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Executive Option Mix and Firm Litigation Risk

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Abstract

Compensating executives with stock options creates incentives for executives and aligns their goals with shareholders. When examining specific components of equity-based compensation, stock options have a larger incentive effect on executives compared to stock awards as options are priced as a function of stock volatility. Since the option incentive effect is more profound than the stock incentive effect, executives may take on more risk. The relationship between firm risk and litigation can be demonstrated by the pricing of directors' and officers' liability insurance, which protects them from the costs of litigation. The purpose of this study is to examine the mix of executive stock options to total stock-based compensation and its effect on firms' litigation risk, specifically looking at firms' CEOs. I find evidence that rejects my hypothesis; a larger mix of options to stock-based compensation is associated with lower risk of litigation; the relationship is not significant in all tests.

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1. Introduction

The utilization of stock-based compensation, specifically options, has grown over time (Coles, Daniel, and Naveen, 2006). As more compensation come in the form of stock options and equity, it is important to understand the effects and consequences of that change. Evidence has shown that higher levels of executive stock incentives are associated with better firm performance (Hall and Liebman, 1998) and are a riskier form of compensation than restricted stock awards or units (Cohen, Hall, and Viceira, 2000; Bryan, Hwang, and Lilien, 2000). In addition, past literature has documented the relationship between stock-based compensation and firm risk is strong as well (Rajgopal and Shevlin, 2002; Armstrong and Vashishtha, 2012). However, economists have done little work to determine the litigation risk levels associated with a specific mix of stock options to total stock-based compensation. In addition, risk measures in past studies include capital investment, capital structure, and oil and gas exploration risk. I extend previous research by measuring risk through firm litigation. According to Armstrong and Vashishtha, (2012), the relationship between litigation and firm risk can be demonstrated by the pricing of directors' and officers' liability insurance, which protects them from the costs of litigation. Insurers hope to identify possible risky behavior to assess the probability of litigation and subsequent damages more accurately.

Overall, if executives are paid in stock, they will be more aligned with shareholders (Hall et al., 1998). Additionally, research by Mehran (1995) and Himmelberg, Hubbard, and Palia (1999) provide evidence of a positive relationship between equity-based executive compensation and firm performance. Furthermore, Bryan et al.(2000) and Cohen et al.(2000) examine specific components of equity-based compensation, showing a statistical difference in stock options and stock award incentives; stock options have a larger incentive effect on executives. Compared to stock awards, options are priced as a function of stock volatility. Cohen et al. (2000) find that the leveraged payoff

profile for options does appear to provide incentives for executives to take actions to increase to value of their options.

Denis, Hanouna, Sarin (2006) set up the basis for my study, examining the relationship between executive incentive intensity and the likelihood of litigation. The authors find that there is a significant positive association between the two. However, the study measured stock option and stock award intensity, and not the structure of the compensation plan. Option intensity is defined as the sensitivity of the executive's option to changes in the firm's stock price.

The purpose of this study is to examine the mix of executive stock options to total stock-based compensation and its effect on firms' litigation risk, specifically looking at firms' CEOs. Additionally, I investigate whether executive gender and age, and firm industry and company size affect the relationship. I predict that there is a strong relationship between a larger ratio of stock options to total stock-based compensation and an increased probability of litigation. Because the option incentive effect is more profound than the stock incentive effect, executives will take on more risk leading to litigation.

In addition to my hypothesis, there are many cross-tests that I investigate. I examine four variables: industry, executive gender, executive age, and firm-size. Past literature has shown that firms with high growth utilize stock options more often (Sesil, Kroumova, Blasi, and Kruse, 2002). The specific industry I focus on is the technology sector because the industry is more volatile. Faccio, Marchica, and Mura (2016) study the relationship between executive gender and risk-taking behavior and find that women-led firms experience lower leverage and overall exhibit less risk. Gender is an important factor in risk-taking behavior that results in litigation. Forbes (2005) finds evidence suggesting younger CEOs are susceptible to taking risks; such actions may have an impact on firms and can lead to litigation. Furthermore, Yermack (1995) show that firm-size is significantly related to firm risk, which may cause potential litigation. Smaller firms are subject to greater risk because of smaller boards of directors, less oversight, and lack of diversity in investments. The

author finds evidence for executives of smaller firms taking on more risk because of stock option incentives than executives of larger firms.

To conduct my study, I examine compensation, litigation, and firm data during the period 2011-2020. I extracted three sets of data from Wharton Research Data Services. I use Audit Analytics to track all categories of filed lawsuits in which firms are involved, CompuStat to retrieve firm historical financials, and ExecuComp to obtain information on executive compensation. CompuStat provides market data for over 80,000 publicly traded companies. Because there is a delay as to when litigation occurs following compensating executives, I extract 2021 litigation data from Audit Analytics to account for compensation observations in 2020. Variables to control the regression include: executive age, tenure, gender, ratio of salary to total compensation, and other firm measures from CompuStat. All executives in the sample are firm CEOs listed on ExecuComp.

This study is valuable to compensation committees, who are charged with the responsibility of establishing executive payment plans that fairly compensate management; ideally, committees are also aligning executive goals with shareholders. The compensation policy needs to be fully disclosed and discussed in the Compensation Discussion & Analysis section of the annual proxy statement (Form DEF 14A). Shareholders closely scrutinize this disclosure and proxy advisory firms such as Glass Lewis and ISS examine and publicly opine on compensation policies (Shapiro, 2020).

Given the importance of executive compensation, boards of directors and compensation committees spend a great deal of time designing compensation plans. Often, committees use outside compensation consultants to vet their plans, providing important benchmarking comparisons to other public companies. Boards address a number of key issues surrounding executive compensation plans such as:

- The level of total compensation
- The make-up of that compensation: cash, stock awards, stock options

- Vesting schedules
- Performance incentives that dictate the vesting of stock or options
- Clawback provisions that can help manage various risks the company faces

Making changes in one of these provisions can have a major impact on the goals of the plans and the risks firms face. An important role played by the board is to understand and help mitigate the risks that arise from a company's compensation program. Specifically, boards need to determine if compensation plans can create materially undesired risks; this process, which often includes input from human resource, legal, and finance departments must be documented and disclosed in proxy statements.

