Executive Stock Option Plans

The Effects of a Change to Nontraditional
Options

Trond Espedokken Vik

Industrial Economics and Technology Management
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Supervisor: Einar Belsom, IØT

Problem description

The paper reviews the value and incentive effects of indexed, Asian and indexed Asian options in a sample of the largest S&P 500 companies that issue executive stock options. Using compensation and assumption data manually gathered from proxy statements, SEC filings and annual reports, details on how an executive's pay-off and incentives would change with nontraditional options can be estimated.

Preface

This paper is the master thesis for the MSc study at the Norwegian Institute of Science and Technology (NTNU), department of Industrial Economics and Technology Management. The thesis is the final part of the specialization in Investment Analysis, Finance, and Business Management.

Parts of the work builds on the project thesis paper *Dividend Protection on Executive Stock Options*, and the work has given deep insight into the world of executive pay, contract theory and option design. The thesis examines the effects of four different option types: 1) the at-the-money option with fixed exercise price that dominates in practice (traditional option); 2) the indexed option; 3) the Asian option and 4) the indexed Asian option. The emphasis will be on incentives created and the value change over time of these options.

I will focus solely on the chief executive officer (CEO) in the largest U.S. companies. As these companies are industry leaders, smaller firms are likely to follow trends emanating from these companies. Compensation size is also closely related to market capitalization, so these firms provide the highest nominal amounts of pay, and the differences between firms are therefore very interesting and distinct. Corporate management consists of more than just the CEO, but like the majority of research on incentive contracts I narrow the scope to the CEO.

I would like to thank my supervisor Einar Belsom for moral and professional support, useful ideas and constructive discussions during the process.

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   Trond Espedokken Vik

Abstract

In order to study the value and incentive effects of indexed, Asian and indexed Asian options in practice I use hand-collected compensation and assumption data to give a realistic representation of how the nontraditional options would differ from the standard at-the-money option without adjustments. The paper implements the data into an analysis of incentives and accumulated value of the options on a sample of the largest S&P 500 companies that issued executive stock options from 2010 to 2014.

The paper employs Delta and Vega to compare the incentives created by the options, and find that the benefits from indexing are typically small. The options linked to average stock price, Asian and indexed Asian options, provide consistently higher incentives to increase stock price, but provide fewer incentives to increase volatility. Compared to earlier research, the differences in incentives created by the four options are smaller. This is mainly due to the low risk-free rates in the sample period, which reduces the number of nontraditional options that can be granted at equal cost. To analyze how the value of options change over time, the paper employs a new way of measuring the value over time, combining the value of realized and unrealized options. The results show that the traditional and Asian options provide significantly higher compensation than their indexed counterparts over the bullish sample period. The findings have important consequences for the viability of the nontraditional options, and might help explain the near uniform use of the standard at-the-money option in practice.

Sammendrag

For å studere verdien og insentiveffektene knyttet til indekserte, asiatiske og indekserte asiatiske opsjoner bruker jeg håndplukket data om kompensasjon og forutsetninger brukt i praksis, som gir en realistisk representasjon av hvordan de utradisjonelle opsjonene ville skilt seg ut fra standard at-the-money opsjoner som er svært utbredt i praksis. Oppgaven implementerer dataene i en analyse av insentiver og akkumulert verdi på et utvalg av de største selskapene fra S&P 500 som utstedte opsjoner til sin CEO fra 2010 til 2014.

Oppgaver bruker Delta og Vega for å sammenligne insentivene opsjonene skaper, og finner at fordelene ved indeksering typisk er små. Opsjonene som er knyttet til gjennomsnittlig aksjepris, de asiatiske og indekserte asiatiske opsjonene, gir konsekvent mer insentiver til å øke aksjeprisen, men mindre insentiver til å øke volatilitet. Sammenlignet med tidligere forskning er forskjellen mellom insentiveffekten til de fire opsjonene redusert. Dette skyldes hovedsakelig en lavere risikofri rente i perioden som studeres, som fører til at antallet utradisjonelle opsjoner som kan utstedes til samme kostnad reduseres. For å analysere hvordan verdien av opsjonene endrer seg over tid bruker oppgaven en ny metode som kombinerer verdien av realiserte og realiserte opsjoner. Resultatene viser at de tradisjonelle og asiatiske opsjonene gir betydelig høyere kompensasjon enn deres indekserte motparter i perioden, som har jevnt høy vekst i aksjepriser. Funnene i oppgaven har viktige konsekvenser for de utradisjonelle opsjonenes brukbarhet, og kan være med å forklare hvorfor ujusterte at-the-money opsjoner er brukt av så godt som alle selskaper i praksis.

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1 Introduction

Executive compensation has attracted a lot of attention from academics, media, politicians, regulators, investors and the public for many decades. From the 1930s until the mid-1980s the real term level of CEO compensation remained stable, but during the 1990s more companies implemented executive options and the amount of options granted grew quickly. This changed the weight of performance-sensitive compensation significantly, leading to an explosion in pay levels throughout the sustained bull market in the 1990s (see Figure 1), and contributing to a large growth in literature on the subject. A wave of corporate scandals around 2001 drew further attention to flawed compensation practices, the power of executives, misalignment of incentives and corporate governance (Bebchuk & Fried, 2004). During the financial crisis in 2007-2008, huge bonuses in the financial sector led to suspicion that the bonus culture induced excessive risk-taking that helped form the crisis, resulting in tighter regulation of compensation in financial firms (Murphy, 2009).

At the core of the executive compensation issue is the widespread use of executive stock options. Options were included into pay packages to make the executive's pay more dependent on their performance, but many critics argue that compensation is more tightly linked to company performance than CEO performance. Market forces have a strong impact on the realized pay from options, rewarding the manager for stock price gains that is out of his control. From the shareholders' perspective, an option plan should be designed to maximize incentives given the amount of dollars spent, or equivalently a certain amount of incentives at lowest possible cost. Gains occurring due to market movements that have nothing to do with performance is poorly spent money (Bebchuk, Fried, & Walker, 2002). However, the overwhelming majority of companies issue standard at-the-money options without adjustments to their executives. I will refer to this as the traditional option and Black-Scholes option, as is common in the literature.

There are many types of options that can be used in place of the traditional option, and the literature has reviewed numerous potential substitutes. This paper examines the most frequently proposed alternative, the indexed option, and two relatively new propositions by Tian (2013), the Asian and the indexed Asian option. The indexed option
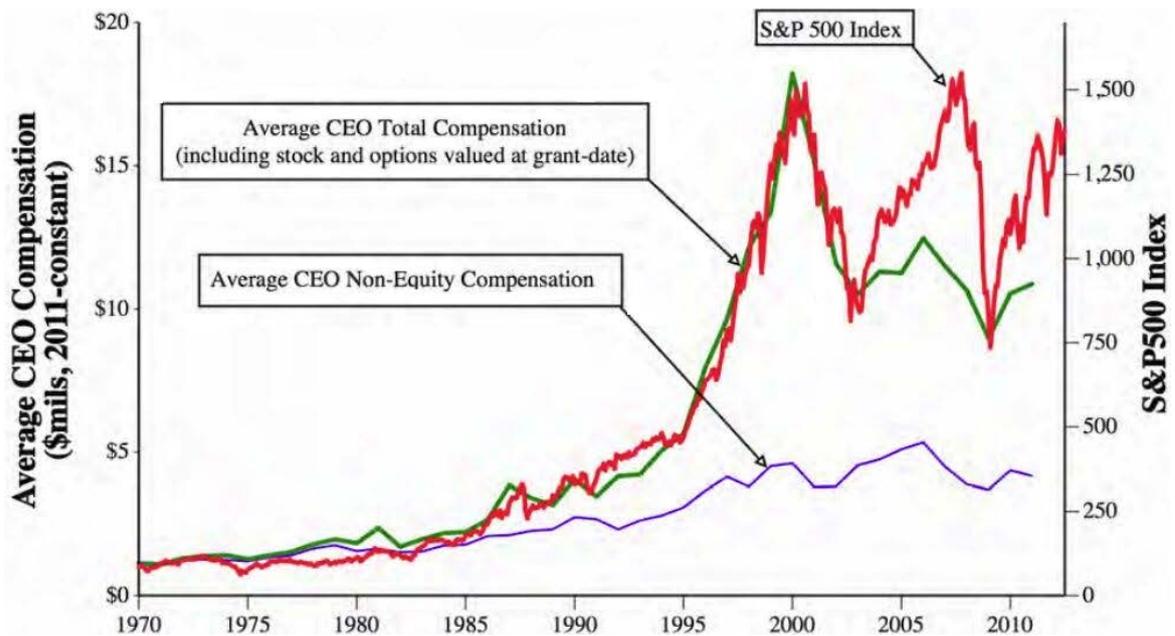
Figure 1 - Grant-date compensation for CEOs in S&P 500 Companies versus the S&P 500 Index, 1970-2011. (Murphy, 2012)

