managers’ interest with those of shareholders (Jensen and Meckling
1976; Murphy 1985; Gaver and Gaver 1995). Although stock options comprise the
fastest growing component of top management compensation, there is no consensus
on the relation between employee stock option compensation and future firm
performance (Yermack 1995; Hanlon et al. 2003). Two competing perspectives,
incentive alignment and rent extraction, address this controversial issue. The
incentive alignment perspective argues that because stock option contracts can align
executives’ incentives with shareholders’, granting stock options can reduce the
moral hazard problem between the principal and the agent (Himmelberg et al., 1999;
Core and Guay, 1999; Rajgopal and Shevlin, 2002). By contrast, the rent extraction
perspective argues that granting stock options to executives an inefficient way to
courage them to stand with their shareholders because self-interest executives may
control the pay-setting process and compensate themselves in excess of the level
optimal for shareholder (Yermack 1995; Yermack, 1997; Hall and Murphy, 2002;
Hanlon et al. 2003).

Nevertheless, prior studies investigating the sensitivity of investment to cash
flow find discordant results that support merely one of the two alternative
perspectives, and such inconsistency can be attributed to firms’ specific
characteristics and the industry they stay in (Smith Jr. and Watts 1992; Lang et al.
Overinvestment, Underinvestment, and SFAS 123 (R)

One potential advantage of stock option compensation packages is that granting ESOs is nearly cashless, but this benefit must be weighed against the compensating differential demanded by option-holding employees (Hall and Murphy 2003). Companies pay ESOs to attract, retain, and motivate its risk-averse and undiversified employees in an anticipation of highly variable payouts in the future (Hall and Murphy 2002). Nevertheless, extant studies provide mixed results on the relation between stock options compensation and cash conservation. Core and Guay (2001) investigate firms granting non-executive stock options and find a positive relation between the use of employee options and the financial constraints. However, in their study with a sample of firms granting executive stock options, Lam and Chng (2006) yield insignificant findings. Ittner et al. (2003) contend that new economy firms with greater cash flows use options more extensively. In addition, option-intensive companies with cash compensation above competitive levels such as Microsoft also use their excess cash to repurchase shares for reducing the dilution caused by large option grants (Hall and Murphy 2003).

Cashless ESOs compensation packages may lead to inefficient investment decisions, which means that not all projects with a positive net present value will be undertaken, and some projects with a negative net present value will be accepted (Krishnaswami et al. 1999; Morgado and Pindado 2003; Zhang 2009). In an environment of information asymmetry, managers endowed with free cash flow have incentive to invest it in projects with negative net present value rather than distribute it to shareholders due to the pecuniary and non-pecuniary benefits related to the dimension of the company, and such misalignment of the interest between managers and shareholders results in managers’ overinvestment decisions (Jensen 1986; Opler et al. 1999).

SFAS 123 (R) may impose disincentives on investment decisions. Ex post settling up problem arises when managers are paid for expected future cash flows that do not materialize. If the managers receive bonuses for signing long-term performance contracts but the contract is canceled later, the shareholders incur costs recouping the bonus paid for expected cash flows that vanish (Watts, 2003a; Barclay et al., 2005). Leone et al. (2005) contend that stock option compensation possesses lower ex post settling up costs than cash compensation. They argue that while the ex post settling up problem also exists in other types of management compensation, it is more severe when payments are made in cash. Given that managers are given stock options today for anticipated but unrealized future gains but these stock options
generally restrict managers as to when they can convert the options into cash. If the unrealized gain evaporates before the claim vests, the equity claim’s price reflects such information and there is no *ex post* settling up problem for the shareholders. Their findings also show that cash compensation is less sensitive to positive stock returns than negative stock returns, which is consistent with boards of directors exercising discretion to reduce costly *ex post* settling up in cash compensation paid to CEOs.

However, as described previously, SFAS 123 (R) remarkably reduced companies’ willingness of rewarding stock options and pushed them to utilize more cash compensation packages. Prior studies evidence a negative association between ESOs compensation and corporate leverage (Ryan Jr. and Wiggins III 2001; Duru et al. 2005). According to Pecking Order Theory, companies have financing behavior of prioritizing their sources of financing based on the principle of least effort, hence they prefer relying on internal sources of funds, and prefer debt to equity if external financing is required (Myers and Majluf 1984). If the theory applies, it appears that SFAS 123 (R) is inducing the likelihood of assets substitution, moral hazard, adverse selection between shareholders and lenders because debt overhang can further depress corporate spending and investment, and even leads to underinvestment (Hennessy 2004; Nini et al. 2009; Occhino 2010).

We go further on this matter and investigate the role of SFAS 123 (R) in the sensitivity of investment to cash flow suffered by the firm. The next section introduces our hypotheses and research design.

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4Please reference Jensen and Meckling (1976); Myers (1977); Leland and Pyle 1977); Stiglitz and Weiss (1981); Myers and Majluf (1984)
III. Hypothesis Development and Research Design

Hypothesis Development

We propose several hypotheses to explore the issue. Following Yermack (1995), we assume that CEOs choose personal stock ownership positions exogenously, without regard to their firms’ compensation policies. If CEO stock ownership represents an endogenous outcome of the contracting process, it may be difficult to detect the following hypotheses.

First, we address the effect of ESOs on the sensitivity of investment to cash flow. In spite of mentioned shortcomings, stock-based compensation mainly contribute to the agency problems between shareholders and managers through encouraging risk-averse managers to be risk-taking and offering latitude to companies in saving additional free cash flow. Yermack (1995) finds that corporations facing internal liquidity problems shift the mix of executive pay away from cash salaries and bonuses and toward stock options. Cohen et al. (2000) contend that executive stock options provide managers with incentives to take actions that increase firm risk since options increase in value with the volatility of the underlying stock. In their study, Malmendier and Tate (2005b) investigate the relation between CEO overconfidence and corporate investment with a sample of S&P 500 companies between 1980 and 1994 and find that investment of overconfident CEOs is significantly more responsive to cash flow, particularly in equity-dependent firms. These studies evidence a functional mechanism of ESOs in encouraging risk-averse managers’ decision making preceding the SFAS 123 (R).

Nevertheless, such a wonderful function appears to vanish under the SFAS 123 (R). Non share-based compensation packages such as cash bonus provide more “options” while ESOs compensation packages do not. Undiversified managers receiving cash bonus can immediately diversify their portfolio, but those who receive stock options of their company can not enjoy the fruits and have to wait for three to five years until the end of the vesting period. Therefore, there is no reason for firms to employ stock option compensation schemes in lieu of cash bonus unless relatively favorable inducements being offered by stock options. Currently, cashless ESOs is not cheap at all for firms to attract, retain, and motivate their excellent executives for long term performance. Hence, the SFAS 123 (R) is quenching the function of ESOs.