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2. Hypothesis Development

Stock-based compensation has been a widely researched aspect of executive compensation. Many economists have studied the relationship between stock compensation and firm performance, as well as varying firm risk measures (Hall et al., 1998; Rajgopal et al., 2002; Denis et al.et al., 2006; Armstrong et al., 2012). However, few economists have considered the mix of stock options to total stock-based compensation and how that relates to litigation risk.

U.S. companies began using stock options to compensate executives in the 1950s. A multitude of factors influenced the decision. First, marginal tax rates were as high as 91%, creating a heavy tax burden for high earners. Congress's passing of the 1950 Revenue Act included a provision that reduced the tax rate on the sale of stock options to the capital gains rate of only 25%. Within one year, the compensation of 18% of executives in the U.S. included stock options. The percentage rose to more than 50% by the next decade.

An effort by lawmakers to force highly paid and wealthy individuals to pay their fair share of taxes drove the adoption of the alternative minimum tax in 1969. Additionally, evidence showed that 155 people with income over $200,000 had legally paid no income tax, or about $1.2 million today. These deductions allowed for reduced tax liabilities that included accelerated depreciation, tax exempt interest, and income from incentive stock options (Fleenor and Chamberlain, 2005).

In 1976, partly in reaction to an option back-dating scandal, Congress passed new tax regulations that ultimately restrained qualified stock option plans as they were taxed as ordinary income; at the time, the tax rate on income was as high as 70%. As a result, there was a notable drop in options as a form of compensation. The passage of President Ronald Reagan's Economic Recovery and Tax Act in 1981 worked to tax gains on options as capital gains rather than ordinary income, once again increasing their popularity. The tax code was changed again in the 1990s, causing option gains to be taxed as ordinary income (Secfi, 2021).

Due to both growing utilization of stock options as a form of compensation and rising equity values, the amount of stock options among US executives grew fifteen times during the 1990s. Later in that decade, the compensation of over 80% of US executives included stock options. These options created tremendous wealth during the Dot-Com bubble of the late 1990s, but the bursting of the bubble in March of 2000 saw much of this wealth evaporate (Tsang and Bachelder, 2014).

Sizable moves in equity values can affect the willingness of companies to issue options to executives; following the slide in stocks in 2000, options grants fell relative to the grants of outright shares. There was a similar impact due to the decline in stock prices following the financial crisis of 2008. In 2006, the introduction of FAS 123R resulted in a charge against earnings for option grants and stock awards. This accounting change did cause some companies to reduce or eliminate the issuance of executive stock options and awards, but others reported pro forma earnings that excluding these non-cash expenses (Berman and Knight, 2014).

Scrutiny of executive compensation plans increased following the 2008 financial crisis with the

passage of the Dodd-Frank Act in July 2010; the act required a say-on-pay vote for public companies. FAS 123R and the Dodd-Frank Act caused a decline in stock options awards relative to restricted share compensation. As in past disruptive equity markets, the recent COVID-19 induced recession in 2020 and the increase in economic uncertainty resulted in a decline in executive stock option utilization (Emanual, 2012).

In terms of literature, Hall et al. (1998) find that level of executive stock-based compensation and responsiveness of compensation to firm performance has risen over time. This evidence counters previous empirical studies such as Jensen and Murphy (1990), who find that on average compensation is independent of firm performance. In addition to Hall et al. (1998), Coles et al. (2006) did further research into the effects of executive incentives. They show that there is a strong causal relationship between sensitivity of executive compensation and investments in R&D and PPE, and a higher leveraged capital structure. The study provides evidence behind incentive theory: when managers are compensated with stock, there is an incentive to be more aligned with shareholders. Additionally, Mehran (1995) and Himmelberg et al.(1999) find evidence of a positive relationship between equity-based executive compensation and firm performance.

The potential financial rewards of option incentives are greater than stock awards if a firm's stock performs well; the amount depends on the specifics of the option grant, however, in most cases, the difference is material (Cohen et al., 2000). Compared to stock awards, options are priced as a function of stock volatility. According to Cohen et al. (2000) the leveraged payoff profile for options does appear to provide incentives for executives to take actions to increase the value of their options; This can be done through taking on riskier investments and increasing the leverage of the firm. However, the authors conclude that the added firm risk resulting from investment was not necessarily damaging to shareholders.

There are several ways of measuring the risk associated with executive compensation plans and the use of stock options. Bryan et al. (2000) analyze both the mix of stock options to cash

compensation and stock awards to cash compensation and noted the differences. The authors find strong evidence for a relationship between an increased mix in stock compensation and firm investment opportunity, and volatile earnings relative to stock returns. Denis et al. (2006) examine the relationship between executive incentive intensity and the likelihood of litigation and find a significant positive association. However, the study measured stock option and stock award intensity, not the structure of the compensation plan. Additionally, the study uses a sample of security class actions rather than all forms of litigation. Studying all forms of litigation allows me to pick up a broader array of risks that firms face.

Rego and Wilson (2012) build on this framework finding there is an economically significant relationship between executive stock compensation and risky tax practices that generate gains for the firm and shareholders. Not only do executives take on riskier investments as a result of stock-based compensation, but also undertake more aggressive tax positions. Using Donelson, Glenn, and Yust's (2021) work that there is higher litigation risk due to increased tax aggressiveness following Fin 48 in 2007, I predict that there may be evidence that stock-based compensation can lead to aggressive tax positions which put the company at higher risk of litigation.