links the exercise price of the option to an index or another benchmark so only CEOs who perform better than the competition are rewarded, while the latter two incorporates average stock and index prices into the design. Most academic research on executive compensation adopts the ex-ante approach, valuing equity-based awards at the fair market value on the grant date. The pay is then referred to as expected compensation, differing from ex-post or realized compensation which is the value at the time options are exercised. Analysis of incentive effects and the relative value of a CEO's compensation relative to his peers should focus on grant-date value (Murphy, 2012). Realized pay depends on the company's past and current performance and is better suited for analyzing whether compensation is sufficiently linked to performance. In this paper both approaches are used. The ex-ante value of options is used to examine incentive effects and determine the amount of options granted with other option types, while the ex-post approach is used to observe how option value changes over time.

Earlier works have focused on hypothetical companies using parameters that are deemed appropriate for the market conditions at the time of writing. This paper adds to this literature by using hand-collected company data to look at how the value and incentive effects of the options would have been in for actual firms in the period between 2010 and 2014. This gives realistic data on how the different options would work in practice. The paper also introduces a new way to examine the value over time of options, combining the value of options that would be exercised and those that would not.

The rest of the paper is organized as follows. First, Chapter 2 provides an introduction to selected topics from the vast literature on executive compensation that are relevant for the paper. Chapter 3 examines the four option types, accounting practice and the choice between stock and stock options. In Chapter 4 the procedures and formulas used for the analysis are presented. In Chapter 5 the data and assumptions used are stated. Chapter 6 presents the results on number of options granted, incentive effects and value over time of the four options. Chapter 7 discusses the results in light of previous research and potential implications of the different options are reviewed. The paper concludes by summarizing the findings and the discussion.

2 The Foundations of Executive Compensation

This chapter introduces some of the most important theoretical frameworks used in executive compensation research. First, the underlying theories used by researchers to examine, explain, analyze and improve compensation are examined. This is followed by a review of how the compensation arrangement is determined in practice and the building blocks of incentive contracts. Finally, the subjective value CEO's place on compensation and theory on incentives effects of equity-based compensation is presented.

2.1 Agency theory

The problem of aligning the interests of shareholders and managers have been acknowledged since companies started separating ownership and control. As Adam Smith (1776) put it in his influential work *The Wealth of Nations*:

> *The directors of such [joint-stock] companies, however, being the managers rather of other people's money than of their own, it cannot well be expected that they should watch over it with the same anxious vigilance with which the partners in a private copartnery frequently watch over their own. Like the stewards of a rich man, they are apt to consider attention to small matters as not for their master's honour, and very easily give themselves a dispensation from having it. Negligence and profusion, therefore, must always prevail, more or less, in the management of the affairs of such a company.*

Since Jensen and Meckling's (1976) seminal paper, the problem of managerial power has been analyzed in modern finance as the agency problem, also called the principal-agent problem. They defined the agency relationship as a contract where one or more individuals, the principals, engage another individual, the agent, to perform services on their behalf that involve delegating some decision-making authority to the agent. A normal assumption for both is that they will seek to maximize their own utility. This follows from the theory that individuals are Resourceful, Evaluative Maximizers (the REMM model, Jensen and Meckling (1994)). Principals can therefore not trust that the agent will always act in their best interests, and will be subject to costs to align the agent's interests with their own. These costs are termed agency costs, which is defined as the sum of monitoring expenses, bonding costs and residual loss. Monitoring refers to activities the principal perform to measure and control the agent's performance, while bonding costs is the expenses related to the compensation arrangement. Even when the monitoring and bonding arrangements are optimal there will be some divergence between

the decisions of the agent and the decisions that maximize utility for the principal. These are referred to as residual loss.

There are two main goals for managerial compensation. First, the pay level must be above the executive's reservation wage and high enough for the agent to exert the required effort for the job. Reservation wage determines the lowest wage the CEO will accept to do the job. If total compensation is lower than this threshold he will reject the contract and look for work elsewhere. Compensation level also determines the amount of effort the CEO will exert, the higher his pay the more effort he will exert. Pay should therefore be increased until the desired level of effort is achieved with the contract. Second, compensation should be designed in a way that aligns the agent's interests with the shareholders'. This includes alignment of risk preferences and to make the executive's utility dependent on shareholders' utility. The compensation package should continue to give value to the agent until the incremental cost of doing so exceeds the incremental benefit the incentives provide. The latter is the basis for the most used approach to research on executive compensation, the optimal contracting view.

To oversee that the agent is acting on behalf of the principal, monitoring and control measures are essential, but measuring the CEO's performance relative to his peers can be troublesome. With multitasking executives, firm diversification, market factors and the organizational impact of the CEO, it is seemingly impossible to put a dollar value on how much the manager is worth to the company. Accounting numbers are inaccurate and focus solely on financial measures, while company goals are often not measureable and the marginal effect of the executive's actions is even harder to distinguish. It is common to determine annual bonus based on accounting criteria, and many companies use multiple criteria for this. Due to the inaccuracy of accounting criteria, stock price is often the chosen method of measuring executive performance, as it achieves better goal congruence than accounting based measures.

While monitoring is an important task for the board, too much focus on monitoring can lead to reduced advising effectiveness. Faleye, Hoitash, and Hoitash (2011) study the effects of monitoring on directors' effectiveness in performing their duties. They find that improved monitoring quality mitigates overcompensation and reduces earnings management, but at the cost of weaker strategic advising and greater managerial myopia, especially for firms operating in complex environments. Strict monitoring takes time

away from advising duties and it might destroy the CEOs trust in the board. This can lead to poorer communication, the board receiving less important strategic information and believing that their primary function is to monitor the CEO (Adams, 2009). Faleye et al. (2011) also find evidence that this leads to worse acquisition performance and less innovation, leading to a 9.5% reduction in firm value for firms with high advising needs, while the effect is insignificant for firms with low advising needs. Thus, for companies operating in complex environments, the board need to add more directors as monitoring increases.

2.2 Managerial power and optimal contracting

The managerial power approach was formalized by Bebchuk et al. (2002), building on ideas dating back to Berle and Means (1932). It can be viewed as a development of the dominating approach in research until then, the optimal contracting approach. Optimal contracting assumes that the board of directors and the CEO bargain at arms-length, creating the compensation arrangement that maximizes shareholder value and minimizes agency costs. The managerial power perspective adds the element of executive power, arguing that executives are able to extract rents by influencing their own compensation. Recognizing the potential managers have to increase their own pay above the optimal contracting value is important in order to counter unprofitable increases in compensation, and is also an important part of the agency problem itself. CEOs' ability to extract rents can result in weakening and distortion of their incentives. Bebchuk and Fried (2005) argue that this effect could well impose a larger cost on shareholders than the nominal value of excessive compensation itself. In other words, it is not just the cost of pay in excess of the optimal contracting value that shareholders incur. Frydman and Jenter (2010) survey recent literature on executive compensation and argue that both perspectives are important determinants of CEO pay, but that neither are fully consistent with the evidence that have been gathered.