Furthermore, expensing stock options based on Black-Shole model or lattice model under the SFAS 123 (R) might cause counter effect. In their study with a sample preceding the SFAS 123 (R), DeFusco et al. (1990) find that stock return volatility, variability of accounting return on assets, and implicit share price
variances computed from the Black-Scholes option pricing model increase after the approval of an executive stock option plan, and argue that executives with stock option grants undertake more risky investment opportunities. However, SFAS 123 (R) significantly increased unavoidable compensation expense bound with stock volatility. One determinant involved in these models is stock volatility. Higher stock volatility generates higher stock option value, and hence higher compensation cost which is required to be amortized over the vesting period and is disallowed to be indemnified as other gains in their income statement if the stock option contracts are expired without exercise or forfeited. Accordingly, managers granted with ESOs after the implementation of SFAS 123 (R) is expected to be more prudent in making investment decisions due to the direct impact of stock volatility on the income statement under the SFAS 123 (R). Building on these arguments, we posit that ESOs are positively associated with the sensitivity of investment to cash flow preceding the SFAS 123 (R), and that the effect of ESOs on the sensitivity of investment to cash flow is lower under the SFAS 123 (R). We frame the following hypotheses.

**H1a:** Ceteris paribus, ESOs are positively related to the sensitivity of investment to cash flow.

**H1b:** Ceteris paribus, the effect of ESOs on the sensitivity of investment to cash flow is lower under the SFAS 123 (R).

Secondly, we address managerial ownership and ESOs, and their effects on overinvestment problem and underinvestment problem preceding the issuance of SFAS 123 (R). Managerial ownership has been considered to be an effective internal control mechanism for aligning interests between managers and shareholders (Jensen and Meckling 1976; Cui and Mak 2002; Lafond and Roychowdhury 2008). However, such mechanism is a double-edged sword. Higher managerial ownership enhances firms’ innovation, long-term performance, and value (Jensen, 1986; Francis and Smith, 1995; Holthausen et al., 1995; Palia and Lichtenberg, 1999; Hanson and Song 2000; Davies et al. 2005). Nevertheless, high managerial ownership can also cause managerial entrenchment and impair firms’ value (DeAngelo and DeAngelo, 1985; Stulz, 1988; Shivdasani, 1993). Based on these two countervailing effects of interest alignment and managerial entrenchment, prior studies have found a nonlinear relationship between managerial ownership and firm performance (Mørck et al. 1988; McConnell and Servaes 1990; Short and Keasey 1999; Cui and Mak 2002). For example, Mørck et al. (1988) and their followers find that managerial entrenchment probably occurs the managerial ownership range
between 5% and 25%. They contend that conditions necessary for entrenchment (voting power, control of the board of directors, status as a founder etc.) are significantly correlated with increased managerial ownership beyond 5%, but these conditions are not much different when the ownership exceeds 20%. The interest alignment effect, in contrast, operates throughout the whole range of ownership.

Prior studies investigating how managerial ownership affects the investment-cash flow sensitivity under the non mutually exclusive assumption between under-investment and over-investment find that alignment of interests between owners and managers alleviate the sensitivity of investment to cash flow in both under-investor and over-investor firms (i.e. the sensitivity of investment to cash flow is lower when there is a convergence of interests between owners and managers as compared to that under managerial entrenchment) (Hadlock 1998; Pindado and Torre 2009). However, ESOs compensation packages may play a crucial role in corporate inefficient investments besides managerial ownership. On the one hand, ESOs per se may cause overinvestment problem. Self-interest executives granted with stock options and capable of expropriating rents may pursue personal interests deviating from value maximization, and invest in risky projects (Rajgopal and Shevlin 2002). Therefore, investment efficiency might become a secondary aim. Liu and Mauer (2011) find a positive relation between CEO risk-taking incentives and cash holdings. In an environment of information asymmetry, managers endowed with free cash flow have incentives to invest it in projects with negative net present value rather than distribute it to shareholders, which lead to over-investment decisions. On the other hand, ESOs may contribute to underinvestment problem. For under-investor firms, ESOs can encourage risk-averse managers to align their incentives with the shareholders’, reduce the moral hazard problem, and mitigate the underinvestment problems.

Compared with interest-aligned mangers, entrenched managers granted with considerable ESOs and capable of expropriating rents may make relatively riskier non-optimal investments decisions that are far from value maximization of shareholders’ wealth for pursuing their own best interests. Hence, the effects of ESOs on over- and under-investment problems are expected to be more pronounced for entrenched firms than that for interest-aligned firms preceding the SFAS 123 (R). Accordingly, we argue that ESOs compensation package affects both the over-investor firms and the under-investor firms, and its effect on entrenched managers is more pronounced than that on interest-aligned managers. To clarify our argument, we create two scenarios, over-investment scenario and under-investment scenario, to examine the interaction between ESOs and managerial ownership, and its influence on companies’ non-optimal investments. For over-investor firms with
higher level of ESOs grants, we expect that the sensitivity of investment to cash flow is higher when there is a managerial entrenchment as compared to that under interest alignment. For under-investor firms with higher level of ESOs grants, we expect that the sensitivity of investment to cash flow is higher when there is a managerial entrenchment as compared to that under interest alignment. We frame the following hypotheses.

H2a: Ceteris paribus, for over-investor firms with higher level of ESOs grants, the sensitivity of investment to cash flow is higher when there is a managerial entrenchment as compared to that under interest alignment.

H2b: Ceteris paribus, for under-investor firms with higher level of ESOs grants, the sensitivity of investment to cash flow is higher when there is a managerial entrenchment as compared to that under interest alignment.

Finally, we address the effect of SFAS 123 (R) on over-investment and under-investment. SFAS 123 (R) established a link between stock volatility and unavoidable compensation expense. Such link is expected to influence both the interest-aligned firms and the entrenched firms, but its impact on the entrenched firms is expected to be higher than that on the interest-aligned firms. Entrenched managers receiving ESOs grants might remain enthusiastic over shares, but substantially higher compensation expense caused by higher stock volatility during the vesting period can hugely impair the firm’s accounting performance and even menace their positions. To protect their jobs, entrenched managers might begin not taking risky actions that may get them removed from their positions (Cohen et al. 2000; Johnson and Tian 2000). Likewise, interest-aligned managers pursuing maximization of shareholders’ wealth and receiving ESOs grants might also face the same dilemma, and may also stopping taking risky actions because ESOs under the SFAS 123 (R) fail to serve as interest alignment tool to converge managers’ interest in line with the shareholders’.

SFAS 123 (R) may lead agency problem back to where it started from and cause companies’ tendency toward suboptimal preference of relying more on debts. Companies may benefit because the SFAS 123 (R) successfully divert their over-confident managers’ attention away from stock performance. Meanwhile, the companies may seek other more attractive and less costly non-stock compensation plans which reduce the firms’ cash flow and cause higher level of leverage (Ryan Jr. and Wiggins III 2001; Duru et al. 2005). Furthermore, Zhang (2009) finds that debt and executive stock options act as substitutes in attenuating a firm's free cash flow
problem. In an extreme case of debt overhang, corporate investment decisions would be further restrained by debt holders, which may even lead to corporate under-investment (Hennessy 2004; Nini et al. 2009; Occhino 2010). Accordingly, we argue that the issuance of the SFAS 123 (R) offers insufficient incentives to risk-averse managers of both interest-aligned firms and entrenched firms in their investment decisions.