Armstrong et al. (2012) study how executive stock options incentivize CEOs to alter their firm's risk profile, both on a systemic and idiosyncratic basis. The authors looked at both stock performance, delta, and the volatility around stock options, vega, and the effect on company risk. They found that vega provides managers with incentives to invest in projects that increase their company's total risk by increasing systematic risk but not idiosyncratic risk. They concluded that stock options might not always encourage CEOs to pursue investments that are largely characterized by idiosyncratic risk when projects with systematic risk can be pursued. Baker, Collins and Reitenga (2003) examined the concept of risk by considering the relationship between stock option compensation and the manipulation of financial disclosures through the use and timing of discretionary accruals. Specifically, the authors sought to determine if executives who are

compensated with stock options try to depress share prices prior to award grants through the release of certain financial information and the use of discretionary accrual components of earnings. They conclude that high levels of option compensation are associated with discretionary accruals that depress earnings in periods leading up to option award dates. Any manipulation of financial disclosure adds an unwanted risk to a company over time.

In this study, I measure a firm's risk with evidence of litigation, linking the prevalence of litigation with operating risk for a company. The relationship between litigation and firm risk is well documented and can be demonstrated by the pricing of directors' and officers' liability insurance which protects them from the costs of litigation (Cao et al., 2012). Pricing such products involves predicting the frequency and severity of litigation. Insurers consider numerous factors such as corporate governance, and accounting restatements. Insurers hope to identify possible risky behavior that will allow them to assess the probability of litigation and subsequent damages more accurately.

Overall, I believe there is a relationship between a higher mix of stock options to total stock-based compensation and higher probability of litigation in firms. Options give strong incentives for executives to implement riskier policy choices which increase risk in litigation, more so than stock awards. Finding evidence on more effective executive compensation can benefit companies primarily implementing stock-based compensation.

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3. Data and Methodology

3.1 Variables and Model

I utilize two types of regression models to test the hypothesis. I use the following equation to test a linear and logistic regression:

Equation (1)

$$LIT\_FLAG_{i,t+1} = \beta_0 + \beta_1 OPTION\_MIX_{i,t} + \beta_2 AGE_{i,t} + \beta_3 YRS\_AS\_CEO_{i,t} + \beta_4 GENDER\_FLAG_{i,t} + \beta_5 SALARY\_TC_{i,t} + \beta_6 AQC\_FLAG_{i,t} + \beta_7 DEBT\_AT_{i,t} + \beta_8 NEG\_EPS\_FLAG_{i,t} + \beta_9 EBITDA\_AT_{i,t} + \beta_{10} MRKT\_VALT_{i,t} + \varepsilon_{i,t}$$

The independent variable I analyze is *OPTION_MIX*, which is defined as the ratio of the grant date fair value of options awards to the grant date fair value of total stock-based compensation (the sum of option awards and stock awards). LIT_FLAG_{t+1} is the dependent variable in my model. Because there is a delay as to when litigation occurs following compensating executives, the variable is 1 when companies experience litigation the year after an executive is paid and 0 when there is no litigation that next year. I use 2021 litigation data from Audit Analytics to account for executive observations in 2020.

I utilize explanatory variables that are consistent with past literature (Coles et al., 2006; Rego et al., 2012). Specifically, I control for executive characteristics including the number of years the executive has worked at the firm (*YRS_AS_CEO*), the gender of the executive (*GENDER_FLAG*), and the age of the executive in years (*AGE*). *GENDER_FLAG* is 1 if the executive is male and 0 if female. Additionally, I control for several firm characteristics including whether the firm had an acquisition that year (*AQC_FLAG*), the company's leverage ratio measured as debt to assets (*DEBT_AT*), whether the firm reported negative diluted earnings per share (*NEG_EPS_FLAG)*, the firm's profitability which scales EBITDA by total assets (*EBITDA_AT*), and the natural logarithm of the firm's market value (*MRKT_VALT)*. *AQC_FLAG* is either a 1 or 0 whether the firm completes an acquisition in that given year or not, respectively. If a company reports negative earnings in that period, *NEG_EPS_FLAG* will be 1, and 0 if positive earnings are reported. To account for executive risk caused by other aspects of compensation, I control for the executive's salary as a percent of total compensation (*SALARY_TC*), consistent with past cash compensation literature (Bryan et al., 2000).

I include fixed effects, year and industry, in my regression model to account for the change in option mix over time and by industry. Bettis, Bizjak, and Lemmon (2005) examine the factors that affect the valuation of options and the exercise behavior of option holders. Consistent with their analysis, I use indicator variables for each industry and year.

3.2 Sample Selection Process

Three separate data sets are necessary for testing my hypothesis. Executive compensation data is from ExecuComp and includes all US company executives from 2011 to 2020. Annual fundamental data is from CompuStat and lists all US company financials from 2011 to 2020. Lastly, Audit Analytics is the source of company litigation data. The data set tracks all US company litigation from 2011 to 2021 (an extra year is included in the set because of the lead in LIT_FLAG_{t+1}). I merged the information based on GVKey and CIK company identifiers. Limiting executives to CEOs provided consistency with prior literature. Additionally, I needed to account for an extra year of litigation data due to the lag in risky decision-making and subsequent lawsuits. Starting with the executive compensation data, I create a CEO flag to specify the executives needed for the sample. Before filtering, I had 106,654 observations; I exclude 86,902 observations in the process.. After merging the executive data with the firm and litigation data using GVKey and CIK identifiers, the set needs to be cleaned. There are 7,294 observations with missing CIK identifiers and could not be merged. With the $MRKT\_VALT$ variable in the regression, 2,430 observations with no listed market value are deleted. After filtering, there are still 82 firms with missing asset, EBITDA, or EPS values. Observations with executive tenure less than zero are omitted, which includes 151. Lastly, I filter out N/A values in *OPTION_MIX*, when executives are not paid in stock compensation; this process includes 984 observations. Because I test my hypothesis in specifically the technology industry, I include firms with SIC code 73 in that regression. I compute additional

regression by other variables including *AGE*, *GENDER_FLAG*, and *MRKT_VALT*. Table 1 outlines my sample selection procedure.