As company insiders, executives possess valuable information that can be taken advantage of in the stock market. Broad freedom to unload options would give the manager incentives to act in ways that hurt the company over time. A manager planning to unload options or stock is more likely to manipulate reported earnings, suppress bad news and choose projects that are less transparent to the market (Bergstresser & Philippon, 2006; Efendi, Srivastava, & Swanson, 2007). Compensation size is also

closely linked to the market capitalization and revenue of the company, and existing pay practices often reward managers for expanding the firm, even though the expansion or acquisition is value-destroying.

According to empirical research, the CEO has more power when the board is relatively weak or ineffectual, when there are fewer institutional shareholders (leads to less monitoring), when there is no large outside shareholder, and when the company is protected by antitakeover protection arrangements (Bebchuk & Fried, 2003). In a study on board and ownership structure, Core, Holthausen, and Larcker (1999) find that firms with weaker governance structures have greater agency problems. CEOs of these firms should be able to extract more rents, and their companies perform worse than peer companies with stronger board and ownership structure do. They also report that compensation is higher when the CEO is also the chairman of the board, when the board is larger, when there are more outside directors in the board and when more outside directors are appointed by the CEO. In addition, compensation is negatively related to the CEO's ownership stake in the company. These results offer support to the managerial power hypothesis. Engelberg, Gao, and Parsons (2013) study the effect of the CEOs network on compensation, and find that an additional high-ranking executive or director in the CEOs network is associated with an average increase in compensation of $17,000. Thus, social power also seems to be valued by the company.

La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2000) describe how legal protection of shareholders affects corporate governance and executive's ability to extract rents. Value expropriation such as transfer pricing, employing unqualified members of their network, asset stripping and investor dilution can be limited through an effective legal system. These possibilities have indeed been limited in many countries. Today, the most prominent rent extraction tool is overcompensation and the possibility to take advantage of inside information. U.S companies are also required by the SEC to report the incremental cost of perquisites provided to the named executive officers. This way the company's cost for aircraft usage, home security, financial counseling, relocation benefits and other non-direct compensation is conveyed to the shareholders, reducing the executives' potential to spend excessive amounts on perquisite spending.

An important consideration for executives trying to extract rents from their company is the possible negative coverage the compensation arrangement will receive. If stakeholders

perceive the compensation level or structure as unjustified it can lead to social and economic costs to the directors and the CEO. If the negative reaction is sufficiently strong it might also affect the firm through investors losing confidence in the company. The consequences of a negative reaction by outsiders is referred to as outrage cost (Bebchuk et al., 2002). In a review of stakeholder pressure on the level of executive compensation, M. F. Johnson, Porter, and Shackell-Dowell (1997) find that CEOs that receive negative media coverage on their compensation received relatively small pay increases during subsequent years and that their pay-performance sensitivity (PPS) increased.

The potential for outrage costs impose an upper constraint on CEO compensation. Excessive compensation alone will not lead to significant outrage costs, there has to be shared recognition among investors that the contract does not maximize shareholder value. Executives will therefore try to reduce the public's ability to identify rent extraction. This is termed camouflage (Bebchuk et al., 2002). Compensation arrangements that are in some way less visible to outsiders, often called stealth compensation, include pension plans, deferred compensation, post-retirement benefits, severance agreements and consulting contracts post-employment. These arrangements largely shift tax liability to the firm in ways that can increase tax liability of both parties.

2.3   Incentive contracts

The objective of a properly designed executive compensation package is to attract, retain and motivate CEOs. Compensation creates incentives for the executive to increase his effort and performance level, leading to lower agency costs and higher return for the shareholders. There are three primary mechanisms to give the CEO variable compensation and incentives (Core, Guay, & Larcker, 2003): 1) flow compensation, which is the stock and option grants, salary, bonus and other compensation; 2) changes in the value of the CEO's equity holdings; 3) the change in the value of his human capital, which increases with good performance and decreases following poor performance or employment termination.

Companies can attract the right individuals to executive positions by adjusting the performance-based portion of compensation. Higher levels of variable payment will attract less risk-averse candidates that have the required qualifications to achieve the expected performance. This is especially suitable for companies with high investment needs. The pay level must also be sufficiently high, so potential candidates and existing

executives do not flee to other firms. Other employment opportunities determine what the minimum level of pay of the CEO has to be. To determine this lower bound for pay companies use benchmarking. Cadman and Carter (2013) find evidence that companies select peers with similarities in economic characteristic. Their evidence suggests that firms use peer companies' pay levels to determine CEO compensation in a competitive labor market, rather than strategically selecting peer firms to influence or justify greater CEO pay.

The retention effect of the compensation package is secured through long-term incentive awards. Options are commonly not immediately exercisable and shares are untradeable for some time. Thus, a portion of the executive's pay is only realized if he stays with the firm. Equity that is not realizable is called unvested equity, and the period until the executive can exercise options or cash out on stock is termed vesting period. Executives naturally assign higher value to options that are exercisable early, even though the cost to the company is the same. High levels of unvested options increase the CEO's stakes in the company, and could also decrease the chances of him being head-hunted to another company. CEOs hired from outside the company are often reimbursed the loss from forfeiture of unvested equity awards in their previous job, so more unvested equity increases the buy-out cost of the executive. There is therefore a tradeoff between keeping the value to the executive high and giving retention incentives when deciding the vesting period of equity-based compensation.

Equity-based compensation also adds the element of incentive alignment between the principals and the agent, and is shown by Abowd (1990) to increase expected shareholder return in the following year. Equity-based pay usually comes in the form of share and stock option awards. The two most common forms of share based compensation are Restricted Stock Units (RSU) and Performance Share Unit (PSU). RSUs are granted to encourage ownership and increase retention while providing incentive alignment with shareholders. The amount of PSUs granted is based on the company's relative performance over a set period. There is a multitude of performance measures in use, and many companies use several different measures to determine the granted amount of PSUs. A common approach is to grant shares based on relative total shareholder return (TSR), where the company's return the previous year is compared to a peer group of similar companies. Some companies also grant Dividend Equivalent Units (DEUs) on shares that have vested to compensate the executive for the loss in value that occurs when

dividends are paid out on unearned shares. Accumulated dividends during the vesting period are then paid out as additional shares when the underlying equity grant vests.

There are also tax considerations that must be taken into account. IRC Section 162(m) generally disallows tax deduction for compensation over $1.0m to the corporation's CEO and the three other most highly compensated executive officers. Performance-based compensation is exempt from the deduction limit if certain requirements are met. Compensation committees aim to structure equity awards to qualify for this exemption, but salaries are on a level above this exempt for most major companies. In-the-money options are not considered performance-based, so unless they become exempt from this rule options are likely to always be granted at- or out-of-the-money.

2.4   The process of setting compensation

Setting the pay for the CEO and other high-ranking executives is one of the primary tasks of the board. A remuneration committee is commonly responsible for evaluating the performance of the CEO and recommending a compensation package, but the committee members lack the time, expertise and information they need to make a qualified recommendation. Initial recommendations typically originate from the human resource department, who often work together with compensation consultants that provide information on market pay practices and current compensation levels (Jensen, Murphy, & Wruck, 2004). These consultants are usually hired by company management, working directly with and for the CEO and other high-ranking executives. The consulting company is often also engaged in larger projects in the same firm. This creates an incentive to please the CEO, thus increasing the chance that the remuneration committee will receive a pay proposal that benefits the executive. After the committee has created a proposal, it is sent to the board for approval. The directors of the board often work under the CEO, are appointed by him or just do not wish to oppose him due to personal career concerns. Directors might also aspire to become CEO themselves, which could make them unwilling to reduce the compensation. The influence the CEO has over the board and the directors' personal incentives to keep the pay level high can therefore be significant, which can lead to excessive pay that is costly to shareholders.