To explore the argument, again, we create two scenarios, over-investment scenario and under-investment scenario, to examine the interaction between ESOs and managerial ownership, and its influence on companies’ non-optimal investments after the issuance of SFAS 123 (R). For over-investor firms with higher level of ESOs grants, we expect that the sensitivity of investment to cash flow is lower when there is a managerial entrenchment as compared to that under interest alignment. For under-investor firms with higher level of ESOs grants, we expect that the sensitivity of investment to cash flow is lower when there is a managerial entrenchment as compared to that under interest alignment.

We propose the following hypotheses:

H3a: Ceteris paribus, for over-investor firms with higher level of ESOs grants under the SFAS 123 (R), the sensitivity of investment to cash flow is lower when there is a managerial entrenchment as compared to that under interest alignment.

H3b: Ceteris paribus, for under-investor firms with higher level of ESOs grants the SFAS 123 (R), the sensitivity of investment to cash flow is lower when there is a managerial entrenchment as compared to that under interest alignment.

Research Design
We begin the research with a construction of a free cash flow index by extending the model developed by Richardson (2006) in an attempt to identify overinvestment and underinvestment. The concept is that total investment expenditure can be roughly decomposed into two parts, required investment expenditure to maintain assets in place and investment expenditure on new projects. Investment expenditure on new projects can be further split into expected investment expenditure in new projects with positive net present value and abnormal investment. The abnormal component of investment can be negative or positive. Positive (negative) value refers to over (under) investment. The fitted value from equation (1) is the estimate of the expected level of new investment, and the residual term captures the abnormal investment. We then use the residual terms to identify over-investor firms and under-investor firms.

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\text{Inew}_t = \alpha_0 + \alpha_1 \text{Inew}_{t-1} + \alpha_2 \frac{V}{P_{t-1}} + \alpha_3 \text{Leverage}_{t-1} + \alpha_4 \text{Cash}_{t-1} + \alpha_5 \text{Age}_{t-1} + \alpha_6 \text{Size}_{t-1} + \alpha_7 \text{Stoct Return}_{t-1} + \alpha_8 \text{Year}_{t-1} + \epsilon_{\text{Inew}}
\]

where

\text{Inew} = \text{New investment. It is calculated as capital expenditure (CAPEX, item 128) plus research and development expenditure (R&D) (RD, item 46) plus acquisition expenditure (Acquisitions, item 129) less cash receipts from sale of property, plant and equipment, (SalePPE, item 107) less depreciation and amortization (item 125). The variable is scaled by average total assets.}

\text{V/P} = \text{A measure of growth opportunities. It is calculated as the ratio of the value of the firm (VAIP) and market value of equity (item 25*item 199). VAIP is estimated as VAIP = (1- \alpha)BV + \alpha (1+r)X - \alpha rd; where, } \alpha = \frac{\omega}{(1+r-\omega)} \text{ and } r=12\% \text{ and } \omega=0.62. \text{ } \omega \text{ is the abnormal earnings persistence parameter from the Ohlson (1995) framework, BV is the book value of common equity (item 60), d is annual dividends (item 21) and X is operating income after depreciation (item 178).}

\text{Cash} = \text{The balance of cash and short term investments (item 1) deflated by total assets measured at the start of the year.}

\text{Age} = \text{The log of the number of years the firm has been listed on CRSP as of the beginning of the year.}

\text{Size} = \text{The log of total assets (item 6) measured at the beginning of the year.}
$Leverage = \text{The sum of the book value of short-term (item 34) and long-term debt (item 9) deflated by the sum of the book value of total debt and the book value of equity (item 60).}$

$StockReturns = \text{Annualized stock returns for the year prior to the investment year.}$

$Year = \text{A vector of indicator variables to capture annual fixed effects.}$

$Iindustry = \text{A vector of indicator variables to capture industry fixed effects based on Fama and French (1997).}$

We then develop equation (2) based on the investment-cash flow sensitivity model (Fazzari et al. 1988; Rauh 2006). We involve non-linearity of ownership structure with respect to firm value. Two-stage least squares method (2SLS) is used to avoid unobservable heterogeneity and endogeneity by using instruments. To clarify non-optimal investment-cash flow sensitivity, we employ the predicted value of new investment obtained from equation (1) as the dependent variable in equation (2). Mork (1988) and his followers document that managerial entrenchment rather than incentive alignment occurs when manager owns between 5% and 25% of the firm’s shares. In according with their findings, we create an indicator variable of the entrenched managerial ownership ($ENTRENCH$) that takes the value of 1 if the managerial ownership is located between 5% and 25%, and 0 otherwise. The variable, $ESO$, refers to an indicator variable coded 1 if firm $i$ grant ESOs at year $t$, and 0 otherwise. To investigate the effect the issuance of SFAS 123 (R), we create an indicator variable equals 1 if the years belong to post SFAS 123(R) years; 0 otherwise.

We also include several control variables in equation (2). Tobin’s q ($Q$) is included in the model to control for investment opportunities. Natural logarithm of the firm’s total assets is included to control for firm size ($lnTA$). We consider the effect of corporate governance in the model by including the governance index ($G_{Index}$) provided by Institutional Shareholder Services (ISS), which is based on twenty four governance provisions and is used by prior literatures, as proxy for corporate governance ratings (Doidge, et al. 2007; Bhagat and Bolton. 2008; Bebchuk, et al. 2009). $G_{Index}$, developed by Gompers et al. (2003) and proxies for the level of shareholder rights, has a possible range from 1 to 24. Higher $G_{index}$ means lower shareholders rights and implies poor corporate governance. In contrast, lower $G_{index}$ means higher shareholders rights and implies better corporate governance. The variable, $GI$, represents reciprocal of $G_{Index}$. Accordingly, higher (lower) $GI$ means better (poor) corporate governance.