Table 1
Descriptive Statistics

Sample Data:

US executive compensation data between 2011 and 2020 in ExecuComp	106,654
Less: executives that are not CEO	(86,902)
Less: executive compensation observations with missing CIK identifier	(7,294)
Less: companies with no listed market value	(2,430)
Less: observations with missing assets, EBITDA, or EPS values	(82)
Less: observations with "negative" years as CEO	(151)
Less: executives not paid in any type stock-based compensation	(984)
Final Sample	8,811

3.3 Descriptive Statistics and Variable Correlation

Table 2 provides descriptive statistics on LIT_FLAG_{t+1}, *OPTION_MIX* and all other control variables listed in Equation (1). Mean, median, standard deviation, quartile data are included in the descriptive statistic tables. Interestingly, at least 25% of all executives in the sample do not get compensated in stock options. Additionally, the mean salary to total compensation ratio is 23% for

the sample. Descriptive statistics for cross-tests are provided in the additional analysis section of the paper.

Table 3 illustrates the correlation between all variables in Equation (1). Above the diagonal, I calculate the Spearman's rank correlation. I also compute the Pearson's correlation coefficient below the diagonal. In the correlation matrix, nine out of the ten variables are significantly correlated to LIT_FLAG_{t+1}. This fact indicates that I effectively choose variables to include in my regression. Moreover, *MRKT_VALT* is most significantly correlated to LIT_FLAG_{t+1}, while the correlation of the dependent variable in question, *OPTION_MIX*, is somewhat significant.

Table 2
Descriptive Statistics

Sample Selection (n = 8,811)

	Mean	Median	Standard Deviation	1st Quartile	3rd Quartile
LIT_FLAG t+1	0.15	0.00	0.36	0.00	0.00
OPTION_MIX	0.26	0.16	0.31	0.00	0.46
AGE	57.01	57.00	6.71	53.00	61.00
YRS_AS_CEO	7.213	5.00	7.23	2.00	10.00
GENDER__FLAG	0.95	1.00	0.22	1.00	1.00
SALARY_TC	0.23	0.16	0.16	0.11	0.23
AQC_FLAG	0.49	0.00	0.50	0.00	1.00
DEBT_AT	0.25	0.23	0.23	0.07	0.37
NEG_EPS_FLAG	0.18	0.00	0.38	0.00	0.00
EBITDA_AT	0.12	0.12	0.14	0.08	0.17
MRKT_VALT	8.18	8.11	1.75	6.92	9.31

Table 3
Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11
1. *LIT_FLAG $_{t+1}$*		**0.02**	**-0.01**	**-0.02**	-0.01	**-0.15**	**0.04**	**0.02**	**-0.02**	**0.03**	**0.21**
2. *OPTION_MIX*	**0.02**		**-0.03**	0.01	**0.03**	**-0.04**	**0.06**	**0.05**	**-0.02**	**0.09**	**0.09**
3. *AGE*	**-0.01**	**-0.01**		**0.39**	**0.03**	**0.01**	-0.01	**-0.03**	**-0.04**	**0.02**	**0.02**
4. *YRS_AS_CEO*	**-0.03**	**0.07**	**0.48**		**0.07**	**0.09**	**0.04**	**-0.05**	**-0.09**	**0.02**	**-0.06**
5. *GENDER__FLAG*	-0.01	**0.05**	**0.05**	**0.08**		**0.02**	**0.05**	**0.05**	**0.03**	**0.01**	**-0.01**
6. *SALARY_TC*	**-0.13**	**0.14**	**0.03**	**0.13**	0.01		**-0.12**	**-0.18**	**0.12**	**-0.14**	**-0.59**
7. *AQC_FLAG*	**0.05**	0.01	-0.01	**0.02**	**0.06**	**-0.13**		**0.11**	**-0.15**	**0.08**	**0.18**
8. *DEBT_AT*	0.01	0.01	**-0.03**	**-0.04**	**0.04**	**-0.11**	**0.05**		**0.09**	**0.04**	**0.15**
9. *NEG_EPS_FLAG*	**-0.02**	**0.02**	**-0.04**	**-0.05**	**0.03**	**0.15**	**-0.15**	**0.10**		**-0.49**	**-0.33**
10. *EBITDA_AT*	**0.01**	**-0.05**	**0.02**	0.01	-0.00	**-0.16**	**0.09**	0.01	**-0.42**		**0.28**
11. *MRKT_VALT*	**0.22**	**-0.03**	**0.02**	**-0.09**	**-0.02**	**-0.53**	**0.17**	**0.08**	**-0.34**	**0.28**	

4. Results

4.1 Descriptive Statistics Results

Table 2 above discusses the descriptive statistics for the full data set of 8,811 observations. Given that some variables are binary in nature, the mean can describe the probability of a specific event occurring given the variable. For LIT_FLAG_{t+1}, the probability of a firm in my sample experiencing a litigation in the following period is 15%. Additionally, about 95% of executives in the sample are men. 49% of firms had an acquisition and 18% of firms reported negative earnings

in the current period. The independent variable in question, *OPTION_MIX*, has a mean of 0.26, meaning the average mix of stock options to total stock-based compensation of firms from 2011 to 2020 is 26%. In addition, the 1st quartile for *OPTION_MIX* is 0.00, which indicates than more than 25% of the executives in the sample are not compensated in options.