Companies want to have competitive pay levels for their executives, and normally set the total compensation above the 50th percentile reported by consultants. Many researchers consider this practice the primary cause of the increase in pay levels during the 1990s.
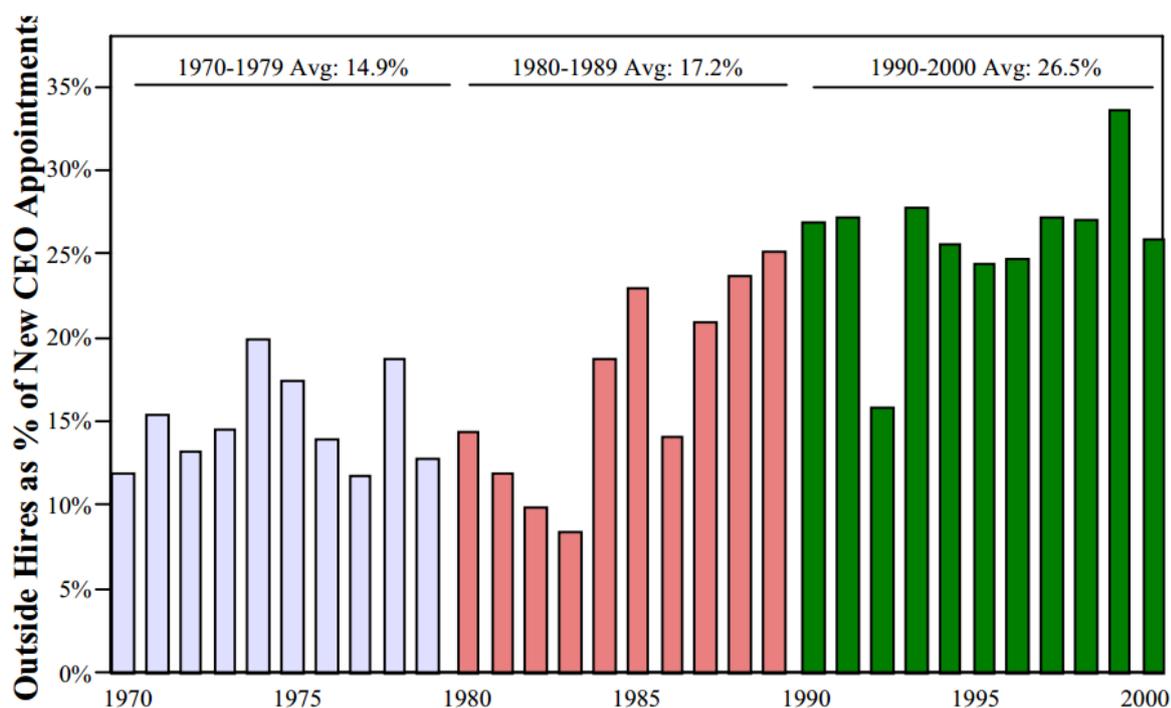
Figure 2- Percentage of new CEO appointments represented by outside hires, 1970-2000 (Murphy & Zabojnik, 2006)

However, competitive pay might be necessary in order to retain human capital, especially in bull markets when other companies might be willing to pay very well for a skilled CEO and outrage costs are weakened. The percentage of new CEOs that were hired from outside the company roughly doubled between 1980 and 2000 (see Figure 2), reflecting a trend where managerial ability increased in importance relative to firm-specific knowledge, which contributed to a higher equilibrium level of CEO compensation. With current practices, the board might therefore be forced to accept higher compensation than what is theoretically optimal in order to recruit and retain skilled executives and avoid costly turnovers.

2.5   Subjective valuation of equity awards

The economic cost of providing incentives is the amount that would be received if the company sold the instrument to an outside investor instead (Hall & Murphy, 2002). The risk-neutral formulas that are used to value options that are traded by investors overstate the value a risk-averse CEO would place on the options. Vesting requirements, hedging and short-sale restrictions, lack of diversification (on both human capital and monetary wealth), non-tradability and forfeiture if the CEO leaves the firm all make the expected cost lower. Figure 3 shows the effect of the vesting period on the CEOs subjective value of the option. When the option is unexercisable for a longer time, the CEO places lower
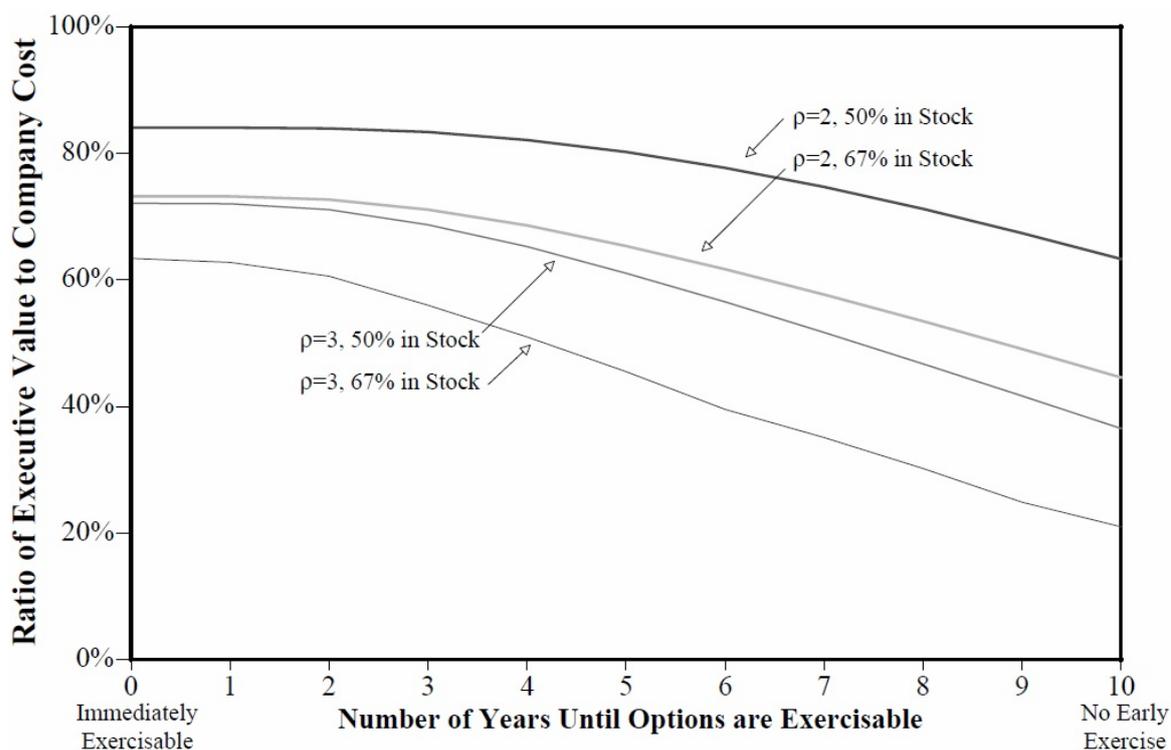
Figure 3 - The ratio of the executive value to the company's cost, by vesting period (Hall & Murphy, 2002). ρ is the executive's risk-aversion parameter and "% in Stock" refer to the percentage of CEO wealth that is in company stock.

value on the option. The true cost of the options will therefore be lower than what the risk-neutral value implies. In addition, CEOs are expected to be risk-averse, so the subjective value to the executive will be lower than the cost to the company, which in turn is lower than the risk-neutral value. An executive's subjective valuation also depends on his liquidity needs, which might make him exercise earlier than optimal. For equity that does not reimburse the CEO for losses due to dividends, a higher dividend yield reduces the subjective value further. Hall (1998) finds that the value of a standard executive option for his typical CEO (32% volatility and option issued at-the-money) is 57% of the grant-date value when no dividends are paid, and with 3% dividend yield the subjective value falls to 36%.

