A Comprehensive Analysis of Employee’s Option Compensation on Firm’s Litigation*†

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Abstract

Are top executives (e.g. CEO and CFO) the only culprits for firm’s fraudulent activities? We find interactions between executives and non-executives employees increase the likelihood of firm’s litigation based on compensations as a proxy for employees’ incentive. This finding implies a collaboration between the two parties; therefore, leaving non-executive employees out when study about the litigation makes the picture incomplete. Moreover, to our knowledge, a sensitivity between a firm’s value and its price change (delta) is the only explanatory variable for litigation in previous research. Concerning the convex ability of option, the sensitivity between firms’ value and its volatility (vega) should be added in the model to explain firm’s litigation likelihood. In contrast to previous literature, we find that it is actually vega that has explanation power, not delta.

*JEL Classification:* G30, G34, J33, K22, M40

*Keywords:* Options; Incentives; Compensation; Fraud
1. Introduction

Previous literature on a corporate fraud focuses on the cause of the fraud from executive employees, such as CEO, with the assumption that executives are the elite group of employees whose decisions dictate the company’s fortune. The most prevalent proxy for the executive incentives are their compensation which directly relates to their wealth. Unlike other compensations, option is more effective in the sense that it helps align the manager and owner incentives to increase firm performance. Therefore, there is a tendency that executives will commit a fraud to increase firm’s value based on their option sensitivities. However, there are many cases that we find non-executive employees are the one who start a fraud. For instance, Volkswagen had an emission scandal in 2015. The ground engineers who took care of the engine software were responsible for the fraud, not a CEO team. JP Morgan Chase London whales is another case of the issue starting from the non-executive employees. Trading desk in London was the starting point for the 2 billion dollar loss of JP Morgan Chase. To name a few, it is important to consider the effect of compensation from rank and file employees on the litigation likelihood of a firm as well. Hence, we close the gap by adding compensations’ sensitivity of non-executive employee in the mix to complete the whole picture of litigation framework. Moreover, to our knowledge, most papers \(^1\) in litigation and compensation area only use the sensitivity between the firm value and option value (delta) as compensation proxy. Motivated by managerial incentive literature \(^2\), we add sensitivity between the firm volatility and option value (vega) as another compensation proxy.

In this paper, we first examine whether non-executive employees have any influence on the likelihood of firms’ litigation. Most papers in the area of compensation and litigation relationship use only Execucomp data which only includes top executives, such as CEO and

\(^{1}\) e.g. Daniel (2006), Peng and Roell (2008)  
\(^{2}\) e.g. Coles, Daniel, and Naveen (2006), Guay (1999), Hochberg and Lindsey (2010), Young et al. (2013)
CFO. Leaving out other employees from the mix implies no influence on fraudulent activities from them. In this case, lower level employees also include managers and senior managers that actually have enough authoritative power to commit a fraud. Our second research question is “How might vega help explain the firms’ litigation prospect?” To our knowledge, all papers in litigation and compensation use only delta as explanatory variable and find significant positive relationship between delta and litigation likelihood.

This topic is of interest not only to researchers, but also to regulators. It is common knowledge that an executive team, such as CEO, COO, and CFO is the only culprit of the firm’s fraudulent may not be true. If lower level employees also take part in a firm’s misrepresentation, regulators should be more concerned in preventing the fraudulent activity by seeking more detail on the non-executive employees.

We use a regression model to find the relationship between the compensation incentive and litigation likelihood. We address the issue of unbalanced data between litigation and non-litigation firms by using propensity score matching on three important variables that impact the litigation likelihood of a firm.

We find that the variable that actually impact the litigation likelihood is not delta but vega. Not including the vega in the mix in previous literature makes the picture incomplete. In other words, it is the change in firms’ volatility not the change in firm’s value on compensation that encourages fraudulent activity. Therefore, it is more important to watch for the period of high volatility of firms’ value but not high sensitivity of compensation based on the change in firm’s value. This vega only appears significant on the executive side in the main regression. However, we find that the interaction terms between vega of non-executive employees and both executive compensation sensitivities (delta and vega) plays an impor-
tant role in increasing likelihood of fraud. This is quite intuitive. From the surface, we can’t detect the fraudulent activity from non-executive employees since it is disguised by the average compensation of all lower-level employees in the firm and the high sensitivity of option compensation per executives. The interaction terms discover the implicit relationship between executives and non-executive employees. Moreover, when we break down firms into high and low growth, the effect of vega on litigation likelihood only appears on high growth firms which is consistent with previous literature.

Section II provides motivation and literature on incentive and agency problem. The hypothesis of the link between compensation and litigation of firms is developed in Section III. In Section IV, we describe our sample and variable constructions. The empirical analysis and results are in Section V. Lastly, we finish with conclusion in Section VI.

2. Discussion of the Prior Literature and Motivation

2.1. Incentive alignment view

Traditional agency theory holds that equity-based are powerful in alleviating agency problems by aligning managers’ interest with that of shareholders. Scholars have done research on how the CEO compensation affects a firm in many aspects, such as performance and ability to take risk (Coles, Daniel, and Naveen (2006)). Some scholars also considered not only CEO compensation but also non-executive compensation as the factors that influence firm’s ability. To be more specific, compensations in this case could be cash compensation, option grants, deferred compensation, Long-Term Incentive Plans (LTIPs), retirement packages, and any other perquisite. Option, among all compensations, has the characteristic that other compensations do not have, which is the convexity of the payoff. In other words, option has potential upside but limited downside. With this characteristic of the option, some literatures showed that executives took excessive risk because they want to hit certain
payoff option values. Some cases, executives even committed fraud. For example, they misrepresent their financial report by inflating revenue or hiding costs in order to increase firm’s performance which, in turn, increase the firm’s stock price.

The traditional view of the managerial incentive literature is that managers are responsive to the increase in proportion of their personal wealth that is related to equity based compensation holdings. Jensen and Meckling (1976) offers an incentive-alignment view that pay-for-performance incentive plans can actually be useful in aligning the managers’ incentive with that of shareholders under an agency theory perspective. Murphy (1999) provides a comprehensive documentation that stock option form of compensation increased largely during 1990s, which is consistent with firm value maximization. This incentive alignment view is supported by subsequent empirical research; J. Core and Guay (1999) show that optimal portfolio of equity-based incentives varies with economic determinants such as firm size, growth opportunity, monitoring costs, etc, in a sense that firms actively set optimal level of incentives in a manner that is consistent with contracting theory. Himmelberg, Hubbard, and Palia (1999) investigate the determinants of managerial ownership and the link between ownership and firm performance on the premise that the owner need to decide how to allocate equity to managers to align incentives for firm’s value maximization. Rajgopal and Shevlin (2002) further extend J. Core and Guay (1999) by examining the relation between exploration risk taking and stock option risk incentives through a simultaneous equations model given stock option incentive is a firm-value-maximizing strategy (other related research include Jensen and Murphy (1990), J. Core and Guay (2002), etc.)

2.2. Equity-based compensation and firms’ misbehavior

Different from the incentive alignment view above, Bebchuk, Fried, and Walker (2002) contend that executives have the power to impact their own pay and so they may use that
power to extract rents, leading to the use of inefficient pay arrangement that offer suboptimal incentives, which in turn negatively affect shareholder value. Similarly, Goldman and Slezak (2006) provide an equilibrium model of incentive contract to show that stock-based compensation can induce managers to misreport and divert firm resources to misrepresent firm performance. First, they analyze how the possibility of earning or firm’s performance manipulation affects the equilibrium level of pay-for-performance sensitivity. Second, based on the Sarbanes-Oxley Act of 2002, what could be the impact of the regulatory change on the firms’ performance and compensation relation. Compared to standard agency models, such as Spence and Zeckhauser (1971) and Ross (1973), in Goldman and Slezak (2006) model, they use inside information by managers while standard models only allow manager to act through the choice of effort. If there is no chance of firm’s performance manipulation, the optimal compensation contract will be weighted between the benefit of effort and cost of proceeding it. Some types of compensation induce managers to exert much higher effort than without the compensations; however, the drawback is the manager tends to inflate the firm’s performance. Other studies regarding stock option incentives as inefficient ways of compensation include Yermack (1995) and Yermack (1997). Both provide evidence that managers use option grants for their own benefit. If managers are aware of the coming improvements of the firm performance, managers may encourage their compensation committees to grant more performance-based pay as reactions to news of the operating improvements. Jensen (2003)) argues that in a budgeting process, the nonlinearity in pay-for-performance may induce the loss of integrity and truthfulness in organizations. Considering the increasing use of equity performance-based incentives and the related academic arguments of its shortcomings, it is natural to relate the financial fraud and manipulation from 1990s to 2000s to these changed incentives.

Bergstresser and Philippon (2006) present evidence that for firms where more stock op-
tion incentives are adopted, the use of discretionary accruals for earnings manipulation is more likely by particularly looking at the use of accruals, which can temporarily alter the reported earnings. Subsequent studies including Burns and Kedia (2006) and Burns and Kedia (2008) also empirically show that the sensitivity of the CEO’s option portfolio to its stock price is positively associated with firm’s misreporting propensity; specifically, they find that executive compensation packages influence the use of aggressive accounting policies. Similarly, Johnson, Ryan, and Tian (2009) add to the literature by showing that managers who commit fraud tend to expect large stock price declines and it will lead to greater losses for managerial equity-based holdings. All these studies jointly show that managerial choices may be affected by incentives structures in a way other than the firm-value-maximization. If executive performance-pay do influence the managerial choices, it is necessary to investigate whether the incentive may lead to price manipulation for the concern that executive pay might be sensitive to short-term performance measures. Gao and Shieves (2002) is to find the variables that affect the extent of earning management by focusing on managerial compensation. They use comprehensive compensation choices. Some papers only use a couple of incentive compensations. Without thoroughly analyzing all the effect of all compensations and interactions between them, the results could be deviate from a true relation. The interesting part of the paper is it addresses various aspects of executive compensation. That is in the scope of contemporary linearity and convexity and incentive-intensity. They found that the earning management intensity has a positive relationship with the following compensations: stock option grants, the overhang of exercisable in-the-money options from prior year’s grants, bonuses, and the incentive intensity of current year stock option awards. However, salaries and restricted stock have a negative association with the earnings management intensity. Efendi, Srivastava, and Swanson (2007) found that CEOs are more likely to misstate financial statements when they hold sizable in-the-money stock options. This could refer to the fact that those CEOs were worrying about their wealth over the firm’s future,
because if a firm gets caught, huge fine could be charged on the firm.