4.2 Correlation Results

Table 3 above provides the correlation between LIT_FLAG_{t+1}, *OPTION_MIX*, and other control variables in Equation (1). When running Pearson's correlation test, eight out of the ten explanatory variables are significantly correlated to LIT_FLAG_{t+1}. However, when running Spearman's correlation test, nine out of the ten variables are significantly correlated to LIT_FLAG_{t+1}. In addition, only two of the control variables are significantly more correlated to LIT_FLAG_{t+1} than *OPTION_MIX*, including *SALARY_TC* and *MRKT_VALT*. The two most correlated variables to *OPTION_MIX* are *SALARY_TC* and *YRS_AS_CEO*, indicating there is a correlation between the mix of salary to total compensation and profitability, and the mix of stock options to total stock-based compensation.

4.3 Regression Analysis

Table 4 describes the regression results of estimating variables in Equation (1) to test my hypothesis: a larger mix of executive stock options to total stock-based is related to higher levels of firm litigation risk. In both the linear and logistic models, the independent variable in question, *OPTION_MIX*, has a negative coefficient that is not significant at the 1%, 5% or 10% levels. The coefficient suggests that a higher mix of stock options to total stock-based compensation leads to less litigation risk; the result rejects my hypothesis. In terms of explanatory variables, I found most significance in *NEG_EPS_FLAG, EBITDA_AT*, and *MRKT_VALT*. *NEG_EPS_FLAG* has significant,

positive coefficient which is evidence of higher litigation risk for firms that report negative earnings. *EBITDA_AT* has a significant, negative coefficient at the 1% level, indicating that the more profitable firms are, there is less risk for litigation. Lastly, *MRKT_VALT* has a significant, negative coefficient at the 1% level, meaning that larger firms are at a higher risk of litigation. Similarly in the logistic model, *NEG_EPS_FLAG, EBITDA_AT*, and *MRKT_VALT* were the only significant variables, containing the same coefficient sign. For the linear model, the F-statistic of 37.34 indicates a strong significance in the regression, and Adjusted R^2 of 0.091 shows that the variability in the dependent variable is well explained by the variables of choice. The logistic model is more significant with a Pseudo R^2 of 0.131. Both regressions are illustrated in Table 4 below.

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5. Additional Analysis

In addition to my hypothesis, there are many cross-tests that I investigate. I examine four variables: industry, gender, age, and firm-size.

5.1 Industry Cross-Test

Past literature has shown that firms with high growth utilize stock options more often overall (Sesil, Kroumova, Blasi, and Kruse, 2002). I decided to investigate technology companies and compare the results of my hypothesis with non-technology companies. Classifying firms by two-digit SIC code, I use code 73 to indicate if a firm is in the technology industry. There are a total of 731 observations in the technology industry sample and 8,080 observations in the non-technology industry sample. Table 5: Panel A shows the statistical difference in sample means and Table 5: Panel B describes quartile data for the samples.

Table 4
Regression Analysis

	Linear Regression		Logistic Regression	
	Coefficient	**P-Value**	**Coefficient**	**P-Value**
Intercept	-0.148	0.11	-20.85	0.92
OPTION_MIX	-0.019	0.14	-0.155	0.16
AGE	-0.001	0.24	-0.009	0.11
YRS_AS_CEO	0.000	0.56	0.004	0.41
GENDER_FLAG	-0.009	0.58	-0.033	0.82
SALARY_TC	-0.025	0.36	-0.767	0.01
AQC_FLAG	0.000	0.99	0.027	0.68
DEBT_AT	0.002	0.89	-0.013	0.93
NEG_EPS_FLAG	0.075	<0.01	0.640	<0.01
EBITDA_AT	-0.124	<0.01	-0.954	<0.01
MRKT_VALT	0.056	<0.01	0.448	<0.01
Observations	8,811		8,811	
Fixed Effect	Year, Industry		Year, Industry	
F-statistic	33.17		N/A	
Pseudo/Adjusted R^2	0.093		0.129	
Area Under ROC	0.734		0.740	

5.2 Gender Cross-Test

In addition to industry effects, past literature has studied the relationship between executive gender and risk-taking behavior. Faccio, Marchica, and Mura (2016) find that women-led firms experience lower leverage and more likely to remain in operation than companies run by male

Table 5
Industry Descriptive Statistics

Panel A: Statistical difference in sample means

	Technology Industry (n = 731)		Non-Technology Industry (n = 8,080)		
	Mean	**STD.**	**Mean**	**STD.**	**Difference**
LIT_FLAG $_{t+1}$	0.15	0.35	0.16	0.36	0.47
OPTION_MIX	0.20	0.31	0.26	0.31	<0.01
AGE	55.96	7.24	57.10	6.65	<0.01
YRS_AS_CEO	7.95	8.17	7.15	7.14	<0.01
GENDER_FLAG	0.97	0.17	0.95	0.22	0.02
SALARY_TC	0.18	0.18	0.21	0.16	<0.01
AQC_FLAG	0.65	0.48	0.47	0.50	<0.01
DEBT_AT	0.20	0.20	0.26	0.23	<0.01
NEG_EPS_FLAG	0.15	0.36	0.18	0.39	0.05
EBITDA_AT	0.14	0.13	0.12	0.14	<0.01
MRKT_VALT	8.25	1.88	8.08	1.74	0.01

Difference (p-value) statistic is the statistically significant difference between the means of the two samples

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executives. Overall, female executives exhibit less risk-taking, thus at a lower risk of litigation. Baixauli-Soler, Belda-Ruiz, and Sanchez-Marin (2017) provide evidence that gender differences in the stock option risk-taking effect are stronger on a CEO level than a non-CEO level. It is important to analyze firm litigation risk and stock compensation structure by gender. The *GENDER_FLAG* variable indicates whether the executive is male (1) or female (0). Gender descriptive statistics are provided below in Table 6.