Murphy (2002) and Hall and Murphy (2003) propose a hypothesis they call the perceived-cost view. They argue that directors and executives commonly perceive the cost of granting options to be far below their actual economic cost to the company, as they do not require any cash expense or reduction in reported earnings. If this is actually the case, the potential for rent extraction increases further. The perceived-cost hypothesis also assumes that risk-averse undiversified executives value the options lower than the actual economic cost of the option. This assumption is backed up by evidence from

Pepper and Gore's (2013) international study of top managers. According to financial theory, individuals should discount future cash flows at rates consistent with return on comparably risky future cash flows adjusted for inflation. The results from the study indicate that executives discount at a much higher rate. Based on responses from 756 top managers around the world they find an average estimated discount rate of 33%. As expected, the survey also indicates risk aversion and uncertainty aversion among executives, with a larger degree of risk aversion.

Subjective value is measured as a fraction of the option's risk neutral value. This fraction is found by assuming that the executive is risk averse with a constant relative risk aversion level γ, which is set to 2 or 3 in the majority of research on the subject. Subjective value also depends on the fraction of the CEOs initial wealth that is tied to options. Higher amounts of options reduce the perceived value of each option, which introduces a tradeoff between stock options and shares that must be taken into account when designing the compensation package. Sircar and Xiong (2007) provide a framework for evaluating executive stock options accounting for the features that are not present in exchange-traded options, making it easier to determine the difference between the firm's granting cost and the subjective value of the options.

2.6   Incentives created by equity-based compensation

There are two main approaches used by researchers to measure the quality of incentives given by different compensation types. One measure is the pay-performance sensitivity, first proposed by Jensen and Murphy (1990), which measures how much the CEO's wealth increases following a given increase in company value. The other approach is to measure the incentive to increase shareholder return with Delta, the partial derivative of the option value with respect to the stock price. Delta measures the change in option value as the price of the underlying stock change. A Delta of 0.6 corresponds to a $0.6 value increase per option when stock price increases by $1. As time to maturity approaches, the Delta of in-the-money options increases while Delta for out-of-the-money options decreases. Stock-return volatility also has a positive effect on Delta. Another factor often incorporated into incentive analysis is the risk-neutral probability of options expiring in the money, $N(d_2)$. CEOs would naturally desire that this value is high as possible, as a low value represents a high chance that the option will be worthless at maturity.

Option value also grows with an increase in volatility. To measure the incentive to increase risk, the partial derivative of the option with respect to volatility, Vega, is commonly used. Other variations of this include total option Vega, which measures the change in value of all outstanding options for a one percentage increase in volatility, and Vega elasticity, which measures the percentage change in option value for a one percentage increase in volatility (Murphy, 2012). Increases in volatility have a positive effect on Vega.

Stock options and unvested restricted stock that is not dividend protected lose value when the company pays out dividends. Thus, options and stock that are not dividend protected or include dividend equivalent units introduce an incentive to reduce the company's dividend yield, which might be suboptimal to shareholders. Many researchers therefore suggest that executive stock options should be dividend protected to mitigate this effect (Bebchuk & Fried, 2005; Jensen et al., 2004). Equity grants can also introduce perverse incentives. Options increase the CEO's focus on short-term gains, which could reduce his attention for more important tasks, surrender positive NPV-projects and make him report false information or withhold important information. When options are deep out-of-the-money, the CEO is not likely to have a substantial payoff from the option before maturity. A temporary decrease in stock price would increase the chance of repricing, and lower stock price would also result in a higher number of options being granted to him at the next grant, unless the company issues a fixed number of options each year.

3 Option-Based Compensation

This chapter presents options as a compensation vehicle, and reviews the four option types that are analyzed in the paper; the traditional, indexed, Asian and indexed Asian options. The primary goal of executive stock options is to align the managers' interests to the shareholders' through increased sensitivity in the pay-performance sensitivity. Numerous researchers have studied this relationship, and the conclusions differ greatly. In 1990, Jensen and Murphy failed to establish a conclusive link between CEO pay and stock price performance. They argued that talented and self-confident individuals would prefer performance-based pay, and claimed that the CEO compensation level was probably not high enough to attract the best candidates, as business law, investment banking and consulting firms recruited an increasing part of students from top MBA programs. As more companies included stock options in the 1990s and the grant-date value grew quickly, the overall pay-performance sensitivity nearly doubled by 1996 (Murphy, 1999). The increased usage of options coincided with an enduring bull market, leading to a large increase in realized pay among CEOs. However, the increase was largely a part of market factors, making it evident that traditional stock options reward the CEO for factors outside their control, leading to excessive pay levels during bull markets.

S. A. Johnson and Tian (2000b) review the value and incentive effects of premium, performance-vested, repriceable, purchased, reload and indexed options. Of the examined option types, the indexed option has the highest sensitivity to changes in stock price and volatility and the lowest sensitivity to changes in dividend yield. Another option type examined in their paper, the purchased option, is found to be superior to traditional options for companies that do not want higher volatility. Asian and indexed Asian options are not examined in their paper. For firms that do not seek higher volatility these two types might be preferable.

3.1 The traditional stock option

Many studies focus solely on the pay-performance relationship and the amount of options, but incentives to increase company value are highly sensitive to the strike price of the option, the executive's wealth and degree of diversification, risk aversion and career concerns (Nohel & Todd, 2001). Tailoring the option design to these parameters is important to avoid costly over- or underinvestment, and might change the optimal amount

of options to grant. The optimal compensation arrangement will vary over time, and depends strongly on the characteristics of the firm, especially its growth opportunities and available projects. It is therefore highly unlikely that it is optimal for all companies to adopt the same practices with options.

In 1992, 95% of executive stock options were granted at-the-money (Hall & Murphy, 2002), and researchers have been unable to find a convincing explanation for this widespread practice. Options that are granted in-the-money are not tax deductible when the part of compensation that is not performance-based exceed $1.0m, so they are not likely to be used unless regulation changes. On the other hand, out-of-the-money options do not have any tax disadvantages, and it has been shown that they would increase firm value on average (Bebchuk et al., 2002). At-the-money options are highly likely to be in the money in the future, especially when the options have a long time to maturity. Granting options at-the-money can therefore be a way to provide higher tax-deductible compensation, as they are not likely to inflict outrage costs due to their extensive use. CEOs would be worse off with higher exercise prices if grant-date value is held constant, as the risk will be higher with out-of-the-money options. They would therefore require higher expected value due to the reduced chance of payoff and lower profit per exercised option. Hall (1998) reports that about two percent of companies issue options that are in-the-money and an even smaller proportion (less than one percent) are issued out of the money, so-called premium options. He also find that the vast majority of companies that have a multi-year plan use either a fixed number or a fixed value plan. Some companies also issue stock options fixing the value at a percentage of total long-term incentive compensation. After Hall's article was written, the amount of major firms that issue executive stock options have decreased significantly and stock options constitute a lower proportion of the total compensation in the firms that still grant them. In the sample of this paper, only one grant includes out-of-the-money options.

Another feature of stock options is repricing, which involves resetting the strike price of options that have fallen out-of-the-money and provide weaker incentives. Firms claimed that option repricing was necessary to prevent the flight of talented executives following a stock price decline (Carter & Lynch, 2001). The cost of a repriceable option is strictly higher than the traditional. In addition, the repriceable option is inferior when increased volatility is problematic. They create weaker incentives to increase stock price than the traditional option, but also create stronger incentives to increase volatility. In modern

practice, most companies require shareholder approval before a repricing can occur, and it is rarely incorporated into option pricing models. Repricing is therefore not taken into account in this paper.