Our research is largely motivated by Denis, Hanouna, and Sarin (2006), which looked at the relations between the option of the executive and the litigation rate of companies. Their results reported a significant positive association between the likelihood of securities fraud allegations and a measure of executive stock option incentives. We have experienced many, especially in the recent years, scandals committed by large companies, such as GM and VW regarding the faulty ignition switches and emission fraud. It is worthwhile to think whether there is a correlation between the option given by the firms and litigation rate of that firm. Denis et al. (2006) found the evidence of the claim as mentioned. However, there is a gap that needs to be closed among the literatures in this area. The question is whether other employees in the firms such as lower level employees have any involvement in the fraudulent process. Along the way, employees are for sure elements of all the decisions. Following Denis et al. (2006), Peng and Röell (2008a) also captured that there is upward manipulation during the litigation class period. Our hypothesis is that it is not only about handful of people that could make a company commit a fraud, it has to be more than that small group of executives involved. Most of the extant literature focus on upper level management such as executives and managers. Thus, our paper will close this gap by also looking at the option for the non-executive employee that it may also influence the litigation rate of a firm. Specifically, we adopt shareholder class action lawsuit filings to proxy the manipulation and fraud. Despite the fact that lawsuit represent just a fraction of litigation a firm may encounter, as Peng and Röell (2008a) highlighted, the lawsuit filing by principle should be an indicator of price manipulation, because security laws provide those who transact at manipulated prices a way of recovering losses. Therefore, our research add to this field of literature by jointly looking at both the executive and non-executive incentives with the consideration that the ignorance of non-executive compensation may overlook mutual monitoring concerns among co-workers.
(Baker, Jensen, and Murry (1988)), because action of each employee may have an impact on wealth of other employees.

3. Hypothesis

3.1. Development of hypotheses

First, regarding the litigation, we are inspired by the fact that not only do the executives have an incentive to increase the stock price or the performance of the firm, rank and file employees also have that incentive. We tied option compensation to the legal dispute of the firm. Our motivation on the aspect of lawsuit of the firm is similar to Denis et al. (2006). Employees are weighing the benefit of higher option value and cost of detection. The value of options held by employees depends on the firm stock price. Firm stock price will be higher or lower depends on the performance of the firms. Literature shows the link of option incentives and performance of the firm, because there are two channels managers can gain through fraudulent behavior (say, material misrepresentation, price manipulation); they may either directly benefit from the compensation associated with the boosted performance, or indirectly benefit from alleviating future career concerns in a sense that the probability of dismissal in the future could be lower (Holmström (1999) and Denis et al. (2006)).

Because option incentive has convexity property, which is when the price of the underlying asset is going up high the payoff of the option is more than 1:1. So, employees have high incentive to manipulate the earning which in turn leads themselves to increase the stock price which is the underlying assets of the employees. However, as discussed earlier regarding managerial incentives, the solution of agency issues, may induce a secondary agency problem because managers tend to inflate the share price for their own benefits. Accounting literature has well documented the link between equity incentives and firm misbehavior, most of which document a positive relation between the two. Burns and Kedia (2006) find that
the propensity of misreporting is positively associated with the option portfolios that are sensitive to the stock price but not the sensitivity of other compensation components, say restricted stock, LTIP, salary bonus, etc. Similarly, Bergstresser and Philippon (2006) focus on the earnings management measured by discretionary accrual, with the finding that periods of high accruals coincide with significant option exercises by incentivized CEOs. Most of the literature documenting the positive relation between the equity based incentives and firm financial manipulation, normally measured by restatement discretionary accrual, or misrepresentation (AAER). Armstrong, Larcker, Ormazabal, and Taylor (2013) is adding to the literature by considering the monetary and nonmonetary risks associated with the financial misreporting, with the finding that portfolio vega unambiguously encourage misreporting. So, we hypothesize that the higher the incentive the more the earning management and consequently the higher likelihood that the firms will be filed a lawsuit.

**H1: Higher option sensitivities results in higher litigation likelihood for both types of employees**

Secondly, we expect to see collaboration to commit fraud between executives and lower-level employees. There are two assumptions behind this hypothesis. First, top-down approach, an executive is the one who starts a fraud, and then order lower-level employees to follow the order. Second, bottom-up approach, the starting point is from lower-level employees and executives agree or support the fraudulent activities. If executives are the only group that perform the fraudulent activities or the only influencer, we should not see any interaction terms significant. However, as I gave some examples in the beginning, there were cases that the fraudulent activities consistent with bottom-up approach. Therefore, we expect to see positive relationship between the compensation interaction between executives and non-executive employees.
H2: The relationship between option sensitivities’ interaction terms of both types of employees and litigation likelihood is positive

Lastly, we would expect that the effect of option incentives on litigation likelihood should be more pronounced in high growth firms, because the upside of the option compensation is higher for these firms. Following J. E. Core and Guay (2001) and Hochberg and Lindsey (2010), we also divide firms into high- and low-growth opportunities to see the effect of option-wealth sensitivities on likelihood of the firm being filed a lawsuit. Hochberg and Lindsey (2010) found that non-executive option incentives are positively associated with firm’s performance only in firms with higher individual growth opportunities. However, we believe that it is very tempting for both types of employees to perform fraudulent activity for high-growth firms. For instance, currently, high technology firms have much higher P/E ratio than other industries. This means investors give much higher future price for the firms in relative to the earnings. The higher the stock price, the higher the option compensation. Moreover, high-growth firms should have higher stock price volatility, which results in high vega. Therefore, we expect that the compensations of both types of employee should have significantly positive association with litigation likelihood.

H3: High growth firms should exhibit stronger relationship between employees’ option sensitivities and litigation prospect

3.2. Firm’s performance on a filing date

[Insert Figure 1 Here]

Another motivation that caught our attention to look at the litigation issue in the first place is the sharp decrease in performance of alleged firms on the filing date. Based on literature on earning management, abnormal profit return should be higher before the filing
date and dropped during the filing date. Figure 1 reports cumulative abnormal returns 200
days before and after the class filing date. Figure 1 (a) and (b) reflect the CAR of the full
sample; Figure 1 (c) and (d) are based on the sample of large firms (which the market-cap is
above the mean), while Figure 1 (e) and (f) from small firm sample. CARs are constructed
from CRSP equally weighted market model, with which the coefficients are estimated from
-101 to -1 days before the class filing date (t=0).

Since the partial goal of the security law is to provide investors who involved in manip-
ulated price transactions a channel to recover losses, the litigation class filing should be an
indicator of manipulation or misbehavior. Throughout Figure 1, from (a) to (f), we consis-
tently observe that there is a decline in CAR around the filing date. However, we can see
the sharp turn after the drop, the CAR increased recovered from the bottom quickly. We
are not sure whether this affect is specific on size of the company. Large firms might behave
differently from small firms. For example, large firms might have a better way to handle the
news and public relations than small firms. So, that strong return of CAR may mostly come
from large firms. So, we categorized all litigation firms into above mean and below the size
mean. Above mean group can be stated as large firm. Below mean group represents small
firms.

We can see that small firms CAR is higher than large firms CAR in general. However,
we can see that large firms have relatively smoother decrease, but small firms have sharp
drop right before the filing date. This indicates that large firms, to some extent, handle the
lawsuit situation better than the small firms.

SCAR is the scaled CAR to give less weight to stocks that have high variance. Some
stocks have high variance and so their CARs are hyped up unstably. We do not want
unstable CAR result so we also use SCAR to check whether the litigation impacts return of companies, which is our concern. If litigation largely impacts firms’ return, it’s valid to investigate more on this issue. We can see that after we gave less weight to the firms that have high variance, for the large firms, CARs did not drop very much but it still dropped. Large firms manage their firms through the litigation period very smoothly after taking into account the firm’s variance. However, for small firms, the same trend as unscaled one still holds. The sharp drop during the filing period indicated that these firms are not good at managing firms through the bad time. Our evidence here support the hypothesis that a high sensitivity of the compensation is more likely leading to firm’s earning manipulation indicated by litigation lawsuits.

4. Sample Collection and Variable Construction

4.1. Dependent variable: litigation data

As mention previously, our dependent variable is whether firms are engaged in litigation. We manually retrieved the litigation data from Stanford Law School, Securities Class Action Clearing house a collaboration with Cornerstone Research. The data is from January 19, 1996 to June 24, 2016 (or around 11 years of data). The total observations are 4,195 and we can see the breakdown of litigation types in Table 1. Classic cases are, for example, material misrepresentations and misstated financial results. These classic cases are more than 80 percent of the total litigation type. We excluded IPO allocation lawsuit since it is not the firm performance related litigation. So, we subtracted out 313 observations that are IPO Allocation related. Then we left with 3,882 observations.

[Insert Table 1 Here]

The litigation data provides Filing Name, Filing Date, District Court, Exchange market, Ticker, and Year. Among 3882 observations. There are 68 cases that the tickers are not correctly filled. Those tickers are filled with the name of the exchange market (e.g. NASDAQ,
New York SE, etc.) or Undetermined. We are able to recover 29 of them. Moreover, there are 183 cases that are not publicly traded firms. They are mutual fund, ETF, and private firms. We excluded all 183 cases that are not public firms and 39 cases that are incorrectly filled and we were not be able to recover. So, for the final litigation sample, we have 3660 observations.

There are firms that have the lawsuit filed more than one time in a year. This happens because the database counts the same filing but different plaintiffs in another district court as different case. We do not want to double count them as two observations so we eliminated 45 cases of the firms with two filing in the same year. So, we left with 3615 observations.

[Insert Table 2 Here]

The highest filing case number is in 2002 with 249 cases filed, the lowest is in 1996 with 99 cases filed. The average number of case each year is around 180 cases.

4.2. Variable construction

Our paper includes both non-executive and executive compensations’ option-wealth sensitivities in the analysis. Conveniently, we come up with the way to calculate compensations’ sensitivity in the easier way based on the previous literature on non-executive compensations. The most popular database on executive compensation is Execucomp whereas most paper on non-executive compensation used the Investors Responsibility Research Center (IRRC) Dilution Database (e.g. Hochberg and Lindsey (2010) and Chang, Fu, Low, and Zhang (2015)) or manually collected data from the financial statement 10-K. For non-executive options, in 2004, Compustat started to collect the data on three types of options: currently granted, unvested, vested options. These three inputs are enough to calculate the options’ sensitivity of non-executive employee on their wealth following J. Core and Guay (2002). The idea to obtain non-executive option data is to calculate the total compensation for the whole company from Compustat and subtract out the executive portion from Execucomp.
We follow Coles et al. (2006) and J. Core and Guay (2002) in computing compensation sensitivity for both executive and non-executive variables. However, non-executive inputs need some estimations.