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$dt$ refers to time-specific effect in equation (2). $\eta$ refers to firm-specific effect in equation (2). $\varepsilon$ refers to random disturbance in equation (2).
We include additional control variables that have been shown in prior studies to be determinants of investment decisions, which include leverage (LEV), managers’ salaries and cash bonus (SALBON) (Baber et al. 1996; Bates 2005). We include the natural logarithm of Gross Domestic Production (GDP) to control for possible effect caused by business cycle. Other unreported control variables are also included in the model. We include the types of audit opinion to control for the effect by outside governance mechanism. We create unreported indicator variables to control for industry effects based on Fama and French (1997). We also include other unreported instrument variables including audit opinion, fiscal year, and an indicator variable with respect to financial crisis which takes the value of 1 if the years lie in 2000 or in 2008.

\[
INV_{it} = \beta_0 + \beta_1 CF_{it} + \beta_2 CF_{it} \times ESO + \beta_3 CF_{it} \times ENTRENCH + \beta_4 CF_{it} \times ESO \times ENTRENCH + \beta_5 CF_{it} \times SFAS123R + \beta_6 CF_{it} \times SFAS123R \times ESO + \beta_7 CF_{it} \times SFAS123R \times ENTRENCH + \beta_8 CF_{it} \times ESO \times SFAS123R \times ENTRENCH + \beta_9 Q_i + \beta_{10} lnTA_{it} + \beta_{11} GI_{it} + \beta_{12} LEV_{it} + \beta_{13} SALBON_{it} + \beta_{14} GDP_{it} + \delta_i + \eta_i + \epsilon
\]

(2)

where

- \(INV_{it}\): Investment for firm \(i\) at year \(t\). It is the predicted value of new investment obtained from equation (1).
- \(CF_{it}\): Cash flow. It is calculated as net income added back depreciation and amortization plus research and development expenditure (RD, item 46), and then is scaled by average total assets.
- \(ENTRENCH\): Entrenchment. An indicator variable coded 1 if the managerial ownership is located between 5% and 25%, and 0 otherwise. The percentage of managerial ownership is calculated as executive’s share holdings (ExecuComp item: SHROWN_EXCL_OPTS) divided by the company’s shares outstanding (Compustat item #25).
- \(ESO_{it}\): An indicator variable coded 1 if firm \(i\) grant ESOs at year \(t\); 0 otherwise.
- \(SFAS123R\): An indicator variable coded 1 if the years belong to post SFAS 123(R) years; 0 otherwise.
- \(Q_i\): Tobin’s q for firm \(i\) at year \(t\). It is calculated as the sum of market value of equity and book value of total liabilities divided by the firm’s total assets at the end of the year.
- \(lnTA_{it}\): The natural logarithm of the total assets at the end of year \(t\).
- \(GI_{it}\): Reciprocal of G_Index. Higher (lower) \(GI\) means better (poor) corporate governance.
- \(LEV_{it}\): The sum of the book value of short-term (item 34) and long-term debt.

6 The classification of the types of audit opinions is based on Compustat classification system. Unqualified opinion is coded 1. Qualified opinion is coded 2. Going concern opinion is coded 3. Unqualified with Additional Language is coded 4. Averse opinion is coded 5.
(item 9) deflated by the sum of the book value of total debt and the book value of equity (item 60).

\[ SALBON_{it} = \text{Executives’ salaries and cash bonus scaled by their total compensation.} \]
\[ GDP_i = \text{Natural logarithm of Gross Domestic Production} \]
\[ d_i = \text{Indicator variables to control time-specific effect} \]
\[ \eta_i = \text{Variables to control to firm-specific effect} \]

To explore the research issue, we then perform equation (2) for over-investor firms and under-investor firms identified by equation (1), respectively. Sargan test is used to check for over-identifying restrictions the absence of the over-identifying restriction test makes it extremely difficult to assess the validity of instrument variable application (Larcker and Rusticus 2010). The following sections report our empirical findings.
IV. Sample Selection

The preliminary sample contains all financial data from *S&P Compustat database* and stock prices from Center for Research in Security Price (*CRSP*), and executive compensation data from *ExecuComp* database over the period from 1992 to 2010. The reason for the sample period starting in 1992 lies in that *ExecuComp* offers compensation data since 1992. Corporate governance data is obtained from *Institutional Shareholder Services* (ISS). We exclude financial service industry (SIC codes between 6000 and 6999) because the demarcation between operating, investing, and financing activities is ambiguous for these firms (Richardson 2006; Pindado and Torre 2009). We remove observations with missing value necessary to construct the regression variables, and firms without at least six consecutive years.

We remove observations with the percentage of managerial ownership above 100%, and delete the observations with the percentage of Black-Shole value of the stock option granted to total compensation above 100%. We assume the G_index in the current year to be the same as that in last year if we observe missing G_index. We manually collect the data if we observe missing values of the firm’s age. We remove top and bottom one percentile of total investment, market value, cash flow, Tubin’s q, managerial ownership, and total assets for ensuring that any evidence supporting our predictions is not driven by outliers and changes to the composition of the sample over time.

The initial sample includes 104,710 firm-years with valid data during the period from 1992 to 2010 from the *Compustat* database, *ExecuComp*, *ISS*, and *CRSP* corresponding to 10,559 firms. Removing observations with missing value, without six consecutive years, and top and bottom one percentile of observations yields a final sample of 14,174 observations corresponding to 1,574 distinct firms.
V. Empirical Results

Figure 5, Figure 6, Figure 7, and Figure 8 exhibit a comparison of size-adjusted stock option value granted to executives, dividend payout ratios, annualized monthly stock return volatility, and standard deviation of size-adjusted annualized monthly excess return between the entrenched sample firms and the interest aligned sample firms over the sample period, respectively. Figure 5 shows a declining trend of rewarding ESOs after year 2000 for both of the entrenched firms and the interest aligned firms, and the level of stock option grants for the entrenched firms are on average higher than that of the interest aligned firms over the sample period. Figure 6 shows that the level of dividend payout ratios for the entrenched firms is on average lower relatively than that for the interest aligned firms over the sample period, which is consistent the argument of literature that because executive stock options are generally not dividend-protected, the addition of a stock option to a manager's compensation package provides an incentive for the executive to reduce corporate dividends (Lambert et al. 1989). We observe in both Figure 7 and Figure 8 that entrench firms on average posses relatively more volatile stock returns and excess returns than interest aligned firms. In addition, it turns out that the descending ESOs grants shown in Figure 5 appear not to reduce the raw return volatility and the standard deviation of market-adjusted excess returns for both entrenched firms and interest aligned firms. When we take a closer look at the period after 2006, we observe a downward volatility after the issuance of SFAS 123 (R). Overall, these figures provide us some insights into the sample firms’ stock option compensation packages, dividend policy, and stock return volatility.
**Descriptive Statistics**

Table 1 summarizes descriptive statistics of scaled main variables. The results in Panel A Table 1 show that the sample firms on average spend 7.8% of the total assets on capital and R&D expenditures. The median capital and R&D expenditure is 4.7% of the total assets, and is lower than the mean value. Combining the descriptive statistics of $Q_t$, the right-skewed distribution of capital and R&D expenditure may derive from the existence of a few high-growth firms that invest heavily in capital assets and R&D and from a low book value of equity that is often encountered in relatively young firms (Kothari et al. 2002). The mean standard deviation of cash flow is 0.122, and the distribution is right skewed, which suggests that the sample firms’ cash flow vary considerably through time. The mean percentage of Black-Shole value of the stock option granted to total compensation is around 15%, which suggests that ESOs possess substantial portion of executives’ compensation packages. Executives on average own 3% of their firms’ capital, which suggests a separation between ownership and control for the sample firms.