3.2   The indexed option

Traditional options violate the fundamental rule that compensation contracts should insure the executive against uncertainty from factors outside his control, while enforcing idiosyncratic effects. It is therefore not surprising that a common critique of option design is that they are not linked to performance in a satisfactory way. For compensation to be truly performance-based, options need to only reward the CEO for share price movements that are within their scope of control and when he can affect the impact of external issues. According to the standard view on compensation based on the model proposed by Holmstrom (1982), shareholders should benefit from filtering out exogenous risk from the contract as they have to compensate the CEO for any risk they impose on him. Indexation should therefore be more valuable when the CEO is more risk-averse and when his investment in the stock market is high.

Only 30% of share price movement reflects corporate performance (Patterson & Smith, 1998), so poorly performing CEOs with ordinary options can earn a significant profit when external factors drive the stock price up. Similarly, skilled CEOs will not gain as much as they should compared to poor performers, and market movements can render options worthless even for a CEO that outperforms his competitors. In this way, traditional options reward executives for gains that the shareholders would receive from any other stock. This results in a closer relationship between CEO pay and company performance, but the more important relationship between pay and the executive's actual contribution to company value does not increase adequately. Since the CEO's performance does not matter as much as market movements, he might be inclined to take advantage of external factors on stock price, and spend time and effort on timing equity grants and information release for his personal gain.

In considering the benefits of using relative performance evaluation (RPE), Hölmstrom (1979) show that the optimal pay for a risk-averse executive should depend exclusively on firm performance, and should filter out exogenous peer performance. The more exposed a firm is to systematic risk, the more beneficial RPE is. However, the extent to which RPE is useful depends on the firm's ability to find a peer group with similar

exposure to the market, so that external shocks affect the whole peer group equally. For firms with more growth opportunities or very high market capitalization the availability of such firms can be limited due to lack of similar-sized firms facing common shocks. Companies that have a high proportion of assets represented by growth options expect growth due firm-specific knowledge, barriers to entry and patents, so their exposure to the market is not similar to any other firms and the performance of the peer group will be governed by each peer firm's idiosyncratic performance (Albuquerque, 2013).

The idea of linking strike price to market movements was suggested at least as far back as Ubelhart (1982). Indexed options are similar to premium options as the expected exercise price is higher than the current stock price, the main difference being that their exercise price is uncertain at the grant date. Each indexed option is worth much less than stock as half of them should expire out-of-the-money, so an executive can be given many of them. Figure 4 illustrates the payoff difference between normal and indexed options with an initial exercise price of $10. In the example, two indexed options can be granted at the same cost as one standard option. The executive receives higher payout with indexed options for stock prices above $20, but is better off with normal options for prices below $20.
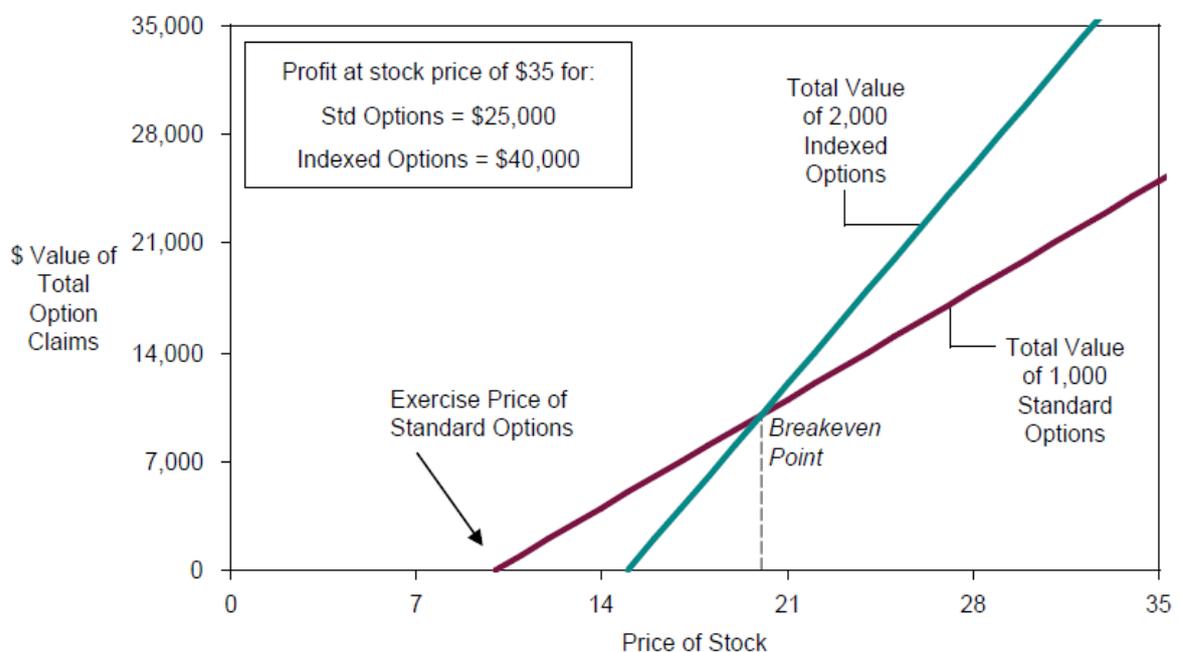

Figure 4 - Payoff comparison of at-the-money and indexed options. Graph is for 4.3 years after issue with 10% cost of capital, giving an exercise price of $15 =1.1^{4.3}*$10 (Jensen et al., 2004).

The indexed option has previously been analyzed in several papers. S. A. Johnson and Tian (2000a) use parameters that were realistic for major firms at the time. They find that the indexed option value is 34% of the comparable Black-Scholes option, while providing more incentives to increase stock price and a higher Vega when total cost is held constant. The traditional option includes the expected growth of the stock, which positively affects value. As both index and stock price is expected to grow at this rate, it disappears from the indexed option formula. This results in a large difference in initial value as the expected growth their assumption is 6%. Additionally, the indexed option has a lower probability of expiring in the money ($N(d_{2I})$) for the indexed option and $N(d_2)$ for the traditional), which is at 42% compared to 72% for the traditional for a company with a correlation of 0.75. As expected growth decreases, $N(d_{2I})$ remains the same while $N(d_2)$ decreases. When $r = \delta$, the expected growth is zero and the probability of the traditional option expiring in the money is down to 38%, which is lower than the indexed option's probability. Executives put a higher value on options with a greater likelihood of expiring in the money. Thus, when the expected growth of the traditional option is high, executives might demand a higher risk premium to accept indexed options.

Using a standard principal-agent model, Dittmann, Maug, and Spalt (2013) find that benefits from indexing is typically small, with an average gain of 3.08% and zero gain for the median firm. Indexing destroys incentives for about 80% of their sample, and when exercise price is tied to a market index associated with a market risk premium the benefits is reduced further. The CEOs that indexing is beneficial for have significantly higher option holdings, and full indexation is only optimal for 13.99% of companies in their sample, while 46.71% would not index at all. Dittmann et al. also study the effects of full mandatory indexation imposed by regulation, and find that it destroys value and for the average and median firm.

Indexed option value is highest when correlation between the stock and index price is zero, but this case is not interesting since no companies would link the stock price to an index that has no relation with the movements of the company's stock price. As correlation increases, the initial value of the indexed option is decrease, and the incentive effects with regards to stock price and volatility is stronger. Companies already track a multitude of competitor data, so there are many possibilities for the choice of index. The index strike price can be tied to a peer group index with companies of similar size, industry or geographical location. Another possibility is to link the amount of options that

are granted to performance goals or rank relative to a peer group, similar to how PSUs are granted. The appropriate benchmarks differ across companies, even for companies within the same industry (Albuquerque, 2009).