Six variables needed for delta, vega, and portfolio option calculation: time, volatility, dividend rate, exercise price, stock price, risk-free rate. J. Core and Guay (2002) divided options into three types: newly granted, vested, and unvested options. Please see the list of our source of input in Appendix A.

Most variables are available in Compustat, Execucomp, and CRSP and can be downloaded and calculated easily, but time to expiration of options needs to be interpolated from the data provided and put some assumptions on some firms that have option available but no time to expiration.

For volatility, we calculated 60 months rolling volatility using data from CRSP return. If the number of observations for calculating volatility is less than 60 months and greater than 12 months, we used as many months as we have. However, if the number of month are less than 12 months, we used average of volatility in that year. As for dividend, we used average previous three-years dividend yield. Volatility and dividend are winsorized at 5 and 95 percentiles. Risk free from FRED treasury rate. FRED website gives only 1,2,3,5,7 and 10 year rates. We interpolate the numbers for 4,6,8, and 9 years. If the option maturity is greater than 10 years we set the risk-free rate equal to ten years.

We calculate three types of option-wealth sensitivity: delta (how much wealth changes when a dollar change in stock price), vega (per one percent change in volatility), and option value sensitivity. For executive delta and option portfolio, Coles et al. (2006) included
the sensitivity of the share own but since we do not have information on the share own of non-executive employees, to make the variables comparable to executive employees, we drop share own sensitivity from executive delta and option value portfolio sensitivity.

Execucomp provided compensation for top five executive. Since non-executive compensation is a firm-level variable, we sum up the compensations for each executive to firm level. There are three types of options needed to be estimated as J. Core and Guay (2002): newly granted, exercisable, and non-exercisable options. Appendix B shows option variables and their descriptions from Compustat. Most option-related variables are collected starting from 2004, therefore 2004 will be our starting year in our analysis. Variables we need to estimate is time to expiration of all three option types: newly granted, vested, unvested options.

To calculate time to maturity of an option, if a firm has options available but no time to expiration provided, we set the time to expiration to 10 years for the newly granted and 9 years for the unvested options and 6 years for the vested options. This way is following J. Core and Guay (2002). If the option life is available, we interpolated from that based on the number of options. OPTLIFE is the life of newly granted options. So, for unvested options, we set its life as OPTLIFE minus one and, for vested options, we set its life as OPTLIFE minus 4. This way is also similar to J. Core and Guay (2002). However, calculating option life this way gives us negative values of option life for some unvested and vested options since some of them have option life less than 1 and 4 years. We set those to zero since some options might be vested immediately.

Next section is how we calculate the weight to find exercise price of each type of option. First sum up the total of options to find the total option number of the firm.

\[ Total\ options = OPTGR + OPTEX + OPTOSEY \]
OPTGR = number of newly granted options during the year

OPTEX = number of options exercisable or vested options

OPTOSEY = number of options outstanding end of year that cannot be exercised or unvested

Total option number is constructed to find the weighted for both executive and non-executive employees. This weights will be used to find the approximation of the exercise price for non-executive employees options for each three option types. Since Compustat stated that exercise price came from the weighted average of all options, so this way of calculating exercise price for non-executive option should be valid.

\[
\text{#options for Nonexecutive} = \text{#options total} - \text{#options executive}
\]

\[
w_{\text{non}} = \text{weighted of Nonexecutive options} = \frac{\text{#options Nonexecutive}}{\text{#options total}}
\]

\[
w_{\text{exec}} = \text{weighted of executive options} = \frac{\text{#options Executive}}{\text{#options total}}
\]

After we obtain the weights for non-executive employees and executives, we then calculate exercise price of non-executive employees using simple algebra. For newly grant,

\[
OPTPRCGR = w_{\text{non}}K_{\text{non}} + w_{\text{exec}}K_{\text{exec}}
\]

From the equation above, the only unknown variable is the exercise price of non-executive options \((K_{\text{non}})\). \(K_{\text{exec}}\) is calculated from Execucomp data based on top five executives of each company. We used the same methodology which is weighted from number of options held by each executive in the same firm and same year. Then, we will obtain average exercise price for each firm for each year. To calculate \(K_{\text{non}}\), we move it to the other side to get

\[
K_{\text{non}} = \frac{OPTPRCGR - w_{\text{exec}}K_{\text{exec}}}{w_{\text{non}}}
\]
For unvested options, the same procedure is applied. We just need to change OPTPRCGR to OPTPRCEY. And, for vested options, we use OPTPRCEX. The uniqueness of our paper is including option-wealth sensitivity of both executive and non-executive as independent variables. Since option’s objective to increase the incentive of executive should be applied to the non-executive as well, we are interested in analyzing the whole companies rather than just top five executives.

The vega and delta calculation follows Guay (1999) and J. Core and Guay (1999). They use the Black-Scholes (1973) option valuation model which is modified by Merton (1973). This consistent with several papers such as Yermack (1995), Hall and Liebman (1998).

As for the control variable, firm specific information is from Compustat. Stock returns from CRSP. Even though we have 3615 litigation firms but we cannot use all of them because we need to concern the availability of the data across several datasets, namely, litigation file, Execucomp, CRSP, and Compustat. Please see Appendix C for number of overlap firms between Execucomp and Compustat. The data started from 1992 following Execucomp database. However, option data in Compustat started to be collected from 2004 onward so our analysis uses data from 2004 to 2015. After we merged the data from Execucomp and Compustat, we then computed the non-executive and executive options as previously described.

[Insert Table 3 Here]

From Table 3, we calculated options per share for both non-executive and executive to have the picture of how large those two types of employee hold options. We can see that averagely the option to total share outstanding is around 10 percent with 8 percent for non-executive and 2 percent for executives. Non-executive option has higher portion than

\[3\)Delta is the change in the dollar value of the executive’s wealth for a one-percentage point change in stock price. Vega is the change in the dollar value of the executive’s wealth for a 0.01 change in annualized standard deviation of stock returns.
executive option, which is reasonable, because number of non-executive employees should be much larger than five executives. However, non-executive option portion could go up to more than 10 percent as we can see from 75 percentile of non-executive options per share. Then, we calculate firm-level delta vega and portfolio option for both executive and non-executive employees. Below is how we calculate option-wealth sensitivity:

\[
Delta = \frac{\partial \text{(option value)}}{\partial \text{(price)}} \times \text{Number of Options Granted} \times 0.01(\text{StockPrice}) \tag{1}
\]

\[
Delta = e^{-dT}N(Z) \times \text{Number of Options Granted} \times 0.01(\text{StockPrice}) \tag{2}
\]

\[
Vega = e^{-dT} \phi(Z) \times S \times \sqrt{T} \times 0.01 \times \#\text{Options} \tag{3}
\]

\[
\text{Option portfolio} = \#\text{Options}[S \times e^{-dT} \Phi(Z) - X \times e^{-rT} \Phi(Z - \sigma \sqrt{T})] \tag{4}
\]

where

\[
Z = \left[ \ln \left( \frac{S}{X} \right) + T(r - d + \frac{\sigma^2}{2}) \right] \div \sigma T^{1/2}
\]

\[N = \text{cumulative probability function for the normal distribution}\]

\[S = \text{the price of the underlying stock}\]

\[X = \text{exercise price of the option}\]

\[\sigma = \text{expected stock return volatility over the life of the option}\]

\[r = \text{natural logarithm of risk free interest rate}\]

\[T = \text{time to maturity of the option in years}\]

\[d = \text{natural logarithm of expected dividend yield over the life of the option}\]

All delta, vega, and option portfolio are the combination of three types of option: currently grant, vest, and unvest options.
From Table 4, we can see that non-executive option measurements are higher in magnitude because the number includes all non-executive employees while executive employees are top five executive. All the units are in dollar. For example, if the stock price increases by one percent then the wealth of all non-executive employees will increase 4.87 millions on average. However, when we perform our analysis, we scale delta and vega to per employee for both executive and non-executive employees.

We would expect compensations’ sensitivity between non-executive and executive employees goes in the same direction. From Table 5, they go together as expected. The delta, vega, and portfolio option value sensitivity correlations of non-executive and executive employees are all positive greater than 0.5 for both delta and option value sensitivity but quite low at 0.3 for vega. It’s interesting that the sensitivity of return volatility on wealth of non-executive and executive employees are quite different. This might imply that the attitudes of return volatility of two types of employees are different.

We have two sets of control variable. Non-option compensation of executives and firm characteristics. All summary of control variables in Table 6 are firm level figure. Salary, LTIP, bonus, restricted stock are all in thousands. Debt to asset is average around 56 percent. Altman z-score below 1.8 means the company has high probability to go bankrupt, while companies with scores above 3 are not likely to go bankrupt. For the average firms with z-score around 4.5, it indicates that most firms are healthy. From Denis et al. (2006) the restricted share intensity is defined as the ratio of the number of restricted shares held by the executive divided by the number of shares outstanding multiplied by $1000. Financial
data was obtained from Compustat. The Altman Z-score is defined as \( Z = 1.2A + 1.4B + 3.3C + 0.6D + E \), where \( A \) is working capital to total assets, \( B \) is retained earnings to total assets, \( C \) is earnings before interest and taxes to total assets, \( D \) is market value of equity to total liabilities, and \( E \) is net sales to total assets. Moreover, we also use free-cash dummy as control variables following Denis et al. (2006). The free-cash dummy is a variable equal to one if the company’s free cash ratio is less than -0.5 and zero otherwise. The free cash ratio is equal to the difference between cash from operations and average capital expenditures over the prior 3 years, all divided by current assets.

[Insert Table 7 Here]

At the median, for the option-wealth sensitivities, sample firms (firms with litigation) have higher delta, vega, and option portfolio value. Sample firms also have, at median, higher non-option compensations (e.g. salary LTIP) than control firms. For firm characteristics, firms with litigation are higher in debt to asset, capital expenditures, market value and book to market value, but lower in z-score, return on assets. In sum, firms that are engaged in litigation are bigger in size by market value, more leverage, lower ability to generate revenue from their assets, and have higher possibility to go bankrupt based on z-score. These characteristics are consistent with the story that they may try to boost the short-term price of the company (from higher market value) in a non-stable and short-term way such as borrowing\(^4\). These companies have lower capability to generate revenue from their assets and are prone to higher chance of getting bankrupt.

[Insert Table 8 Here]

Table 8 shows latest data before performing propensity score matching. We have roughly 30 to 50 sample firms and 1,500 to 1,900 control firms each year. Total sample firms are 516 and

\(^4\)Fischer and Verrecchia (2000) and Goldman and Slezak (2006) show that stock-related compensations encourage managers to manipulate short-term stock price
control firms are 20,757. The sample firms are reduced from 3615 to 516 after concerning the availability of the information across all databases.