Panel B of Table 1 reports the sample distribution of the managerial ownership and the over (under) investment based upon the criterion described in the research design. There are relatively small numbers of observations (1,755) locating under the managerial entrenchment category. The observations belonging to overinvestment category and underinvestment category are 9,165 and 6,553, respectively, which indicate that there is little evidence of sample clustering.
Table 2 Descriptive Statistics and Sample Distribution in Each Category

Panel A: Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>$INV_{It}$</td>
<td>0.078</td>
<td>0.047</td>
<td>0.118</td>
<td>-1.667</td>
<td>1.772</td>
</tr>
<tr>
<td>$CF_{It}$</td>
<td>0.188</td>
<td>0.174</td>
<td>0.122</td>
<td>-2.020</td>
<td>1.306</td>
</tr>
<tr>
<td>$Q_{It}$</td>
<td>2.039</td>
<td>1.575</td>
<td>1.679</td>
<td>0.364</td>
<td>46.10</td>
</tr>
<tr>
<td>$lnTA_{It}$</td>
<td>6.918</td>
<td>6.791</td>
<td>1.528</td>
<td>4.617</td>
<td>12.269</td>
</tr>
<tr>
<td>$BSvalue/Compensation$</td>
<td>0.150</td>
<td>0.130</td>
<td>0.135</td>
<td>-0.035</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Panel B: Sample Distribution in Each Category

<table>
<thead>
<tr>
<th>Managerial Ownership (MO)</th>
<th>MO &lt; 5%</th>
<th>5% ≤ MO ≤ 25%</th>
<th>MO &gt; 25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>13,577</td>
<td>1,755</td>
<td>386</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INVESTMENT</th>
<th>Overinvestment</th>
<th>Underinvestment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>9,165</td>
<td>6,553</td>
</tr>
</tbody>
</table>

The sample contains 14,174 firm years on the Compustat, ExecuComp, ISS, and CRSP from 1992–2010. $INV_{It}$ refers to investment for firm $i$ at year $t$. It is the predicted value of new investment obtained from equation (1). $CF_{It}$ refers to Cash flow. It is calculated as net income added back depreciation and amortization plus research and development expenditure (RD, item 46), and then is scaled by market value at year $t-1$. $lnTA_{it}$ refers to natural logarithm of the total assets at the end of year $t$. $FCF_{It}$ refers to free cash flow scaled by average total assets. $Q_{it}$ refers to Tobin’s q for firm $i$ at year $t$. It is calculated as the sum of market value of equity and book value of total liabilities divided by the firm’s total assets at the end of the year. $BSvalue/Compensation$ refers to Black-Shole value of the stock option granted (ExecuComp item: BLKSHVAL) scaled by executives’ total compensation. Managerial Ownership refers to the percentage of managerial ownership.
**Regression Results**

Table 3 reports the regression results over the sample period. The regression results of full sample exhibit a crucial role of ESOs in the sensitivity of investment to cash flow. The estimated coefficient ($\alpha$2) measures the association between ESOs and the sensitivity of investment to cash flow preceding the issuance of SFAS 123 (R). Likewise, the sum of the coefficients ($\alpha_3 + \alpha_4$) measures the association between ESOs and the sensitivity of investment to cash flow after the issuance of SFAS 123 (R). The positive coefficient on the interaction term $CF \times ESO$ (0.088) suggests that ESOs enhance the sensitivity of investment to cash flow preceding the SFAS 123 (R). In terms of the interaction term $CF \times SFAS123R \times ESO$, we find that the estimated coefficient is significantly negative (-0.066; $p<0.01$). The overall effect of ESOs under the SFAS 123 (R) on the sensitivity of investment to cash flow is -0.222 ($p<0.01$) ($\alpha_3 + \alpha_4$), which represents that the sensitivity of investment to cash flow for the firms rewarding ESOs is lower than that for the non-ESOs firms under the SFAS 123 (R). Consistent with literatures, the results of $Q$ and $LEV$ show that corporate investment is associated with firms with higher growth opportunities or higher leverage (Hennessy 2004; Nini et al. 2009; Occhino 2010). Overall, the findings in Table 3 provide consistent support for Hypothesis H1.

It is likely that these results are caused by decreasing usage of ESOs compensation packages. To mitigate the concern, we divide the sample into Option Grants-increasing subsample and Option Grants-decreasing subsample, and perform regression analysis based on each subsample. If the findings of the full sample are not caused by diminishing usage of ESOs compensation packages, we expect to observe identical evidence from the findings of both subsamples. Consistent with our prediction, the regression results of Option Grants-increasing subsample and Option Grants-decreasing subsample are consistent with that of the full sample, which clarify possible qualms about the effect by decreasing usage of ESOs grants.
## Table 3 Regression Results Over the Full Sample Period

<table>
<thead>
<tr>
<th>(Coefficient Number) Variable</th>
<th>Full Sample</th>
<th>Option Grants-Increasing Sample</th>
<th>Option Grants-Decreasing Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>P-Value</td>
<td>Coef.</td>
</tr>
<tr>
<td>Interception</td>
<td>3.702</td>
<td>0.48</td>
<td>3.950</td>
</tr>
<tr>
<td>(a1) CF</td>
<td>0.150***</td>
<td>&lt;0.01</td>
<td>0.185***</td>
</tr>
<tr>
<td>(a2) CF×ESO</td>
<td>0.088***</td>
<td>&lt;0.01</td>
<td>0.085***</td>
</tr>
<tr>
<td>(a3) CF×SFAS123R</td>
<td>-0.120***</td>
<td>&lt;0.01</td>
<td>-0.137***</td>
</tr>
<tr>
<td>(a4) CF×SFAS123R×ESO</td>
<td>-0.118***</td>
<td>&lt;0.01</td>
<td>-0.133***</td>
</tr>
<tr>
<td>(a5) Q</td>
<td>0.006***</td>
<td>&lt;0.01</td>
<td>0.004</td>
</tr>
<tr>
<td>(a6) lnTA</td>
<td>-0.001</td>
<td>0.17</td>
<td>0.000</td>
</tr>
<tr>
<td>(a7) GI</td>
<td>0.007</td>
<td>0.75</td>
<td>-0.011</td>
</tr>
<tr>
<td>(a8) LEV</td>
<td>0.016***</td>
<td>&lt;0.01</td>
<td>0.015</td>
</tr>
<tr>
<td>(a9) SALBON</td>
<td>0.000</td>
<td>0.55</td>
<td>0.000</td>
</tr>
<tr>
<td>(a10) GDP</td>
<td>-0.421</td>
<td>0.49</td>
<td>-0.448</td>
</tr>
<tr>
<td>Sargan test for over-identifying restrictions</td>
<td>0.16</td>
<td>&lt;0.01</td>
<td>0.42</td>
</tr>
<tr>
<td>Hausman (1978) simultaneity test P-value</td>
<td>10.4%</td>
<td>10.5%</td>
<td>10.5%</td>
</tr>
</tbody>
</table>