Table 5
Industry Descriptive Statistics

Panel B: Quartile data of two samples

	Technology Industry (n = 731)			Non-Technology Industry (n = 8,080)		
	1st Quartile	**Median**	**3rd Quartile**	**1st Quartile**	**Median**	**3rd Quartile**
LIT_FLAG $_{t+1}$	0.00	0.00	0.00	0.15	0.00	0.00
OPTION_MIX	0.00	0.00	0.33	0.00	0.18	0.47
AGE	51.00	56.00	60.00	53.00	57.00	61.00
YRS_AS_CEO	2.00	5.00	11.00	2.00	5.00	10.00
GENDER_FLAG	1.00	1.00	1.00	1.00	1.00	1.00
SALARY_TC	0.07	0.12	0.21	0.23	0.16	0.17
AQC_FLAG	0.00	1.00	1.00	0.46	0.00	0.00
DEBT_AT	0.00	0.14	0.35	0.26	0.24	0.23
NEG_EPS_FLAG	0.00	0.00	0.00	0.00	0.00	0.00
EBITDA_AT	0.09	0.13	0.19	0.08	0.12	0.16
MRKT_VALT	7.07	8.38	9.41	6.99	8.17	9.37

5.3 Age Cross-Test

I choose to include executive age as a cross-test in my empirical study because of the significant effect age has on risk-taking. Forbes (2005) finds evidence suggesting younger CEOs susceptible to taking risks. Such actions may have an impact on firms and can lead to litigation. The *AGE* variable provides the executive's age. In the pooled sample, the mean and median for *AGE* is 57.01 and 57.00, respectively. I create two groups for the cross-test: executives who are older than 57 and executives who are 57 and younger. The descriptive statistics by age are provided below in

Table 6
Gender Descriptive Statistics

Panel A: Statistical difference in sample means

	Male Executives (n = 8,371)		Female Executives (n = 440)		
	Mean	**STD.**	**Mean**	**STD.**	**Difference**
LIT_FLAG $_{t+1}$	0.15	0.36	0.16	0.37	0.18
OPTION_MIX	0.26	0.31	0.19	0.28	<0.01
AGE	57.08	6.76	55.73	5.57	0.71
YRS_AS_CEO	7.341	7.33	4.78	4.48	0.42
SALARY_TC	0.21	0.16	0.20	0.16	0.01
AQC_FLAG	0.49	0.50	0.37	0.48	<0.01
DEBT_AT	0.25	0.23	0.21	0.21	<0.01
NEG_EPS_FLAG	0.18	0.39	0.13	0.34	0.01
EBITDA_AT	0.12	0.14	0.12	0.11	0.27
MRKT_VALT	8.17	1.75	8.32	1.81	0.37

Difference (p-value) statistic is the statistically significant difference between the means of the two samples

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Table 7.

5.4 Firm-Size Cross-Test

The last cross-test I run is the size of the firm to analyze its effect on my hypothesis. Yermack (1995) show that firm-size is significantly related to firm risk, thus litigation. Smaller firms usually have smaller boards of directors and less oversight. Additionally, smaller firms tend to be less diverse in investments and subject to greater risk. The author finds evidence for executives of smaller firms take on more risk because of stock option incentives than executives of larger firms.

Table 6
Gender Descriptive Statistics

Panel B: Quartile data of two samples

	Male Executives (n = 8,371)			**Female Executives (n = 440)**		
	1st Quartile	**Median**	**3rd Quartile**	**1st Quartile**	**Median**	**3rd Quartile**
LIT_FLAG $_{t+1}$	0.00	0.00	0.00	0.00	0.00	0.00
OPTION_MIX	0.00	0.17	0.46	0.00	0.00	0.31
AGE	53.00	57.00	61.00	53.00	56.00	59.00
YRS_AS_CEO	2.00	5.00	10.00	1.00	4.00	7.00
SALARY_TC	0.11	0.16	0.24	0.10	0.15	0.22
AQC_FLAG	0.00	0.00	1.00	0.00	0.00	1.00
DEBT_AT	0.08	0.23	0.37	0.01	0.17	0.35
NEG_EPS_FLAG	0.00	0.00	0.00	0.00	0.00	0.00
EBITDA_AT	0.08	0.12	0.17	0.07	0.12	0.17
MRKT_VALT	7.00	8.11	9.36	7.03	8.15	9.79

diverse in investments and subject to greater risk. In the cross-test, I split the pooled sample into two groups: firms with *MRKT_VALT* greater than 8.11 and firms with *MRKT_VALT* less than or equal to 8.11 (the median of *MRKT_VALT* in the pooled sample). The listed market value of 8.11 is about 3.3 billion (Euler's number to the power of 8.11). I choose to use the median rather than a pre-defined cutoff for large and small sized firms. Table 8 below shows the descriptive statistics for the two samples.

5.5 Cross-Test Regression Analysis

My independent variable in the model, *OPTION_MIX*, is only significant in the gender cross-test.

Table 7
Age Descriptive Statistics

Panel A: Statistical difference in sample means

	Executives Older Than 57 (n = 4,090)		**Executives 57 and Younger (n = 4,721)**		
	Mean	**STD.**	**Mean**	**STD.**	**Difference**
LIT_FLAG $_{t+1}$	0.15	0.36	0.16	0.36	0.16
OPTION_MIX	0.25	0.31	0.26	0.31	0.03
YRS_AS_CEO	9.91	8.60	4.88	4.67	0.04
GENDER_FLAG	0.96	0.20	0.94	0.23	<0.01
SALARY_TC	0.21	0.17	0.20	0.16	<0.01
AQC_FLAG	0.49	0.50	0.49	0.50	0.63
DEBT_AT	0.25	0.22	0.26	0.24	<0.01
NEG_EPS_FLAG	0.16	0.37	0.19	0.40	0.01
EBITDA_AT	0.13	0.13	0.12	0.15	<0.01
MRKT_VALT	8.25	1.80	8.11	1.71	0.26

Difference (p-value) statistic is the statistically significant difference between the means of the two samples