5. Methodology

We use multivariate regression as our model. The dependent variable is litigation status which is dummy variable with value 1 if a firm has fraud allegation and 0 otherwise. We first need to match sample and control firms.

5.1. Propensity score matching

We have two groups of sample: litigation and non-litigation firms in which we call them sample and control firms respectively. We have 516 litigation firms whereas non-litigation firms are 20,757. If we had not matched the sample and control firms, we would have ended up with highly unbalanced sample and different firms characteristics. We need to match the sample and control firms so as to have similar number of firms and similar characteristics, because there might be some confounding factors affecting dependent variable rather than our focus variables which, in this case, are option compensations. Propensity score matching (PSM) is one of the best ways to reduce the bias of confounding factors. In the past, it is quite difficult to match sample and control groups with more than two dimensions. Denis et al. match used size and industry. Denis et al (2006) first matched sample and control firms with four digit SIC and then matched the market value to be in the 10 percent higher and lower of sample firms’ market value. If control firms are out of 10 percent market value range, they are excluded and put in the sample for lower digit SIC match. The lower SIC digit matches are three digit, two digit, and one digit SIC respectively. 92 percent of sample firms are matched with the breakdown of 4 digit 33 percent, 3 digit 12 percent, 2 digit 26 percent, and 1 digit 21 percent.
We improved low dimension matching of Denis et al. (2006) by using three dimensions matching that is pertaining to the litigation. The three matching variables are relevant to the litigation likelihood to reduce the confounding factors. First, market value matters a lot when we talk about the lawsuit of a firm. Peng and Röell (2008b) show that incentives are monotonically related to firm size because a firm still focuses on the short-term indicator like market value. Second, we matched sample and control firms on performance measure. We used ROA which is known as one of the best ways to measure operating performance. Peng and Röell (2008a) state that ROA could be viewed as a sign of successful management, so high ROA should reduce the likelihood of fraud behavior. In contrast, with low ROA, firms that pushed for the performance might have higher lawsuit filing because they might have a bad way to increase the performance of the firms such as earning management, reducing cost unethically. Last, we match the firms with leverage. We used total debt to total asset as a proxy for leverage. In terms of the effect of leverage on the litigation, there are several aspects. One could be firms have high default rate because of the high leverage. This could spark the debt holder or equity holder to come into conflict (Perotti and Spier (1993)), because they have different perspective on leverage level of the firms. Another one could be firms borrow to increase short-term performance of the firms. There are many papers that show firms are sometimes very myopia in terms of boosting firm’s growth (DeFond and Park (1997), Degeorge, Patel, and Zeckhauser (1999)). They might borrow money to increase sales or reduce cost with little deliberating process. So, they might end up being filed a lawsuit by their own investors or creditors. We stopped at three dimensions matching because overmatching will create the sampling bias and will lead to the lower ability to generalize the result to the population or lower external validity.

[Insert Table 9 Here]

After we matched the sample and control firms, we then check the mean difference between the two groups of the two types of firm. Table 9 shows the test between the mean
difference of the two groups: sample and control. In Table 9, we can see that the t-test are very low or the null hypothesis that the group means are not different cannot be rejected. Hence, our propensity score matching does its job which is eliminating the difference in characteristics among chosen variables: market value, ROA, and debt to total assets.

[Insert Table 10 Here]

Table 10 and 11 show characteristics of the sample and control firms final dataset before the regression analysis. From Table 10, there are 985 firms: 504 sample and 481 control firms. We can see that our final set of sample and control variables are very close in number each year. They are not concentrated in just one or two years, which is good for the analysis in terms of the sample balance. The balance sample each year results from the fact that we matched sample and control year by year.

[Insert Table 11 Here]

From Table 11, we can see that the number of control and sample firms are very similar in each industry. Most of our samples come from manufacturing, finance, insurance, and real estate, then from services. The top three lowest case filings by industry is public administration, wholesale trade, and construction.

6. Empirical results

6.1. Option sensitivities and litigation

For robustness check, before we match on all three variables using PSM, we first match only on size or market value of firms between sample and control firms. This way is similar to Denis et al. (2006). Denis et al. (2006) matched sample and control firms first by SIC industry then market value. We matched by market value then control the industry and year using fixed effect. The result can be found in Table 12.
For executive employees, we find that executive vega is positively associated with all types of specification. Positive vega indicates that when vega increases, the likelihood of the firm will be filed a lawsuit or the chance that the executive employees will commit fraud is higher. Executive vega is the option-wealth executive employee when there is an increase in volatility of return by 0.01 standard deviation. However, we can see that executive delta has no consistent significant across specifications. For non-executive employees, all compensation proxies do not show consistent association with litigation likelihood. For all results, we also have portfolio value of both types of employees as control variables, but they are not our focus here, so we exclude them to reduce the confusion with other compensation sensitivities.

Then we match control and sample firms with two dimensions in Table 13: size and ROA. Vegas of executive are still consistently significant for all specifications. Now, executive vega is more significant than the previous specification where we only match firms by market value. At this point, no other compensation sensitivities have explanatory power. Previously, we can see some significant from the delta of both executives and non-executives employees.

The result in Table 14 is our main result. We match litigation and non-litigation firms using three dimensions: market value, ROA, and total debt to total asset with industry and year fixed effects. This should reduce most of confounding effect in the model. We can see that Vega of executive employees is significant across all types of control variables. Positive association between vega and likelihood of firm engaging in litigation shows that higher vega associates with higher likelihood of firms being filed a lawsuit or higher option-wealth sensitivity from firms’ stock return volatility encourages executive employees to commit a fraud. Similar to one and two variables matching, delta and vega of non-executive employees
have no explanatory power. This could be explained by the fact that we only have aggregate data of option compensation on non-executive side. When we average them over all non-executive employees, the variation is dissipated. For instance, non-executive employees also include lower level managers which should have higher option compensations than average employees. However, in the next section, we find that, if we interact executive and non-executive option sensitivities, non-executive employees show an involvement in fraudulent activities. Another question that may arise is why vega significantly positive but delta is not consistently significant like in the previous literature findings. This implies delta cannot help explain the likelihood of a firm being filed a lawsuit or firms being in litigation. This indicates that executive employees may not care much on the option-wealth sensitivity from stock price change but care more on the option-wealth sensitivity from the volatility of the stock price. Furthermore, we also perform the three-dimension match with and without industry and year fixed effects. The high significance of non-executive vega still pronounces on all specifications. In sum, for firm level, executive vega consistently and strongly shows positive association with litigation likelihood.

6.2. Option sensitivities’ interactions and litigation

Table 15 shows the result of interaction between executive and non-executive compensation sensitivities. The suffix ”-Non” means non-executive employees and ”-Ex” means executives. For instance, DeltaNon is delta of non-executive employees. We can see that, out of four interactions, two interactions are consistently significant across all specifications. First interaction is between non-executive vega and executive delta. The second is between non-executive vega and executive vega. One interesting observation here is that only interactions with non-executive vega are significant. This implies that not only is the vega important in executive employees in relationship with fraudulent activity, vega of non-executive employ-
ees also plays an important role. It is interesting that option sensitivities of non-executive employees by themselves have no explanatory power on litigation likelihood, but, when they interact with executive option sensitivities, they have explanatory power. The implication of these results could be that since we don’t know the exact compensation value for each non-executive employee. The per employee compensation for non-executive employees is calculated from the aggregate number of compensation divided by the number of employees. The average compensation may render in average out the effect of option compensation on the likelihood of being filed a lawsuit. In other words, the effect of non-executive employees’ incentive from compensation is disguised under the higher explanatory power of executive employees. However, when they interact, the explanatory power of non-executive employees’ incentive on litigation shows up.

6.3. Growth firms and litigation

Moreover, Horchberg and Lindsey (2010) found that the incentive-performance-effect appeared only in high growth firms. Following Smith and Watts (1992), we use the book value to market value as a proxy for growth opportunities. Horchberg and Lindsey (2010) predicted that firms with greater growth opportunities have lower book-to-market ratios. We separated sample into below (high growth) and above (low growth) median book to market value with the regression results in Table 16 Panel A and Panel B, respectively. We find that executive vega is consistently and positively associated with firm’s litigation for high growth firms whereas none of the effects can be found in low growth firms. This finding is consistent with Horchberg and Lindsey (2010).

We also perform the same interaction analysis for high growth firm to see whether there is any collaboration between executive and non-executive employees. From Table 17, now the
only interaction that exhibits consistent significant is the interaction between non-executive and executive vega. Another interesting observation from Table 17 is the explanatory power from the interaction is lower than the single option sensitivity. In other words, from Table 16, we can see that vega of executive is significant at one percent level whereas the interaction term is significant at 5 to 10 percent level. Though both of them have positive relationship with litigation likelihood, for high growth firms, the result may imply that the influence of the executive’s action on the litigation is higher.

7. Conclusion

Whether option compensations encourage employees to commit a fraud has not been fully discovered. Previous literature found that executive option compensation encouraged the probability of the firms being filed a lawsuit. However, we conjecture that executive option compensation is still not the whole story. Therefore, we also include non-executive employees in our analysis. To our knowledge, we are the first to include all types of employee (non-executive and executive) and proxies (vega and delta) in the same set of analysis on firm’s litigation. The upside of this comprehensive view is we can have a clearer picture of what factors in option compensation and which group of employees are really the cause of firms’ fraudulent activities, and, in turn, being filed a lawsuit. To reduce the confounding effects, we matched sample and control firms on three dimensions: size, performance, and leverage. Following previous literature, we find that it is the executive option compensation that plays a role in the firm’s litigation likelihood. But the finding is different from the previous literature in that it is the vega of executive, not delta, that has explanatory power. Non-executive option compensation also increases the likelihood of a firm chance of fraud allegations under interaction with executives. Moreover, we investigate further into firms with different growth opportunity. We find that only high growth firms exhibit the relationship between the litigation likelihood and compensation sensitivities. Our results could be contributed to
regulators (e.g. SEC, FASB, GAAP) that, during the period of high fluctuation of firm value (i.e. high vega), regulators should watch for fraudulent activities in firms with large option compensation for executives, especially, firms with high growth opportunities, because a firm with described specification has a high tendency to commit a fraud.
References


Figure 1 present cumulative abnormal returns 200 day before and after the litigation class filing date (t=0). CARs and SCARs are estimated using CRSP equally weighted market model with coefficients obtained from (-101, -1) trading days prior the filing date.