* *, **, *** refers to significant at 10%, 5%, and 1% levels, respectively. The sample contains 14,174 firm years on the Compustat, ExecuComp, ISS, and CRSP from 1992-2010. Invit refers to investment for firm i at year t. It is the predicted value of new investment obtained from equation (1). CFit refers to Cash flow. It is calculated as net income added back depreciation and amortization plus research and development expenditure (RD, item 46), and then is scaled by market value at year t-1. ESOs refers to an indicator variable coded 1 if firm i grant ESOs at year t; 0 otherwise. SFAS123R refers to an indicator variable coded 1 if the years belong to post SFAS 123(R) years; 0 otherwise. Qit refers to Tobin’s q for firm i at year t. It is calculated as the sum of market value of equity and book value of total liabilities divided by the firm’s total assets at the end of the year. lnTAit refers to natural logarithm of the total assets at the end of year t. GI refers to reciprocal of G_index. Higher (lower) GI means better (poor) corporate governance. LEVit refers to the sum of the book value of short-term (item 34) and long-term debt (item 9) deflated by the sum of the book value of total debt and the book value of equity (item 60). SALBONit refers to executives’ salaries and cash bonus scaled by their total compensation. GDPit refers to natural logarithm of Gross Domestic Production.
Table 4 reports the regression results for over-investor firms and under-investor firms over the sample period, respectively. The sum of the coefficients \((a_2 + a_3 + a_4)\) measures the effect of the interaction of ESOs and managerial ownership on the sensitivity of investment to cash flow preceding the issuance of SFAS 123 (R). Similarly, the sum of the coefficients \((a_5 + a_6 + a_7)\) measures the effect of the interaction of ESOs and managerial ownership on the sensitivity of investment to cash flow after the issuance of SFAS 123 (R).

We firstly shed light on the regression results for the over-investor firms. The coefficient on the interaction term \(CF \times SFAS123R \times ESO \times ENTRENCH\) is -0.170 and is statistically significant. In addition, the unreported test shows that coefficient on cash flow when there is managerial entrenchment \((a_5 + a_6 + a_7 = -0.147)\) is significantly smaller than the coefficient under convergence of interests alignment \((a_5 + a_6 = 0.023)\). These findings indicate that when firms are facing over-investment problem, the sensitivity of investment to cash flow caused by ESOs for the entrenched firms than that for the interest aligned firms, which also implies either an improvement of entrenched firms’ over-investment problem or a futile function of ESOs due to accounting standard change. The regression results preceding the issuance of SFAS 123 (R), though statistically insignificant, suggests that the effect of ESOs on the sensitivity of investment to cash flow for the entrenched firms is higher than that for interest aligned firms when these firms both are encountering over-investment problems prior to the SFAS 123 (R).

We then shed light on the regression results for the under-investor firms. The insignificant coefficients on the interaction term \(CF \times ESO \times ENTRENCH\) and \(CF \times SFAS123R \times ESO \times ENTRENCH\) indicate that the interaction of cash flow and ESOs is indifferent between the entrenched firms and interests aligned firms during the pre- and post-SFAS 123 (R) period when these firms both are facing under investment problem. When we pay attention to the main effect, we find that the coefficient on \(CF \times ESO\) and on \(CF \times SFAS123R \times ESO\) are 0.136 and -0.214, respectively, and are statistically significant, which indicate that ESOs help enhance under-investment problem prior to the SFAS 123 (R) but they seem to lose efficacy after the issuance of SFAS 123 (R).
Table 4 Regression Results for Over Investor Firms and Under-Investor Firms

<table>
<thead>
<tr>
<th>(Coef. Number) Variable</th>
<th>Over-investor firms</th>
<th>Under-investor firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>** Intercept **</td>
<td>4.253</td>
<td>-0.168</td>
</tr>
<tr>
<td>(a1) CF</td>
<td>0.074</td>
<td>0.164***</td>
</tr>
<tr>
<td>(a2) CF×ESO</td>
<td>0.069***</td>
<td>0.136***</td>
</tr>
<tr>
<td>(a3) CF×ENTRENCH</td>
<td>0.014</td>
<td>-0.072</td>
</tr>
<tr>
<td>(a4) CF×ESO×ENTRENCH</td>
<td>-0.010</td>
<td>0.094</td>
</tr>
<tr>
<td>(a5) CF×SFAS123R</td>
<td>-0.021</td>
<td>-0.140***</td>
</tr>
<tr>
<td>(a6) CF×SFAS123R×ESO</td>
<td>0.044</td>
<td>-0.214***</td>
</tr>
<tr>
<td>(a7) CF×SFAS123R×ESO×ENTRENCH</td>
<td>-0.170***</td>
<td>0.033</td>
</tr>
<tr>
<td>(a8) Q</td>
<td>0.006***</td>
<td>0.005***</td>
</tr>
<tr>
<td>(a9) lnTA</td>
<td>0.000</td>
<td>-0.002</td>
</tr>
<tr>
<td>(a10) GI</td>
<td>0.001</td>
<td>0.022</td>
</tr>
<tr>
<td>(a11) LEV</td>
<td>0.001</td>
<td>0.019**</td>
</tr>
<tr>
<td>(a12) SALBON</td>
<td>0.000*</td>
<td>0.000</td>
</tr>
<tr>
<td>(a13) GDP</td>
<td>-0.487</td>
<td>0.023</td>
</tr>
<tr>
<td>Hausman (1978) simultaneity test</td>
<td>0.48</td>
<td>0.08</td>
</tr>
<tr>
<td>P-value</td>
<td>7.7%</td>
<td>12.1%</td>
</tr>
</tbody>
</table>

*, **, *** refers to significant at 10%, 5%, and 1% levels, respectively. The sample contains 14,174 firm years on the Compustat, ExecuComp, ISS, and CRSP from 1992–2010. INVit refers to investment for firm i at year t. It is the predicted value of new investment obtained from equation (1). CFit refers to Cash flow. It is calculated as net income added back depreciation and amortization plus research and development expenditure (RD, item 46), and then is scaled by market value at year t-1. ESOs refers to an indicator variable coded 1 if firm i grant ESOs at year t; 0 otherwise. ENTRENCH refers to an indicator variable coded 1 if there is a managerial entrenchment; 0 otherwise. The percentage of managerial ownership is calculated as executive’s share holdings (ExecuComp item: SHROWN_EXCL_OPTS) divided by the company’s shares outstanding (Compustat item #25). SFAS123R refers to an indicator variable coded 1 if the years belong to post SFAS 123(R) years; 0 otherwise. Qit refers to Tobin’s q for firm i at year t. It is calculated as the sum of market value of equity and book value of total liabilities divided by the firm’s total assets at the end of the year. lnTAit refers to natural logarithm of the total assets at the end of year t. Giit refers to reciprocal of GI Index. Higher (lower) GI means better (poor) corporate governance. LEVit refers to the sum of the book value of short-term (item 34) and long-term debt (item 9) deflated by the sum of the book value of total debt and the book value of equity (item 60). SALBONit refers to executives’ salaries and cash bonus scaled by executives’ total compensation. GDPit refers to natural logarithm of Gross Domestic Production.
To further comprehend the effect of ESOs on the sensitivity of investment to cash flow for entrenched firms and interest aligned firms under over-investment scenario and under-investment scenario, we divide the sample into entrenchment subsample and alignment subsample, and separately perform regression analysis under each scenario.