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Specifically, the variable in the male sample group has a significant, negative coefficient at the 5% level. In the female sample group, interestingly *OPTION_MIX* has a much large positive coefficient, though no significant at the 10% level (it is significant at the 15% level). The evidence confirms the theory that women exhibit less risk-taking then men. For all cross-tests (besides the firm-size cross-test) *MRKT_VALT* has a significant, positive coefficient at the 1% level. In the age and firm-size cross test, *NEG_EPS_FLAG* has a significant, positive coefficient across all groups, consistent with my linear regression in Table 4. Another interesting piece of evidence is supported in the technology sample group in the industry cross-test. *GENDER_FLAG* has a significant, negative coefficient at the

Table 7
Age Descriptive Statistics

Panel B: Quartile data of two samples

	Executives Older Than 57 (n = 4,090)			Executives 57 and Younger (n = 4,721)		
	1st Quartile	**Median**	**3rd Quartile**	**1st Quartile**	**Median**	**3rd Quartile**
LIT_FLAG $_{t+1}$	0.00	0.00	0.00	0.00	0.00	0.00
OPTION_MIX	0.00	0.09	0.46	0.00	0.19	0.46
YRS_AS_CEO	4.00	8.00	14.00	1.00	4.00	7.00
GENDER_FLAG	1.00	1.00	1.00	1.00	1.00	1.00
SALARY_TC	0.11	0.16	0.24	0.11	0.16	0.24
AQC_FLAG	0.00	0.00	1.00	0.00	0.00	1.00
DEBT_AT	0.07	0.22	0.36	0.07	0.24	0.38
NEG_EPS_FLAG	0.00	0.00	0.00	0.00	0.00	0.00
EBITDA_AT	0.08	0.12	0.17	0.08	0.12	0.17
MRKT_VALT	6.98	8.18	9.51	7.02	8.05	9.23

1% level, indicating that if women are CEOs in the technology industry, the firm will be at less risk of litigation. In the firm-size cross-test, in both large and small firm samples, *SALARY_TC* had significant, negative coefficients at the 1% level, showing that a higher mix of executive cash salary to total compensation is associated with lower litigation risk. The adjusted R^2 values in all regressions are similar except in the large firm-size sample group. With an adjusted R^2 of 0.029, the large firm-size regression variables may not explain the variability in the dependent variable as well as other sample groups.

Table 8
Firm-Size Descriptive Statistics

Panel A: Statistical difference in sample means

	***MRKT_VALT* Greater than 8.11 (n = 4,413)**		***MRKT_VALT* Less or Equal to 8.11 (n = 4,398)**		
	Mean	**STD.**	**Mean**	**STD.**	**Difference**
LIT_FLAG $_{t+1}$	0.21	0.00	0.10	0.10	<0.01
OPTION_MIX	0.26	0.19	0.26	0.22	<0.01
AGE	57.12	57.00	56.90	57.09	0.92
YRS_AS_CEO	6.64	5.00	7.79	7.92	0.42
GENDER_FLAG	0.95	1.00	0.95	0.95	0.90
SALARY_TC	0.14	0.12	0.27	0.31	<0.01
AQC_FLAG	0.56	1.00	0.41	0.39	<0.01
DEBT_AT	0.26	0.26	0.23	0.23	<0.01
NEG_EPS_FLAG	0.09	0.00	0.27	0.28	<0.01
EBITDA_AT	0.15	0.13	0.10	0.09	<0.01

Difference (p-value) statistic is the statistically significant difference between the means of the two samples

6. Conclusion

Designing compensation plans for senior executives of public companies is a critical role of boards of directors and is among the most scrutinized of boards' responsibilities. Shareholders and proxy advisors examine both the level and make-up of executive's compensation, and how compensation programs motivate leaders. Incentive stock options have been an important component of executive compensation over the past 70 years and has been used as a means of

Table 8
Firm-Size Descriptive Statistics

Panel B: Quartile data of two samples

	***MRKT_VALT* Greater than 8.11 (n = 4,413)**			***MRKT_VALT* Less or Equal to 8.11 (n = 4,398)**		
	1st Quartile	**Median**	**3rd Quartile**	**1st Quartile**	**Median**	**3rd Quartile**
LIT_FLAG $_{t+1}$	0.00	0.00	0.00	0.00	0.00	0.00
OPTION_MIX	0.00	0.21	0.44	0.00	0.00	0.48
AGE	53.00	57.00	61.00	52.00	57.00	61.00
YRS_AS_CEO	2.00	5.00	9.00	2.00	5.00	11.00
GENDER_FLAG	1.00	1.00	1.00	1.00	1.00	1.00
SALARY_TC	0.09	0.12	0.16	0.15	0.22	0.33
AQC_FLAG	0.00	1.00	1.00	0.00	0.00	1.00
DEBT_AT	0.13	0.26	0.38	0.02	0.19	0.36
NEG_EPS_FLAG	0.00	0.00	0.00	0.00	0.00	1.00
EBITDA_AT	0.10	0.13	0.18	0.07	0.11	0.15

providing C-suite executives with equity exposure in the companies they lead. While higher equity ownership causes the goals of executives to be aligned with shareholders, the leverage offered by stock options can also motivate CEOs to take additional operating risk to drive the share price higher. Accordingly, like many pieces of compensation plans, the use of stock options can have unintended consequences. In this study, I examine the potential for increased risk taking by examining one possible negative outcome of higher operational risk: incidents of litigation. Investing in riskier projects and pushing for faster growth — actions often taken by companies focused on short term stock price increases — put companies at risk to more lawsuits. There are