(a) CAR (full sample)  
(b) SCAR (full sample)  
(c) CAR (large firms)  
(d) SCAR (large firms)  
(e) CAR (small firms)  
(f) SCAR (small firms)
The lawsuit filing data is from Stanford law school securities class action clearing house. The data is manually retrieved from [http://securities.stanford.edu/filings.html](http://securities.stanford.edu/filings.html). We started collecting the data from January 19, 1996 to June 24, 2016. The total observations are 4,195. More than 80 percent of the cases are “Classic cases”. Classic cases are, for example, material misrepresentations and misstated financial results (Denis et al. (2006)).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classic Case</td>
<td>3508</td>
</tr>
<tr>
<td>IPO Allocation</td>
<td>313</td>
</tr>
<tr>
<td>Credit Crisis</td>
<td>206</td>
</tr>
<tr>
<td>Analyst</td>
<td>68</td>
</tr>
<tr>
<td>Option Backdating</td>
<td>40</td>
</tr>
<tr>
<td>Mutual Fund (Market Timing)</td>
<td>26</td>
</tr>
<tr>
<td>Madoff-Related Case</td>
<td>24</td>
</tr>
<tr>
<td>Bid Rigging (Insurance Kickbacks Allegations)</td>
<td>10</td>
</tr>
<tr>
<td>All cases</td>
<td>4195</td>
</tr>
</tbody>
</table>
Table 2
The Breakdown of Cleaned Litigation Data by Year

This table shows the breakdown of the firms under a lawsuit by year. 2002 is the year with the highest number of lawsuit whereas 1996 is the lowest. The average number of case each year is around 180 cases.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Cases</th>
<th>Percent</th>
<th>Cumulative Frequency</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>99</td>
<td>2.74</td>
<td>99</td>
<td>2.74</td>
</tr>
<tr>
<td>1997</td>
<td>167</td>
<td>4.62</td>
<td>266</td>
<td>7.36</td>
</tr>
<tr>
<td>1999</td>
<td>203</td>
<td>5.62</td>
<td>701</td>
<td>19.39</td>
</tr>
<tr>
<td>2000</td>
<td>206</td>
<td>5.7</td>
<td>907</td>
<td>25.09</td>
</tr>
<tr>
<td>2001</td>
<td>173</td>
<td>4.79</td>
<td>1080</td>
<td>29.88</td>
</tr>
<tr>
<td>2002</td>
<td>249</td>
<td>6.89</td>
<td>1329</td>
<td>36.76</td>
</tr>
<tr>
<td>2003</td>
<td>205</td>
<td>5.67</td>
<td>1534</td>
<td>42.43</td>
</tr>
<tr>
<td>2004</td>
<td>217</td>
<td>6</td>
<td>1751</td>
<td>48.44</td>
</tr>
<tr>
<td>2005</td>
<td>170</td>
<td>4.7</td>
<td>1921</td>
<td>53.14</td>
</tr>
<tr>
<td>2006</td>
<td>115</td>
<td>3.18</td>
<td>2036</td>
<td>56.32</td>
</tr>
<tr>
<td>2007</td>
<td>166</td>
<td>4.59</td>
<td>2202</td>
<td>60.91</td>
</tr>
<tr>
<td>2008</td>
<td>182</td>
<td>5.03</td>
<td>2384</td>
<td>65.95</td>
</tr>
<tr>
<td>2009</td>
<td>133</td>
<td>3.68</td>
<td>2517</td>
<td>69.63</td>
</tr>
<tr>
<td>2010</td>
<td>154</td>
<td>4.26</td>
<td>2671</td>
<td>73.89</td>
</tr>
<tr>
<td>2011</td>
<td>181</td>
<td>5.01</td>
<td>2852</td>
<td>78.89</td>
</tr>
<tr>
<td>2012</td>
<td>144</td>
<td>3.98</td>
<td>2996</td>
<td>82.88</td>
</tr>
<tr>
<td>2013</td>
<td>158</td>
<td>4.37</td>
<td>3154</td>
<td>87.25</td>
</tr>
<tr>
<td>2014</td>
<td>166</td>
<td>4.59</td>
<td>3320</td>
<td>91.84</td>
</tr>
<tr>
<td>2015</td>
<td>188</td>
<td>5.2</td>
<td>3508</td>
<td>97.04</td>
</tr>
<tr>
<td>2016</td>
<td>107</td>
<td>2.96</td>
<td>3615</td>
<td>100</td>
</tr>
</tbody>
</table>
After we merged Compustat and Execucomp databases together, we then calculated the option numbers earned by executive and non-executive employees. We also calculated the option number per share outstanding to see the picture of how large those options are comparing to the total share of the firms.

<table>
<thead>
<tr>
<th>Label</th>
<th>Mean</th>
<th>Median</th>
<th>Std Dev</th>
<th>25th Pctl</th>
<th>50th Pctl</th>
<th>75th Pctl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-executive options (unit:1000)</td>
<td>20080.87</td>
<td>3802.05</td>
<td>82367.07</td>
<td>1113.49</td>
<td>3802.05</td>
<td>11585.35</td>
</tr>
<tr>
<td>Executive options (unit:1000)</td>
<td>2127.95</td>
<td>989.1</td>
<td>5364.51</td>
<td>302.88</td>
<td>989.1</td>
<td>2316.44</td>
</tr>
<tr>
<td>Share outstanding (unit:1000)</td>
<td>250899.61</td>
<td>70378</td>
<td>765787.81</td>
<td>34650</td>
<td>70378</td>
<td>183551</td>
</tr>
<tr>
<td>Non-executive options/share outstanding</td>
<td>0.08</td>
<td>0.06</td>
<td>0.08</td>
<td>0.02</td>
<td>0.06</td>
<td>0.11</td>
</tr>
<tr>
<td>Executive options/share outstanding</td>
<td>0.02</td>
<td>0.01</td>
<td>0.03</td>
<td>0</td>
<td>0.01</td>
<td>0.03</td>
</tr>
</tbody>
</table>
Table 4
Summary Statistics of Option-Wealth Sensitivity

The table shows three types of option-wealth sensitivity for both executive and non-executive employees. Delta is the change in option value when the price of the stock change by one percent. Vega is the change in option value when the volatility of the stock return change by one percent. Option portfolio is the value of options holding by employees in dollar term. Unit: thousands

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Sum</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-executive delta</td>
<td>4870</td>
<td>18035</td>
<td>80534321</td>
<td>0</td>
<td>487164</td>
</tr>
<tr>
<td>Executive delta</td>
<td>654.14468</td>
<td>1544</td>
<td>10841140</td>
<td>1.80E-08</td>
<td>57490</td>
</tr>
<tr>
<td>Non-executive vega</td>
<td>3266</td>
<td>14783</td>
<td>54006863</td>
<td>0</td>
<td>434877</td>
</tr>
<tr>
<td>Executive vega</td>
<td>133.43406</td>
<td>595.29756</td>
<td>2211403</td>
<td>0</td>
<td>55555</td>
</tr>
<tr>
<td>Non-executive option portfolio</td>
<td>225637</td>
<td>803870</td>
<td>3731361919</td>
<td>0</td>
<td>21814315</td>
</tr>
<tr>
<td>Executive option portfolio</td>
<td>31926</td>
<td>86222</td>
<td>529113049</td>
<td>1.80E-06</td>
<td>2996590</td>
</tr>
</tbody>
</table>
Table 5
Correlation coefficient matrix

Correlation coefficient matrix of all three option-wealth sensitivities between executive and non-executive employees. The table also shows the test between two variables with null hypothesis of the correlation is not different from zero. All pairs have p-value less than 0.0001 which means the correlations are significantly different from zero.

<table>
<thead>
<tr>
<th></th>
<th>Non-executive delta</th>
<th>Executive delta</th>
<th>Non-executive vega</th>
<th>Executive vega</th>
<th>Non-executive option portfolio</th>
<th>Executive option portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-executive delta</td>
<td>1</td>
<td>0.59541</td>
<td>0.82916</td>
<td>0.32382</td>
<td>0.95187</td>
<td>0.49196</td>
</tr>
<tr>
<td>Executive delta</td>
<td>0.0001</td>
<td>1</td>
<td>0.4002</td>
<td>0.41843</td>
<td>0.61805</td>
<td>0.91383</td>
</tr>
<tr>
<td>Non-executive vega</td>
<td>0.0001</td>
<td>0.41843</td>
<td>0.30706</td>
<td>1</td>
<td>0.3325</td>
<td>0.38585</td>
</tr>
<tr>
<td>Executive vega</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>Non-executive option portfolio</td>
<td>0.0001</td>
<td>0.61805</td>
<td>0.73512</td>
<td>0.3325</td>
<td>1</td>
<td>0.57242</td>
</tr>
<tr>
<td>Executive option portfolio</td>
<td>0.0001</td>
<td>0.91383</td>
<td>0.25819</td>
<td>0.38585</td>
<td>0.57242</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 6  
Control variable summary statistics

Summary statistics of all control variables. LTIP, salary, restricted stock, and bonus are from Execucomp and only for top five executives. LTIP is long term incentive plan or a type of executive compensation that typically comes in the form of performance shares or matching shares of the company. Restricted stock is stock of a company that is not fully transferable until certain conditions have been met. Debt to Asset is total debt value to total assets value of firms. The Altman Z-score is defined as $Z = .2A + 1.4B + 3.3C + 0.6D + E$, where $A$ is working capital to total assets, $B$ is retained earnings to total assets, $C$ is earnings before interest and taxes to total assets, $D$ is market value of equity to total liabilities, and $E$ is net sales to total assets. Return on asset ($ROA$) is net income over total asset value. Capital expenditures is the average three-year capital expenditure.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Median</th>
<th>Std Dev</th>
<th>25th Pctl</th>
<th>50th Pctl</th>
<th>75th Pctl</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTIP</td>
<td>124.9</td>
<td>0</td>
<td>1427.49</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Salary</td>
<td>2694.41</td>
<td>2452.88</td>
<td>1409.83</td>
<td>1816.46</td>
<td>2452.88</td>
<td>3280.17</td>
</tr>
<tr>
<td>Restricted stock</td>
<td>281.15</td>
<td>123.82</td>
<td>639.74</td>
<td>15.48</td>
<td>123.82</td>
<td>324.5</td>
</tr>
<tr>
<td>Bonus</td>
<td>1113.42</td>
<td>2.72</td>
<td>3828.75</td>
<td>0</td>
<td>2.72</td>
<td>750</td>
</tr>
<tr>
<td>Debt to Asset</td>
<td>0.56</td>
<td>0.56</td>
<td>0.26</td>
<td>0.4</td>
<td>0.56</td>
<td>0.72</td>
</tr>
<tr>
<td>Z-Score</td>
<td>4.51</td>
<td>3.51</td>
<td>6.86</td>
<td>2.1</td>
<td>3.51</td>
<td>5.43</td>
</tr>
<tr>
<td>Return on Assets</td>
<td>0.04</td>
<td>0.05</td>
<td>0.16</td>
<td>0.01</td>
<td>0.05</td>
<td>0.09</td>
</tr>
<tr>
<td>Capital Expenditures</td>
<td>386.63</td>
<td>48.49</td>
<td>1413.4</td>
<td>11.89</td>
<td>48.49</td>
<td>195.73</td>
</tr>
<tr>
<td>Market Value</td>
<td>10151.52</td>
<td>2105.37</td>
<td>29916.78</td>
<td>761.28</td>
<td>2105.37</td>
<td>6969.16</td>
</tr>
<tr>
<td>Book to Market</td>
<td>0.53</td>
<td>0.42</td>
<td>2.54</td>
<td>0.24</td>
<td>0.42</td>
<td>0.67</td>
</tr>
</tbody>
</table>
Table 7
Summay Statistics of Option Sensitivities and Control Variables by Sample