Table 5 reports the regression results for each subsample under each scenario. The results for the interest aligned firms are more pronounced under both over-investment scenario and under-investment scenario. Under the over-investment scenario, the coefficient on the interaction term \( CF \times ESO \) for the interest aligned firms is 0.070 and is statistically significant, which indicates that ESOs grants induce higher sensitivity of investment to cash flow when the interest aligned firms are facing over-investment problem preceding the implementation of SFAS 123 (R). However, the insignificant but negative coefficient on the interaction term \( CF \times SFAS123R \times ESO \) (-0.011) suggests that ESOs grants become ineffective under the SFAS 123 (R). These findings appear to imply that expensing stock options is a remedy for corporate over-investment.

When focusing on the under-investment scenario, we find that the coefficient on the interaction terms \( CF \times ESO \) is positive for the interest aligned firms (0.138; \( P<0.01 \)), which evidences that ESOs grants are positively associated with the sensitivity of investment to cash flow when the interest aligned firms are facing under-investment problem preceding prior to the SFAS 123 (R). Nevertheless, the negative coefficients on the interactions \( CF \times SFAS123R \times ESO \) for the interest aligned firms (-0.211; \( P<0.01 \)) indicate that the sensitivity of investment to cash flow for the interest aligned firms rewarding ESOs is lower than that without ESOs grants when these firms are facing under-investment problem. Combined with the phenomenon depicted in Figure 7 and 8, such shift suggest that SFAS 123 (R), though does not affect companies’ cash flow, indeed affect managers decision in exercising the option to undertake positive net present value projects that could potentially reduce share value. When managers are facing under-investment problems, the direct impact of expensing stock options on the income statement during the vesting period, ceteris paribus, raises their tendency to reject these positive NPV projects.

Overall, the findings of Table 5 depict a consequence of SFAS 123 (R) imposing disincentives on managers’ investment decisions, and evidence a dysfunctional incentive mechanism due to accounting standard change.
### Table 5 Regression Results for the Sub-Samples

<table>
<thead>
<tr>
<th>(Coeff. Number) Variable</th>
<th>Over-Investment</th>
<th></th>
<th></th>
<th>Under-Investment</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Entrenchment</td>
<td>Alignment</td>
<td>Entrenchment</td>
<td>Alignment</td>
<td>Entrenchment</td>
<td>Alignment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coef.</td>
<td>P-Value</td>
<td>Coef.</td>
<td>P-Value</td>
<td>Coef.</td>
<td>P-Value</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.399</td>
<td>0.55</td>
<td>4.178</td>
<td>0.52</td>
<td>-0.503</td>
<td>0.45</td>
<td>-0.067</td>
</tr>
<tr>
<td>(a1) CF</td>
<td>0.110</td>
<td>0.70</td>
<td>0.057*</td>
<td>0.06</td>
<td>0.694*</td>
<td>0.06</td>
<td>0.167***</td>
</tr>
<tr>
<td>(a2) CF×ESO</td>
<td>0.047</td>
<td>0.86</td>
<td>0.070***</td>
<td>&lt;0.01</td>
<td>-0.413</td>
<td>0.27</td>
<td>0.138***</td>
</tr>
<tr>
<td>(a3) CF×SFAS123R</td>
<td>-0.099</td>
<td>0.74</td>
<td>-0.116**</td>
<td>0.03</td>
<td>-0.834**</td>
<td>0.03</td>
<td>-0.095*</td>
</tr>
<tr>
<td>(a4) CF×SFAS123R×ESO</td>
<td>-0.059</td>
<td>0.84</td>
<td>-0.011</td>
<td>0.82</td>
<td>0.553</td>
<td>0.16</td>
<td>-0.211***</td>
</tr>
<tr>
<td>(a5) Q</td>
<td>0.006**</td>
<td>0.03</td>
<td>0.008***</td>
<td>&lt;0.01</td>
<td>0.011**</td>
<td>0.02</td>
<td>0.004**</td>
</tr>
<tr>
<td>(a6) lnTA</td>
<td>-0.002</td>
<td>0.59</td>
<td>-0.000</td>
<td>0.78</td>
<td>-0.002</td>
<td>0.73</td>
<td>-0.001</td>
</tr>
<tr>
<td>(a7) GI</td>
<td>0.173</td>
<td>0.10</td>
<td>-0.015</td>
<td>0.70</td>
<td>-0.076</td>
<td>0.49</td>
<td>0.039</td>
</tr>
<tr>
<td>(a8) LEV</td>
<td>0.015</td>
<td>0.63</td>
<td>-0.003</td>
<td>0.77</td>
<td>0.043</td>
<td>0.26</td>
<td>0.017*</td>
</tr>
<tr>
<td>(a9) SALBON</td>
<td>0.001</td>
<td>0.16</td>
<td>0.000</td>
<td>0.30</td>
<td>-0.001</td>
<td>0.14</td>
<td>0.000</td>
</tr>
<tr>
<td>(a10) GDP</td>
<td>0.037</td>
<td>0.59</td>
<td>-0.478</td>
<td>0.52</td>
<td>0.051</td>
<td>0.47</td>
<td>0.012</td>
</tr>
</tbody>
</table>

Sargan test for over-identifying restrictions

Hausman (1978) simultaneity test P-value

Adjusted R-Square (%)

9.1%  6.8%  8.2%  12.6%

*, **, *** refers to significant at 10%, 5%, and 1% levels, respectively. The sample contains 14,174 firm years on the Compustat, ExecuComp, ISS, and CRSP from 1992–2010. INVit, the predicted value of investment obtained from equation (1), refers to investment for firm i at year t. CFit refers to Cash flow. ESOs refers to an indicator variable coded 1 if firm i grant ESOs at year t; 0 otherwise. ENTRENCH refers to an indicator variable coded 1 if there is a managerial entrenchment; 0 otherwise. SFAS123R refers to an indicator variable coded 1 if the years belong to post SFAS 123(R) years; 0 otherwise. Qit refers to Tobin’s q for firm i at year t. lnTAit refers to natural logarithm of the total assets at the end of year t. GI refers to reciprocal of G_Index. Higher (lower) GI means better (poor) corporate governance. LEVit refers to the sum of the book value of short-term (item 34) and long-term debt (item 9) deflated by the sum of the book value of total debt and the book value of equity (item 60). SALBONit refers to executives’ salaries and cash bonus scaled by executives’ total compensation. GDPit refers to natural logarithm of Gross Domestic Production.
High-Tech firms and Non-High-Tech firms