A potential problem with the indexed option is that its subjective value is lower for risk-averse executives. Tian (2013) finds that an executive with a risk aversion factor of 2 discounts the indexed option by 47.8% when 25% of his initial wealth is tied to options, which is 40.5% lower than the subjective value of the comparable traditional option. If the weight in options or the risk aversion parameter increases, subjective value of both options decrease, but the ratio stays roughly the same. Meulbroek (2001) criticizes the indexed option and shows that they do not function as intended by its proponents, as the payoff remains highly sensitive to market price movements. She proposes an alternative design where the exercise price is fixed, and the underlying asset is a portfolio comprised of the company's stock hedged against the market price.

The Delta of the indexed option increases more as stock price increases than the comparable traditional option (S. A. Johnson & Tian, 2000a). While the stock price is in-the-money the indexed option should therefore always provide higher incentives to increase stock price. For options deep out-of-the-money the effect is opposite. For their typical firm, Johnson and Tian finds that the indexed option have 93% higher Delta at-the-money, increasing to 170% when the stock price is 1.5 times the exercise price. Their typical firm also has 328% higher Vega. As volatility increases, the indexed option Vega decreases slightly while the traditional option Vega increases, but the difference between the two remain large. It is possible to incorporate penalty functions to reduce the payoff of executives trying to manipulate parameters such as volatility, increasing complexity but reducing the perverse incentives introduced by options. Unlike the traditional option, indexed options do not require repricing following a market crash, as the strike price will follow the decline in stock price. Even when the stock performs worse than the market, the indexed option will not be as deep out-of-the-money as the traditional.

3.3 The Asian option

Asian options have not been widely studied in the executive compensation literature, but have been used for commodity linked bond contracts, and have also appeared as currency options and in interest rate contracts (Kemna & Vorst, 1990). Similar approaches have been advocated for use in executive compensation by researchers such as Chhabra (2008)

and Bebchuk and Fried (2010), but the only analysis on Asian options that has been performed only consider the option theoretically (Tian, 2013).

Research has shown that the manager can manipulate the determinants of the firm's risk characteristics in an opportunistic way. Coles, Daniel, and Naveen (2006) find that CEOs with higher Vega on their options implement riskier policy choices, have higher leverage and invest more in R&D and less in property, plant and equipment. Bergstresser and Philippon (2006) argue that increased pay-to-performance sensitivity may encourage managers to engage in earnings management and manipulate earnings risk. They document that periods with high accruals coincide with unusually significant option exercises. Zhang, Bartol, Smith, Pfarrer, and Khanin (2008) find that manipulation of earnings is more likely when the CEO have more out-of-the-money options and low stock ownership. CEOs with substantial amounts of out-of-the-money options may want to create the illusion that the firm's performance meets expectations, potentially raising the stock price until the options have positive intrinsic value. On the other hand, in-the-money options are found to have weak or no effect on the likelihood of earnings manipulation. Agrawal and Mandelker (1987) find that CEOs with higher option and stock holdings are more likely to undertake acquisitions that increase volatility and leverage. By using the average stock price instead of the real-time stock price, some of these problems related to the standard option can be reduced. Companies might therefore prefer Asian options to traditional options because it reduces the possibility of stock price manipulation and opportunistic timing by the executives.

Tian (2013) compares the cost to the company of the traditional option to the Asian option, holding the expected utility of the CEO constant. For an executive in a firm with moderate stock return characteristics the risk aversion threshold for preferring options linked to average stock price is only 0.67, much lower than the normal assumed risk aversion of 2 or 3. The threshold decreases as volatility increases, and increases as the firm's excess return increases. For the average firm in this paper's sample, with a volatility of 28.8%, the firm would need an excess return of almost 14% for a CEO with risk aversion of 2 to have higher expected utility with traditional options. When the stock's volatility is below 20% the risk aversion threshold can be higher than 2, but this is only the case for two sample companies. Most, if not all, of the sample companies should therefore have a lower cost of providing a particular utility level with Asian options

according to Tian's analysis. The Asian option also has marginally higher subjective value than the traditional when options are granted at-the-money.

There are several ways to design an Asian option. Average price can be used in place of the stock price or the strike price. The floating-strike Asian option is not suitable for incentive contracts since risk-averse executives should prefer receiving the average stock price instead of subtracting it from the payoff (Tian, 2013). Averaging stock price over a smaller time period or gradually paying out the option payoff after exercise also achieves some of the desired effects of the Asian option. One of the companies in this paper's sample, Pfizer, has a similar approach to the Asian option for their grants, using the 20-day average of closing prices in place of the company stock price.

The valuation formula for Asian options is similar to that of the traditional option. The main difference is that the underlying stock price is replaced by an asset that tracks the average price movement of the stock. In addition, drift and volatility terms are different for the average stock price. The asset that mimics the movement of the average stock price is assumed to follow geometric Brownian motion:

$$\frac{d\hat{S}_t}{\hat{S}_t} = (\hat{\mu} - \hat{\delta})dt + \hat{\sigma}d\hat{z}_t$$

where $d\hat{z}_t$ is the Brownian motion driving the stock price. The parameters of drift and volatility is given by Kemna and Vorst (1990):

$$\hat{\mu} = \frac{1}{2}(\mu + r)$$

$$\hat{\delta} = \frac{1}{2}\left(r + \delta + \frac{1}{6}\sigma^2\right)$$

$$\hat{\sigma} = \frac{\sigma}{\sqrt{3}}$$

Where μ is the expected rate of return, δ is the expected dividend yield, σ is the expected volatility and r is the risk-free rate. Thus, the drift of the average stock price is given by

$$\hat{\mu} - \hat{\delta} = \frac{1}{2}\left(\mu - \delta - \frac{1}{6}\sigma^2\right)$$

So the average price has a lower expected growth than the traditional stock, and its volatility is $\sqrt{3}$ lower than the stock price volatility (57.7% of σ).

3.4 The indexed Asian option

The indexed Asian option is a new proposition by Tian (2013) that adds the concept of average stock prices to the more thoroughly studied indexed option. As is the case for the traditional Asian option, the option has lower volatility and expected return than the indexed option. This should make the risk-neutral value lower than the indexed option, so more options can be granted at equal cost. The subjective valuation of the indexed Asian option is also higher than the indexed option, suggesting that CEOs might be more willing to accept the indexed Asian option than normal indexed options. However, the subjective value is lower than for the corresponding traditional and Asian options, so executives might demand a higher grant-date risk neutral value.

The tracking stock mimicking the average index price follows standard geometric Brownian motion, and the movements can be described in the same way as the average stock price in 3.3, exchanging the parameters with the corresponding index parameters:

$$\frac{d\hat{I}_t}{\hat{I}_t} = (\hat{\mu}_I - \hat{\delta}_I)dt + \hat{\sigma}_I d\widehat{w}_t$$

where $d\widehat{w}_t$ is the Brownian motion driving the index price, which is correlated to $d\hat{z}_t$ with the correlation coefficient ρ. Furthermore:

$$\hat{\mu}_I = \frac{1}{2}(\mu_I + r)$$

$$\hat{\delta}_I = \frac{1}{2}\left(r + \delta_I + \frac{1}{6}\sigma_I^2\right)$$

$$\hat{\sigma}_I = \frac{\sigma_I}{\sqrt{3}}$$

where μ_I is the expected rate of return on the market index, δ_I is the index dividend yield and σ_I is the volatility of the index. Thus, the drift of the average index price is given by

$$\hat{\mu}_I - \hat{\delta}_I = \frac{1}{2}\left(\mu_I - \delta_I - \frac{1}{6}\sigma_I^2\right)$$

3.5 Accounting practice on equity grants

Firms are required by U.S. accounting requirements to disclose compensation data to the public. The cost of a stock option is set to the grant-date fair value, which defined as by the Financial Accounting Standards Board (FASB) Topic 718 as:

The amount at which an asset (or liability) could be bought (or incurred) or sold (or settled) in a current transaction between willing parties, that is, other than in a forced or liquidation sale.