Independent variables for regressions by sample (litigation) and control firms (no litigation). This table shows both mean and median for sample and control firms’ independent variables. Independent variables are including option-wealth sensitivities, non-option compensation of executives, and firm specifics.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (Control firms)</th>
<th>Median (Control firms)</th>
<th>Mean (Sample firms)</th>
<th>Median (Sample firms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-executive delta</td>
<td>4754.55</td>
<td>617.16</td>
<td>10070.12</td>
<td>1087.46</td>
</tr>
<tr>
<td>Executive delta</td>
<td>646.98</td>
<td>213.05</td>
<td>974.87</td>
<td>372.69</td>
</tr>
<tr>
<td>Non-executive vega</td>
<td>3120.54</td>
<td>389.71</td>
<td>9812.81</td>
<td>856.43</td>
</tr>
<tr>
<td>Executive vega</td>
<td>129.16</td>
<td>0.77</td>
<td>324.68</td>
<td>17.42</td>
</tr>
<tr>
<td>Non-executive option portfolio</td>
<td>220506.9</td>
<td>32032.91</td>
<td>456828.16</td>
<td>53888.37</td>
</tr>
<tr>
<td>Executive option portfolio</td>
<td>31651.52</td>
<td>8828.7</td>
<td>44227.16</td>
<td>13053.59</td>
</tr>
<tr>
<td>LTIP</td>
<td>121.97</td>
<td>0</td>
<td>256.54</td>
<td>0</td>
</tr>
<tr>
<td>salary</td>
<td>2681.66</td>
<td>2443.13</td>
<td>3267.1</td>
<td>2916.51</td>
</tr>
<tr>
<td>Restricted stock</td>
<td>277.05</td>
<td>122.78</td>
<td>465.47</td>
<td>178.28</td>
</tr>
<tr>
<td>bonus</td>
<td>1083.88</td>
<td>1.5</td>
<td>2440.8</td>
<td>187.5</td>
</tr>
<tr>
<td>Debt to Asset</td>
<td>0.56</td>
<td>0.56</td>
<td>0.61</td>
<td>0.59</td>
</tr>
<tr>
<td>Z-Score</td>
<td>4.51</td>
<td>3.52</td>
<td>4.55</td>
<td>3.39</td>
</tr>
<tr>
<td>Return on Assets</td>
<td>0.04</td>
<td>0.05</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Capital Expenditures</td>
<td>377.81</td>
<td>47.8</td>
<td>779.79</td>
<td>102.84</td>
</tr>
<tr>
<td>Market Value</td>
<td>9902.38</td>
<td>2092.74</td>
<td>21332.18</td>
<td>3237.24</td>
</tr>
<tr>
<td>Book to Market</td>
<td>0.53</td>
<td>0.42</td>
<td>0.74</td>
<td>0.45</td>
</tr>
</tbody>
</table>
Table 8
Final Sample Before Matching

Final sample before performing propensity score matching. The sample consists of 20,757 control firms and 516 sample firms.

<table>
<thead>
<tr>
<th>Year</th>
<th>Control firms</th>
<th>Sample firms</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>1643</td>
<td>48</td>
<td>1691</td>
</tr>
<tr>
<td>2005</td>
<td>1556</td>
<td>38</td>
<td>1594</td>
</tr>
<tr>
<td>2006</td>
<td>1711</td>
<td>27</td>
<td>1738</td>
</tr>
<tr>
<td>2007</td>
<td>1904</td>
<td>49</td>
<td>1953</td>
</tr>
<tr>
<td>2008</td>
<td>1850</td>
<td>56</td>
<td>1906</td>
</tr>
<tr>
<td>2009</td>
<td>1835</td>
<td>38</td>
<td>1873</td>
</tr>
<tr>
<td>2010</td>
<td>1803</td>
<td>49</td>
<td>1852</td>
</tr>
<tr>
<td>2011</td>
<td>1783</td>
<td>33</td>
<td>1816</td>
</tr>
<tr>
<td>2012</td>
<td>1740</td>
<td>42</td>
<td>1782</td>
</tr>
<tr>
<td>2013</td>
<td>1702</td>
<td>49</td>
<td>1751</td>
</tr>
<tr>
<td>2014</td>
<td>1684</td>
<td>42</td>
<td>1726</td>
</tr>
<tr>
<td>2015</td>
<td>1546</td>
<td>45</td>
<td>1591</td>
</tr>
<tr>
<td>Total</td>
<td>20757</td>
<td>516</td>
<td>21273</td>
</tr>
</tbody>
</table>
Table 9
PSM Matching Variables

The t-test for different in group mean after propensity score matching. We matched on three dimensions: size (market value), performance (ROA), and leverage (total debt to total asset). The null hypothesis is the mean difference between the sample and control groups are not different. With high p-value, we cannot reject the null hypothesis that means between the two samples are different.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market value</td>
<td>7846.9</td>
<td>7620.1</td>
</tr>
<tr>
<td>ROA</td>
<td>0.02897</td>
<td>0.33</td>
</tr>
<tr>
<td>Total Debt to total asset</td>
<td>0.56866</td>
<td>0.55733</td>
</tr>
</tbody>
</table>
Table 10
Summary of Sample and Control Firms by Year After Propensity Score Matching

After propensity score matching on three dimensions, we have 481 control firms and 504 sample firms. Since we matched control and sample firms by year, we have roughly the same number of control and sample firms for each year. Total firms for regressions are 985 firms.

<table>
<thead>
<tr>
<th>Year</th>
<th>Control firms</th>
<th>Sample firms</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>42</td>
<td>46</td>
<td>88</td>
</tr>
<tr>
<td>2005</td>
<td>34</td>
<td>38</td>
<td>72</td>
</tr>
<tr>
<td>2006</td>
<td>26</td>
<td>26</td>
<td>52</td>
</tr>
<tr>
<td>2007</td>
<td>47</td>
<td>49</td>
<td>96</td>
</tr>
<tr>
<td>2008</td>
<td>49</td>
<td>56</td>
<td>105</td>
</tr>
<tr>
<td>2009</td>
<td>35</td>
<td>37</td>
<td>72</td>
</tr>
<tr>
<td>2010</td>
<td>48</td>
<td>48</td>
<td>96</td>
</tr>
<tr>
<td>2011</td>
<td>28</td>
<td>30</td>
<td>58</td>
</tr>
<tr>
<td>2012</td>
<td>40</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>2013</td>
<td>47</td>
<td>47</td>
<td>94</td>
</tr>
<tr>
<td>2014</td>
<td>42</td>
<td>42</td>
<td>84</td>
</tr>
<tr>
<td>2015</td>
<td>43</td>
<td>45</td>
<td>88</td>
</tr>
<tr>
<td>Total</td>
<td>481</td>
<td>504</td>
<td>985</td>
</tr>
</tbody>
</table>
After propensity score matching on three variables, the top three industries by number of lawsuit filed are Manufacturing, Finance, insurance, and real estate, and Services. The bottom three are Public Administration, Construction, and Wholesale Trade. We can see from the row percentage that the number of firms between control and sample firms are very close together.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Control firms</th>
<th>Sample firms</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>5</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>38.46</td>
<td>61.54</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.04</td>
<td>1.59</td>
<td></td>
</tr>
<tr>
<td>Finance, Insurance, &amp; Real Estate</td>
<td>86</td>
<td>100</td>
<td>186</td>
</tr>
<tr>
<td></td>
<td>46.24</td>
<td>53.76</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17.88</td>
<td>19.84</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>195</td>
<td>196</td>
<td>391</td>
</tr>
<tr>
<td></td>
<td>49.87</td>
<td>50.13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40.54</td>
<td>38.89</td>
<td></td>
</tr>
<tr>
<td>Mining</td>
<td>23</td>
<td>17</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>57.5</td>
<td>42.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.78</td>
<td>3.37</td>
<td></td>
</tr>
<tr>
<td>Public Administration</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.62</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Retail Trade</td>
<td>49</td>
<td>49</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.19</td>
<td>9.72</td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td>70</td>
<td>91</td>
<td>161</td>
</tr>
<tr>
<td></td>
<td>43.48</td>
<td>56.52</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14.55</td>
<td>18.06</td>
<td></td>
</tr>
<tr>
<td>Transportation, Communications</td>
<td>43</td>
<td>33</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>56.58</td>
<td>43.42</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.94</td>
<td>6.55</td>
<td></td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>7</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>46.67</td>
<td>53.33</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.46</td>
<td>1.59</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>481</td>
<td>504</td>
<td>985</td>
</tr>
</tbody>
</table>
Table 12
Regression Results Based on Propensity Score Matching on One Variable: Market Value