Table 9
Cross-Test Regression Analysis

Panel A: Industry and gender cross-tests

	Technology		**Non-Technology**		**Male**		**Female**	
	Coefficient	**P-Value**	**Coefficient**	**P-Value**	**Coefficient**	**P-Value**	**Coefficient**	**P-Value**
Intercept	-0.112	0.51	-0.453	<0.01	-0.158	0.09	-0.197	0.41
OPTION_MIX	0.044	0.28	-0.011	0.41	-0.025	<0.05	0.111	0.12
AGE	-0.002	0.27	0.000	0.58	-0.001	0.25	-0.001	0.68
YRS_AS_CEO	-0.001	0.64	0.000	0.47	0.000	0.48	0.002	0.76
GENDER_FLAG	-0.202	<0.01	0.000	0.99	-	-	-	-
SALARY_TC	-0.007	0.93	-0.031	0.29	-0.014	0.61	-0.265	0.07
AQC_FLAG	-0.001	0.98	0.008	0.33	0.000	0.97	-0.011	0.76
DEBT_AT	-0.008	0.91	0.003	0.84	0.008	0.62	-0.142	0.14
NEG_EPS_FLAG	0.028	0.50	0.078	<0.01	0.076	<0.01	0.038	0.55
EBITDA_AT	-0.057	0.61	-0.114	<0.01	-0.124	<0.01	0.056	0.78
MRKT_VALT	0.050	<0.01	0.055	<0.01	0.056	<0.01	0.047	<0.01
Observations	731		8,080		8,371		440	
Fixed Effect	Year		Year		Year, Industry		Year, Industry	
F-Statistic	7.267		44.6		36.89		3.495	
Pseudo/Adjusted R^2	0.129		0.086		0.090		0.128	
Area Under ROC	0.762		0.727		0.733		0.798	

several limitations in the study that should be noted. The time frame I use is 2011 to 2020. While the time frame encompasses many years and includes relatively recent data, stock options have been used prior to the start of my data set. A period going back further may yield more significant conclusions. Different regulatory and legal environments over time are other variables to consider.

Table 9
Cross-Test Regression Analysis

Panel B: Age and firm-size cross-tests

	***AGE* Over 57**		***AGE* 57 and Younger**		***MRKT_VALT* Over 8.11**		***MRKT_VALT* 8.11 and Under**	
	Coefficient	**P-Value**	**Coefficient**	**P-Value**	**Coefficient**	**P-Value**	**Coefficient**	**P-Value**
Intercept	-0.048	0.72	-0.284	0.01	0.590	<0.01	-0.104	0.63
OPTION_MIX	-0.022	0.24	-0.019	0.29	-0.025	0.27	0.008	0.59
AGE	-	-	-	-	-0.001	0.39	0.000	0.86
YRS_AS_CEO	-0.000	0.60	0.001	0.21	0.000	0.63	0.000	0.75
GENDER_FLAG	-0.002	0.93	-0.013	0.56	-0.015	0.60	-0.003	0.89
SALARY_TC	0.026	0.51	-0.076	0.05	-0.363	<0.01	-0.148	<0.01
AQC_FLAG	-0.004	0.71	0.003	0.75	0.024	0.05	-0.004	0.70
DEBT_AT	0.003	0.91	0.001	0.95	-0.040	0.19	0.038	0.05
NEG_EPS_FLAG	0.068	<0.01	0.082	<0.01	0.027	0.24	0.038	<0.01
EBITDA_AT	-0.104	0.03	-0.140	<0.01	-0.229	<0.01	-0.019	0.50
MRKT_VALT	0.054	<0.01	0.057	<0.01	-	-	-	-
Observations	4,090		4,721		4,413		4,398	
Fixed Effect	Year, Industry		Year, Industry		Year, Industry		Year, Industry	
F-Statistic	15.87		19.50		12.13		4.99	
Pseudo/Adjusted R^2	0.086		0.092		0.067		0.029	
Area Under ROC	0.734		0.739		0.679		0.655	

The study does not distinguish between different vesting triggers for incentive options. Often, the size of option grants depends on certain financial metrics being met such as total shareholder return, return on equity, or earnings growth. Analyzing different vesting triggers could have shed

light on how such incentive-based measures impact management behavior.

When looking at options grants, the data is not adjusted for the differential between the strike price and the price of the underlying stock at the time of the grant. In other words, the structure of the option grant may play a role in influencing the behavior of CEOs. Additionally, I assume a one-year lead when analyzing the relationship between *OPTION_MIX* and LIT_FLAG_{t+1} because litigation often does not occur in the year the options were granted. While assuming a lead is sensible, the lead may be more than one year. Ideally, I would have run regressions using different time leads.

To consider litigation against the firms in the study, I examine all forms of litigation. It may be helpful to distinguish between types of litigation to analyze the relationship between *OPTION_MIX* and other forms of litigation. For example, shareholder class action litigation might suggest a different level of risk versus other types of litigation. In addition, the size of the potential suit is not considered. Small, inconsequential suits may not suggest added risk-taking, but simply follow a somewhat random pattern for many large companies.

This paper only considers the options being granted to the CEOs of the firms included in the data. Other key executives such as chief financial officers, chief operating officers, and presidents receive options as part of their compensation. Options being granted to the broader executive team could influence management's behavior. Furthermore, I did not adjust the data for legal or regulatory environment changes. Changes in the legal environment that might be driven by such factors are federal or state judicial appointments over time could have impacted the pace of litigation for many of the companies included in the study. Similarly, the study does not account for changing economic conditions. The amount of litigation could very well vary depending on the economic conditions during a particular period.

Given the ongoing use of options and the need of boards of directors to understand how options can incentive management risk-taking, my hope is that future research can expand on the findings in this paper. Specifically, it would be insightful to examine the impact that varying financial

triggers have on management incentives and behaviors. In addition, determining the relationship between stock awards, options, and litigation can shed light on the risk-taking incentives of stock grants versus options, allowing boards to optimize compensation structure. Further, using different measures of risk rather than litigation could allow for a more statistically significant analysis of executive risk-taking behavior from option grants.

The purpose of the study is to analyze the relationship between the mix of executive options to total stock-based compensation and firm litigation risk. Rejecting my hypothesis, I find that a greater mix is associated with lower levels of litigation; the evidence is significant in the male executive sample. In terms of explanatory variables, I find evidence of the relationship between higher firm profitability and lower litigation risk.

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