We further investigate the impact of SFAS 123 (R) on high-tech sector and other sectors. Following prior studies, we define a high-tech firm as a firm belongs to a member of Pharmaceuticals (two-digit SIC codes 2833–2836), Computers (35), Electronics (36), Communications (48), Programming (7371–7379), or R&D Services (8731–8734), industries (Francis and Schipper 1999; Hanlon et al. 2003). Other firms are group as non-high-tech firms. We then perform regression analysis of equation (2) based on high-tech firms and non-high-tech firms, respectively. In the regression analysis, we remove unreported indicator variables controlling for industry effects based on Fama and French (1997). Table 6 reports the regression results for each subsample. The results in Table 6 suggest that the impact of SFAS 123 (R) on the high-tech firms is similar to that on other sectors.
### Table 6 Regression Results for High-Tech Firms and Non-High-Tech Firms

<table>
<thead>
<tr>
<th>(Coef, Number) Variable</th>
<th>High-Tech Sector</th>
<th>Other Sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>P-Value</td>
</tr>
<tr>
<td><strong>Intercept</strong></td>
<td>6.893</td>
<td>0.47</td>
</tr>
<tr>
<td>(a1) CF</td>
<td>0.162***</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>(a2) CF×ESO</td>
<td>0.066**</td>
<td>0.03</td>
</tr>
<tr>
<td>(a3) CF×SFAS123R</td>
<td>-0.123**</td>
<td>0.03</td>
</tr>
<tr>
<td>(a4) CF×SFAS123R×ESO</td>
<td>-0.105*</td>
<td>0.05</td>
</tr>
<tr>
<td>(a5) Q</td>
<td>0.005***</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>(a6) lnTA</td>
<td>-0.002</td>
<td>0.16</td>
</tr>
<tr>
<td>(a7) GI</td>
<td>0.018</td>
<td>0.64</td>
</tr>
<tr>
<td>(a8) LEV</td>
<td>0.001</td>
<td>0.94</td>
</tr>
<tr>
<td>(a9) SALBON</td>
<td>0.001**</td>
<td>0.02</td>
</tr>
<tr>
<td>(a10) GDP</td>
<td>-0.783</td>
<td>0.47</td>
</tr>
<tr>
<td><strong>Adjusted R-Square (%)</strong></td>
<td>8.9%</td>
<td></td>
</tr>
</tbody>
</table>

* *, **, *** refers to significant at 10%, 5%, and 1% levels, respectively. The sample contains 14,174 firm years on the Compustat, ExecuComp, ISS, and CRSP from 1992–2010. INVi \( \text{t} \) refers to investment for firm \( i \) at year \( t \). It is the predicted value of new investment obtained from equation (1). \( CF_i \) refers to Cash flow. It is calculated as net income added back depreciation and amortization plus research and development expenditure (RD, item 46), and then is scaled by market value at year \( t-1 \). \( ESOs \) refers to an indicator variable coded 1 if firm \( i \) grant ESOs at year \( t \); 0 otherwise. \( SFAS123R \) refers to an indicator variable coded 1 if the years belong to post SFAS 123(R) years; 0 otherwise. \( Q_{it} \) refers to Tobin’s q for firm \( i \) at year \( t \). It is calculated as the sum of market value of equity and book value of total liabilities divided by the firm’s total assets at the end of the year. \( lnTA_{it} \) refers to natural logarithm of the total assets at the end of year \( t \). \( GI_{it} \) refers to reciprocal of G_Index. Higher (lower) GI means better (poor) corporate governance. \( LEV_{it} \) refers to the sum of the book value of short-term (item 34) and long-term debt (item 9) deflated by the sum of the book value of total debt and the book value of equity (item 60). \( SALBON_{it} \) refers to executives’ salaries and cash bonus scaled by executives’ total compensation. \( GDP_{it} \) refers to natural logarithm of Gross Domestic Production.
Robustness Checks

To ensure that our results are not driven by alternative research design choices and variable definitions, we perform several robustness checks.

Results of different percentages of Black-Shole value of the stock option granted to total compensation. We reset the criterion of the percentages of Black-Shole value of the stock option granted to total compensation to 5% and 15%, respectively. The results remain qualitatively similar to the original results.

Results of different intervals of managerial ownership. We re-define the criterion of the entrenched managerial ownership as the interval between 5% and 15% and between 5% and 30%, respectively. The results remain qualitatively similar to the original results.

Zero growth of managerial ownership. We focus on the firms with zero growth of managerial ownership to clarify possible effect by the change of managerial ownership. The results of sample with constant managerial ownership remain qualitatively similar to the main results.
VI. Conclusion and Suggestion

This paper investigates the effect the issuance of the SFAS 123 (R) on corporate over-investment and under-investment problems. We explore this issue by extending the findings of prior studies which contend that the alignment of interests between owners and managers alleviate the sensitivity of investment to cash flow in both under-investor and over-investor firms. We propose three conjectures. First of all, we address the effect of ESOs on the sensitivity of investment to cash flow. Secondly, we address the issues of managerial ownership and ESOs, and their effects on overinvestment problem and underinvestment problem preceding the issuance of SFAS 123 (R). Finally, we address the effect of SFAS 123 (R) on over-investment and under-investment.

The findings support part of the proposed hypotheses. First of all, we find that executives’ stock option compensation packages enhance the sensitivity of investment to cash flow preceding the SFAS 123 (R), but that the issuance of the SFAS 123 (R) reduces the sensitivity of corporate investment to cash flow. In addition, we find that for over-investor firms with higher level of ESOs grants under the SFAS 123 (R), the sensitivity of investment to cash flow is lower when there is a managerial entrenchment as compared to that under interest alignment, which suggests either an improvement of entrenched firms’ over-investment problem or a futile function of ESOs due to accounting standard change. When further dividing the sample into entrenchment subsample and alignment subsample under over-investment scenario and under-investment scenario, we find that the positive effect of ESOs grants on the
sensitivity of investment to cash flow for firms facing over-investment problem disappears after the issuance of the SFAS 123 (R). Similar shift in the effects of ESOs grants on the sensitivity of investment to cash flow due to the accounting standard change also exists in the interest aligned firms under the under-investment scenario, which implies that the direct impact of expensing stock options on the income statement during the vesting period, ceteris paribus, raises managers’ tendency to reject positive NPV projects when they are facing under-investment problems. We also conduct several robustness checks to polish our conclusion, and the results remain qualitatively similar.

There are several caveats in this research. First of all, it is likely that financial tsunamis occurred during the sample period may influence the results even though it is statistically controlled in the model. Secondly, some studies employ various methodologies to extract corporate governance components which may differ from the corporate governance data we obtained from the professional institute, but extracting corporate governance components is beyond the scope of our research. Finally, other non-financial factors that are hardly to be quantified may also affect the sensitivity of investment to cash flow.

Future studies can extend this research and shed light on other stock-based compensation plans such as restrict stock compensation after the issuance of the SFAS 123 (R). In addition, it is interesting to investigate whether the issuance of the SFAS 123 (R) is associated with losing competitive power of the U.S. Furthermore, future research can also explore the association between managers’ investment behavior and risk hedging in the post SFAS 123 (R) era.
REFERENCES