For robustness check, this table is the result of only market value match. Dependent variable is a zero one dummy. If firms are in litigation, they are assigned value of 1 and 0 otherwise. All the option compensations are scaled to per employee both executive and non-executive. The regressions have five model based on the set of control variables. (1) include only wealth-option sensitivity variables (2) include firm specific controls (3) include non-option compensation of executives (4) exclude matching variables (5) include all variables. We also perform year and industry fixed effects.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Options</th>
<th>(2) Firm specific control</th>
<th>(3) Non-option compensation</th>
<th>(4) No matching variables</th>
<th>(5) All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vega(Non-executive)</td>
<td>-0.0257236</td>
<td>0.0600312</td>
<td>-0.0207789</td>
<td>0.0714542*</td>
<td>0.0573589</td>
</tr>
<tr>
<td></td>
<td>(-1.00)</td>
<td>(1.48)</td>
<td>(-0.81)</td>
<td>(1.87)</td>
<td>(1.44)</td>
</tr>
<tr>
<td>Delta(Non-executive)</td>
<td>-0.0563633*</td>
<td>-0.0299288</td>
<td>-0.0477181</td>
<td>-0.0265028</td>
<td>-0.0219811</td>
</tr>
<tr>
<td></td>
<td>(-1.66)</td>
<td>(-0.84)</td>
<td>(-1.34)</td>
<td>(-0.69)</td>
<td>(-0.59)</td>
</tr>
<tr>
<td>Vega(Executive)</td>
<td>0.0013036***</td>
<td>0.0009658**</td>
<td>0.0011231***</td>
<td>0.0008045*</td>
<td>0.0009543***</td>
</tr>
<tr>
<td></td>
<td>(3.52)</td>
<td>(2.19)</td>
<td>(2.79)</td>
<td>(1.72)</td>
<td>(2.07)</td>
</tr>
<tr>
<td>Delta(Executive)</td>
<td>0.0005736***</td>
<td>0.0003693</td>
<td>0.0003687</td>
<td>0.0003911</td>
<td>0.0003074</td>
</tr>
<tr>
<td></td>
<td>(2.63)</td>
<td>(1.37)</td>
<td>(1.56)</td>
<td>(1.41)</td>
<td>(1.14)</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.8286042**</td>
<td></td>
<td></td>
<td></td>
<td>-0.8456159**</td>
</tr>
<tr>
<td></td>
<td>(-2.21)</td>
<td></td>
<td></td>
<td></td>
<td>(-2.28)</td>
</tr>
<tr>
<td>Log(assets)</td>
<td>-0.0205997</td>
<td></td>
<td></td>
<td></td>
<td>-0.0392675</td>
</tr>
<tr>
<td></td>
<td>(-0.89)</td>
<td></td>
<td></td>
<td></td>
<td>(-1.44)</td>
</tr>
<tr>
<td>Book to market</td>
<td>0.0555033</td>
<td></td>
<td></td>
<td></td>
<td>0.1127491**</td>
</tr>
<tr>
<td></td>
<td>(1.13)</td>
<td></td>
<td></td>
<td></td>
<td>(0.85)</td>
</tr>
<tr>
<td>Total debt to total assets</td>
<td>0.0211317</td>
<td></td>
<td></td>
<td></td>
<td>-0.0268150</td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td></td>
<td></td>
<td></td>
<td>(-0.21)</td>
</tr>
<tr>
<td>Z-Score</td>
<td>0.0164325</td>
<td></td>
<td></td>
<td></td>
<td>0.0137426*</td>
</tr>
<tr>
<td></td>
<td>(1.60)</td>
<td></td>
<td></td>
<td></td>
<td>(1.60)</td>
</tr>
<tr>
<td>Free-cash dummy</td>
<td>0.1636447**</td>
<td></td>
<td></td>
<td></td>
<td>0.2197979**</td>
</tr>
<tr>
<td></td>
<td>(1.88)</td>
<td></td>
<td></td>
<td></td>
<td>(1.79)</td>
</tr>
<tr>
<td>Market Value</td>
<td>0.0000112***</td>
<td></td>
<td></td>
<td></td>
<td>0.0000120***</td>
</tr>
<tr>
<td></td>
<td>(4.50)</td>
<td></td>
<td></td>
<td></td>
<td>(4.78)</td>
</tr>
<tr>
<td>Log(1+bonus)</td>
<td>0.0109631**</td>
<td>0.0086938</td>
<td></td>
<td></td>
<td>0.0098602</td>
</tr>
<tr>
<td></td>
<td>(2.00)</td>
<td>(1.30)</td>
<td></td>
<td></td>
<td>(1.56)</td>
</tr>
<tr>
<td>Log(1+salary)</td>
<td>0.1398426***</td>
<td>0.1074076</td>
<td></td>
<td></td>
<td>0.1271843</td>
</tr>
<tr>
<td></td>
<td>(2.74)</td>
<td>(1.30)</td>
<td></td>
<td></td>
<td>(1.50)</td>
</tr>
<tr>
<td>Log(1+LTIP)</td>
<td>-0.0218145</td>
<td>-0.0273864*</td>
<td></td>
<td></td>
<td>-0.0299599**</td>
</tr>
<tr>
<td></td>
<td>(-1.57)</td>
<td>(-1.76)</td>
<td></td>
<td></td>
<td>(-2.00)</td>
</tr>
<tr>
<td>Restricted shares intensity</td>
<td>-0.0003238</td>
<td>-0.0007333</td>
<td></td>
<td></td>
<td>0.0005360</td>
</tr>
<tr>
<td></td>
<td>(-0.06)</td>
<td>(-0.11)</td>
<td></td>
<td></td>
<td>(0.08)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.2801494***</td>
<td>0.3025790</td>
<td>-0.8396967**</td>
<td>-0.7918344</td>
<td>-0.5175016</td>
</tr>
<tr>
<td></td>
<td>(2.81)</td>
<td>(1.43)</td>
<td>(-2.12)</td>
<td>(-1.44)</td>
<td>(-0.93)</td>
</tr>
<tr>
<td>Observations</td>
<td>891</td>
<td>679</td>
<td>891</td>
<td>679</td>
<td>679</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.0308</td>
<td>0.0617</td>
<td>0.0419</td>
<td>0.0465</td>
<td>0.0679</td>
</tr>
<tr>
<td>Industry FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table 13
Regression Results Based on Propensity Score Matching on Two Variables:
Market Value and ROA

For robustness check, this table is the result of market value and ROA match. Dependent variable is a zero one dummy. If firms are in litigation, they are assigned value of 1 and 0 otherwise. All the option compensations are scaled to per employee both executive and non-executive. The regressions have five model based on the set of control variables. (1) include only wealth-option sensitivity variables (2) include firm specific controls (3) include non-option compensation of executives (4) exclude matching variables (5) include all variables. We also perform year and industry fixed effects.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Options</th>
<th>(2) Firm specific control</th>
<th>(3) Non-option compensation</th>
<th>(4) No matching variables</th>
<th>(5) All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vega(Non-executive)</td>
<td>-0.0354521</td>
<td>-0.0413399</td>
<td>-0.0308238</td>
<td>-0.0275492</td>
<td>-0.0465414</td>
</tr>
<tr>
<td>Delta(Non-executive)</td>
<td>0.0121262</td>
<td>0.0150017</td>
<td>0.0210729</td>
<td>0.0138109</td>
<td>0.0211502</td>
</tr>
<tr>
<td>Vega(Executive)</td>
<td>0.0014151***</td>
<td>0.0015699***</td>
<td>0.0012458***</td>
<td>0.0015667***</td>
<td>0.0016219***</td>
</tr>
<tr>
<td>Delta(Executive)</td>
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<td>0.0000044</td>
<td>0.0003042</td>
<td>0.0003374</td>
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<tr>
<td>ROA</td>
<td>-0.6663977*</td>
<td>-0.663977**</td>
<td>-0.6353401</td>
<td>-0.6492290*</td>
<td>-0.6492290*</td>
</tr>
<tr>
<td>Log(assets)</td>
<td>0.0167598</td>
<td>-0.0353401</td>
<td>-0.0200908</td>
<td>-0.0200908</td>
<td>-0.0200908</td>
</tr>
<tr>
<td>Book to market</td>
<td>0.0073291</td>
<td>0.0725410</td>
<td>0.0012900</td>
<td>0.0012900</td>
<td>0.0012900</td>
</tr>
<tr>
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<td>-0.0047641</td>
<td>-0.0014197</td>
<td>-0.0014197</td>
<td>-0.0014197</td>
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<td>Z-Score</td>
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<td>-0.0014197</td>
<td>-0.0014197</td>
<td>-0.0014197</td>
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<td>Free-cash dummy</td>
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<td>-0.0826427</td>
<td>-0.0826427</td>
<td>-0.0826427</td>
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<td>Market Value</td>
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<td>-0.0000019</td>
<td>-0.0000017</td>
<td>-0.0000017</td>
<td>-0.0000017</td>
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<td>Log(1+bonus)</td>
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<td>0.0045427</td>
<td>0.0045427</td>
<td>0.0045427</td>
<td>0.0045427</td>
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<tr>
<td>Log(1+salary)</td>
<td>0.1277905***</td>
<td>0.1608337*</td>
<td>0.1647072*</td>
<td>0.1647072*</td>
<td>0.1647072*</td>
</tr>
<tr>
<td>Log(1+LTIP)</td>
<td>-0.0178571</td>
<td>-0.0175213</td>
<td>-0.0180899</td>
<td>-0.0180899</td>
<td>-0.0180899</td>
</tr>
<tr>
<td>Restricted shares intensity</td>
<td>-0.0084443</td>
<td>-0.0108072*</td>
<td>-0.0108072*</td>
<td>-0.0108072*</td>
<td>-0.0108072*</td>
</tr>
<tr>
<td>Constant</td>
<td>0.3626927***</td>
<td>0.2131671</td>
<td>-0.6257593</td>
<td>-0.6866393</td>
<td>-0.7259478</td>
</tr>
<tr>
<td>Observations</td>
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<td>947</td>
<td>733</td>
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<tr>
<td>Adjusted R-squared</td>
<td>0.0049</td>
<td>0.0093</td>
<td>0.0141</td>
<td>0.0128</td>
<td>0.0146</td>
</tr>
<tr>
<td>Industry FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1
### Table 14
Regression Results Based on Propensity Score Matching on Three Variables: Market Value, ROA, and Debt to Asset

This is our main table with three variables matched: market value, ROA, and debt to asset. Dependent variable is a zero one dummy. If firms are in litigation, they are assigned value of 1 and 0 otherwise. All the option compensations are scaled to per employee both executive and non-executive. The regressions have five model based on the set of control variables. (1) include only wealth-option sensitivity variables (2) include firm specific controls (3) include non-option compensation of executives (4) exclude matching variables (5) include all variables. We also perform year and industry fixed effects.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Options</th>
<th>(2) Firm specific control</th>
<th>(3) Non-option compensation</th>
<th>(4) No matching variables</th>
<th>(5) All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vega(Non-executive)</td>
<td>-0.0041896</td>
<td>0.0188657</td>
<td>0.0009121</td>
<td>0.0088123</td>
<td>0.0163613</td>
</tr>
<tr>
<td>Delta(Non-executive)</td>
<td>-0.0337184</td>
<td>-0.0167526</td>
<td>-0.0289674</td>
<td>-0.0125885</td>
<td>-0.0088909</td>
</tr>
<tr>
<td>Vega(Executive)</td>
<td>0.0011959***</td>
<td>0.0012882***</td>
<td>0.0009556**</td>
<td>0.0011161***</td>
<td>0.0011098**</td>
</tr>
<tr>
<td>Delta(Executive)</td>
<td>0.0002013</td>
<td>0.0003614</td>
<td>0.0000877</td>
<td>0.0003784</td>
<td>0.0003110</td>
</tr>
<tr>
<td>ROA</td>
<td>0.4266269</td>
<td>0.4116943</td>
<td>0.4116943</td>
<td>0.4116943</td>
<td>0.4116943</td>
</tr>
<tr>
<td>Log(assets)</td>
<td>-0.0242411</td>
<td>-0.0375565*</td>
<td>-0.0546616**</td>
<td>0.0114533</td>
<td>0.0097092</td>
</tr>
<tr>
<td>Book to market</td>
<td>0.1671387***</td>
<td>0.1203979***</td>
<td>0.1588069***</td>
<td>0.1588069***</td>
<td>0.1588069***</td>
</tr>
<tr>
<td>Total debt to total assets</td>
<td>0.0589675</td>
<td>0.0140548</td>
<td>0.0140548</td>
<td>0.0140548</td>
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<tr>
<td>Z-Score</td>
<td>-0.0084354</td>
<td>-0.0043245</td>
<td>-0.0043245</td>
<td>-0.0043245</td>
<td>-0.0043245</td>
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<tr>
<td>Free-cash dummy</td>
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<td>-0.0515265</td>
<td>-0.0315261</td>
<td>-0.0515265</td>
<td>-0.0315261</td>
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<tr>
<td>Market Value</td>
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<td>0.0000022</td>
<td>0.0000022</td>
<td>0.0000022</td>
<td>0.0000022</td>
</tr>
<tr>
<td>Log(1+bonus)</td>
<td>0.032993***</td>
<td>0.0092825</td>
<td>0.0092825</td>
<td>0.0092825</td>
<td>0.0092825</td>
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<tr>
<td>Log(1+salary)</td>
<td>0.0683212</td>
<td>0.1268745</td>
<td>0.1363270*</td>
<td>0.1363270*</td>
<td>0.1363270*</td>
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<tr>
<td>Log(1+LTIP)</td>
<td>0.0568899</td>
<td>0.1968588</td>
<td>0.0194523</td>
<td>0.0194523</td>
<td>0.0194523</td>
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<td>-0.0064321</td>
<td>-0.0064321</td>
<td>-0.0064321</td>
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<td>Constant</td>
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<td>0.3590030*</td>
<td>-0.2991950</td>
<td>-0.5287469</td>
<td>-0.491283</td>
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</tbody>
</table>

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1
Table 15
Regression Results of interaction terms between executives and non-executive compensation sensitivities.

This table shows the results of interaction terms. The suffix "-Non" means non-executive employees and "-Ex" means executives. For instance, DeltaNon is delta of non-executive employees while VegaEx is vega of executive employees. All the option compensations are scaled to per employee both executive and non-executive. The regressions have five models based on the set of control variables. (1) include only wealth-option sensitivity variables (2) include firm specific controls (3) include non-option compensation of executives (4) exclude matching variables (5) include all variables. We also perform year and industry fixed effects.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Options</th>
<th>(2) Firm specific control</th>
<th>(3) Non-option compensation</th>
<th>(4) No matching variables</th>
<th>(5) All</th>
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<tbody>
<tr>
<td>DeltaNon*DeltaEx</td>
<td>0.00065</td>
<td>0.00033</td>
<td>0.00071</td>
<td>0.00072</td>
<td>0.00055</td>
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<tr>
<td></td>
<td>(0.77)</td>
<td>(0.36)</td>
<td>(0.86)</td>
<td>(0.79)</td>
<td>(0.62)</td>
</tr>
<tr>
<td>DeltaNon*VegaEx</td>
<td>-0.00186**</td>
<td>-0.00164</td>
<td>-0.00175**</td>
<td>-0.00214</td>
<td>-0.00206</td>
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<tr>
<td></td>
<td>(-2.57)</td>
<td>(-6.74)</td>
<td>(-2.54)</td>
<td>(-0.96)</td>
<td>(-0.92)</td>
</tr>
<tr>
<td>VegaNon*DeltaEx</td>
<td>0.00110***</td>
<td>0.00150**</td>
<td>0.00108***</td>
<td>0.00131**</td>
<td>0.00144**</td>
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<tr>
<td></td>
<td>(2.15)</td>
<td>(2.54)</td>
<td>(2.10)</td>
<td>(2.24)</td>
<td>(2.39)</td>
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<tr>
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<td>0.00287***</td>
<td>0.00236***</td>
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<td>0.00287**</td>
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<tr>
<td></td>
<td>(3.89)</td>
<td>(3.64)</td>
<td>(3.69)</td>
<td>(3.53)</td>
<td>(3.65)</td>
</tr>
<tr>
<td>ROA</td>
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<td>0.52189</td>
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</tr>
<tr>
<td></td>
<td>(1.64)</td>
<td></td>
<td></td>
<td>(1.59)</td>
<td></td>
</tr>
<tr>
<td>Log(assets)</td>
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<td>-0.05303**</td>
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<tr>
<td></td>
<td>(-0.79)</td>
<td></td>
<td>(-1.79)</td>
<td>(-2.02)</td>
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<tr>
<td>Book to market</td>
<td>0.18358***</td>
<td>0.12766***</td>
<td>0.12777***</td>
<td>0.17377***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.74)</td>
<td>(3.03)</td>
<td>(3.03)</td>
<td>(3.34)</td>
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</tr>
<tr>
<td>Total debt to total assets</td>
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<td>-0.00404</td>
<td>-0.01144</td>
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<tr>
<td></td>
<td>(0.34)</td>
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<td>(-0.04)</td>
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<tr>
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<td>-0.00404</td>
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<tr>
<td></td>
<td>(-1.10)</td>
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<td>(-0.58)</td>
<td>(-1.27)</td>
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</tr>
<tr>
<td>Free-cash dummy</td>
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<tr>
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<td>(-0.15)</td>
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<tr>
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<td></td>
<td>0.00000</td>
<td>0.00000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.66)</td>
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<td>(0.79)</td>
<td>(0.79)</td>
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</tr>
<tr>
<td>Log(1+bonus)</td>
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<td>0.01414***</td>
<td>0.01088*</td>
<td>0.01088*</td>
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<tr>
<td></td>
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<td>(2.72)</td>
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</tr>
<tr>
<td>Log(1+salary)</td>
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<td>0.05230</td>
<td>0.14274*</td>
<td>0.14914*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.23)</td>
<td>(1.91)</td>
<td>(1.95)</td>
<td></td>
</tr>
<tr>
<td>Log(1+LTIP)</td>
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<td>(1.36)</td>
<td>(1.35)</td>
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<td></td>
<td></td>
<td>(-0.12)</td>
<td>(-1.03)</td>
<td>(-0.86)</td>
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<td>0.37074*</td>
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<td></td>
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<td>971</td>
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<td>770</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
We separated sample into two by book to market value: above median (low growth firms) and below median (high growth firms). Panel A, from (1) to (5), represents the regression results of high growth firms. Panel B, from (6) to (10), represents the regression results of low growth firms. The regressions have five models based on control variables for each Panel. (1) and (6) include only wealth-option sensitivity variables (2) and (7) include firm specific controls (3) and (8) include non-option compensation of executives (4) and (9) exclude matching variables (5) and (10) include all variables. We also perform year and industry fixed effects. Dependent variable is a zero one dummy. If firms are in litigation, they are assigned value of 1 and 0 otherwise. All the option compensations are scaled to per employee both executive and non-executive.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Panel A: High growth firms (book to market value below median)</th>
<th>Panel B: Low growth firms (book to market value above median)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) Options</td>
<td>(2) Firm specific control</td>
</tr>
<tr>
<td>Vega(Non-executive)</td>
<td>-0.0319568</td>
<td>-0.04530267</td>
</tr>
<tr>
<td>Delta(Non-executive)</td>
<td>-0.0173769</td>
<td>-0.04518520</td>
</tr>
<tr>
<td>Vega(Executive)</td>
<td>0.00013183**</td>
<td>0.00012117**</td>
</tr>
<tr>
<td>Delta(Executive)</td>
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<td>0.00016880</td>
</tr>
<tr>
<td>ROA,</td>
<td>0.5865680</td>
<td>0.10700000</td>
</tr>
<tr>
<td>Log(asset)</td>
<td>-0.739933**</td>
<td>-0.06522800</td>
</tr>
<tr>
<td>Book to market</td>
<td>-0.014153</td>
<td>-0.02420000</td>
</tr>
<tr>
<td>Total debt to total assets</td>
<td>0.142153</td>
<td>0.06400000</td>
</tr>
<tr>
<td>Z-Score</td>
<td>-0.079909</td>
<td>-0.00947000</td>
</tr>
<tr>
<td>Free-cash dummy</td>
<td>0.1777587</td>
<td>0.1576891</td>
</tr>
<tr>
<td>Market Value</td>
<td>0.00036777</td>
<td>0.00000747</td>
</tr>
<tr>
<td>Log(1-bonus)</td>
<td>0.012100</td>
<td>0.004178</td>
</tr>
<tr>
<td>Log(1-salary)</td>
<td>0.0299968</td>
<td>0.2188683**</td>
</tr>
<tr>
<td>Log(1-LTIP)</td>
<td>0.0000750</td>
<td>0.013718</td>
</tr>
<tr>
<td>Restricted shares intensity</td>
<td>-0.0001222</td>
<td>-0.00790900</td>
</tr>
<tr>
<td>Constant</td>
<td>0.3040551*</td>
<td>0.55405300</td>
</tr>
<tr>
<td>Observations</td>
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<td>413</td>
</tr>
<tr>
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<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

**Robust t-statistics in parentheses**

*** p<0.01, ** p<0.05, * p<0.1
Table 17
Regression Results of interaction terms between executives and non-executive compensation sensitivities for high growth firms.

This table shows the results of interaction terms. The suffix "-Non" means non-executive employees and "-Ex" means executives. For instance, DeltaNon is delta of non-executive employees while VegaEx is vega of executive employees. All the option compensations are scaled to per employee both executive and non-executive. The regressions have five model based on the set of control variables. (1) include only wealth-option sensitivity variables (2) include firm specific controls (3) include non-option compensation of executives (4) exclude matching variables (5) include all variables. We also perform year and industry fixed effects.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Options</th>
<th>(2) Firm specific control</th>
<th>(3) Non-option compensation</th>
<th>(4) No matching variables</th>
<th>(5) All</th>
</tr>
</thead>
<tbody>
<tr>
<td>DeltaNon*DeltaEx</td>
<td>0.00043</td>
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Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
## Appendix

### Appendix A

**Sources of Option Inputs**

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## Appendix B

### Description of Option Variable in COMPUSTAT

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<td>OPTFVGR</td>
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<td>After 2003, availability depend on availability of other variables such as life, dividend, vol</td>
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## Appendix C
### Summary Number of Firms Overlapped between Compustat and Execucomp
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