Consistency in assumptions and valuations technique from period to period is important, and it should not be changed unless expected to produce a better estimate of fair value. In this paper's sample, all companies except Disney appear to be using Black-Scholes for option valuation. Disney estimates fair value based on the binomial valuation model, taking in expected exercise multiple and forfeiture rate in place of the expected term of the option, but otherwise using the same parameters. The American style of the options, vesting schedules and option termination upon resignation is not directly reflected when Black-Scholes is used, which is therefore an imperfect way to value the option cost, but it is endorsed by FASB as it sets the price to the market value of the option.

The maturity used to calculate grand-date fair value is commonly not set to the term of the option. Companies make assumptions on expected term by analyzing employees' historical exercise patterns from its history of grants and exercises, vesting period, post-vesting termination behavior and CEO parameters such as age and length of service. The time to maturity used for grant-date valuation is therefore lower than the actual term of the option, which gives a better estimate of the actual cost of the option.

The expected volatility assumption commonly considers both historical and implied volatility over a period similar to the expected term, so it may be impacted by both company performance and changes in market conditions. The objective is to determine the assumption about expected volatility that market participants would likely use. Implied volatility is based on publicly traded options with much lower maturities than the executive option, so it might not be a good predictor of the long-term expected volatility. However, it can still be more representative of future stock price trends than historical volatility, so companies find that a combination is needed. A few companies also include historical volatility of similar firms into their estimates. The combination of implied and historical volatility companies use to determine expected volatility is not publicly disclosed, so firms are relatively free to set the volatility parameter to a level that benefits the company or the CEO without outrage costs.

The risk-free rate is estimated with the interpolated yield of U.S. Treasury zero-coupon issues, so that the term matches the expected term of the option. Table 1 shows the average risk-free rate used by the sample companies for each year, and the average

deviation from the 10-year risk-free rate at grant date. The difference is commonly higher for options with lower expected terms, and firms show consistency in their deviation from the 10-year rate. As with the volatility assumption, firms do not disclose how the risk-free rate is calculated apart from a short comment on what foundation that is used. It might therefore be possible to adjust the parameter opportunistically to reduce grant-date fair value and lower the likelihood of outrage costs.

Average	2010	2011	2012	2013	2014
Risk-free rate	2.7 %	2.3 %	1.3 %	1.0 %	1.7 %
Difference	-1.0 %	-1.0 %	-0.8 %	-0.8 %	-0.9 %

Table 1 - Average risk-free rates used by the sample companies and difference between the used rate and the 10-year U.S. Treasury rate at grant date.

65.5% of the sample companies set exercise price to the closing price at grant date. The rest of the companies use the average between the highest and lowest stock price on the grant date. This has little effect on the actual exercise price of the option, as these deviations are typically small. Average exercise price of these grants is $0.06 lower than the closing price of the grant date, and they are also considered as at-the-money options.

3.6   Proportions of stock and options

Perhaps the most important issue in the compensation arrangement is what fraction of total pay that should be options. The fraction depends primarily on the required investment risk of the company and the risk and wealth parameters of the CEO. Increasing the amount of options generally lead to increased risk-taking, but when options already constitute a large portion of compensation the reverse is possible (Tian, 2004). Granting too many options can also result in excess risk-seeking by the manager, which causes overinvestment and suboptimal project choices. The question of what fraction of compensation that should be stock options is beyond the scope of this paper, but the option design is important no matter how many options that are granted to the CEO and other employees. There is no consensus in the literature to which equity form that is best. Dittmann and Maug (2007) find that the equity proportion of the optimal contract should only include stock, while Habib and Ljungqvist (2005) find that CEOs own too little stock, too many options, and their options are insufficiently sensitive to risk. Other researchers, such as Armstrong, Larcker, and Su (2007) reach the conclusion that stock options should almost always be part of the optimal contract, and Kadan and Swinkels (2008) show that options dominate stock for non-startup firms and firms that are not financially distressed. Observed practice also differ greatly. Some major companies, such

as Facebook and Amazon, do not grant any equity-based pay as the CEO's current ownership is deemed to sufficiently align their interests with shareholders' interests. Other companies, like Oracle, grant the vast majority of CEO compensation in the form of stock options.

Dittmann et al. (2013) claim that most CEOs are overexposed to the risk of their own company, so a reduction of their stockholdings would increase their risk-taking incentives. Hall (1998) finds that if CEO stock holdings were replaced by stock options, the pay-to-performance sensitivity of the median CEO would approximately double. Boyle, Jha, Kennedy, and Tian (2011) create an optimal contract that would remove CEOs incentive to alter volatility, and find that firms with higher volatility should use more options in their compensation arrangement. The proportion of compensation constituted by options has varied significantly after the usage of stock options exploded in 1992. Over the last decade, the usage of RSUs and PSUs has increased while the proportion of stock options has decreased, partly due to less favorable accounting treatment following the adoption of FAS 123R in 2005 (Hayes, Lemmon, & Qiu, 2012). Figure 5 displays the median distribution for the firms included in the original S&P 500, showing that options still represents a large and important part of the compensation package.
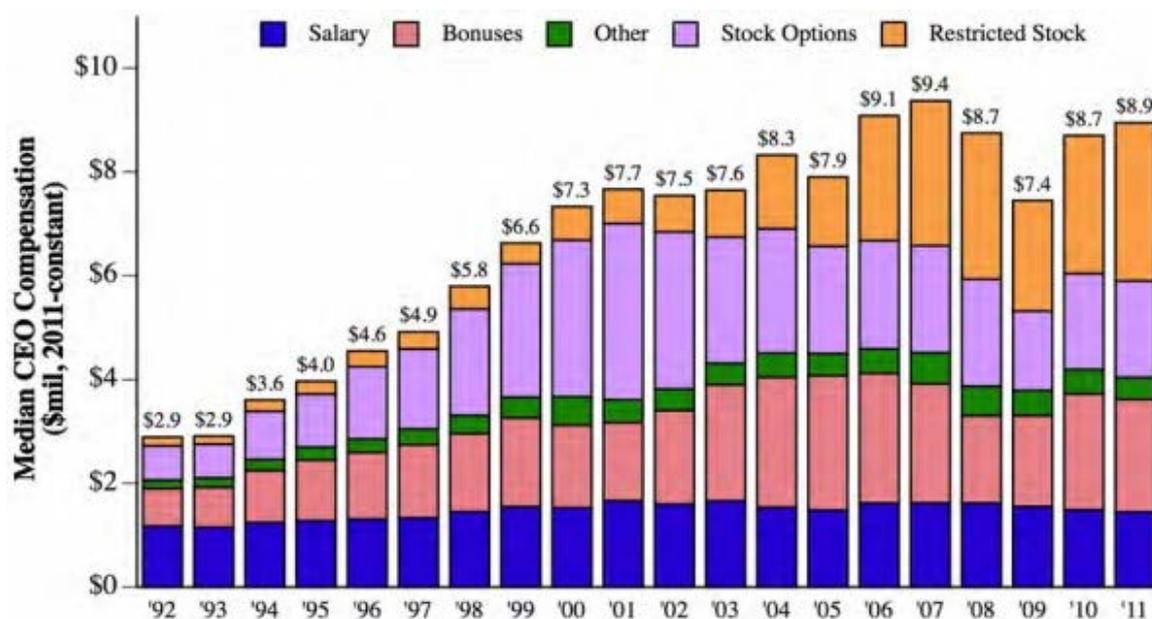
Figure 5 - Median grant-date value of CEO compensation in the 1992 S&P 500 firms (Murphy, 2012).

4 Model

The sample firms are required by FASB ASC Topic 718 to report grant date fair value of equity-based grants in their financial statements. This data includes the number of options and shares granted, an estimate of the fair value of the option and share packages, and the assumptions used to calculate the grant date fair value. Utilizing this information to calculate the risk-neutral value of the option grant, the amount of indexed, Asian or indexed Asian options that would be granted at equal cost to the company can be found. The focus in the analysis will be on options granted at-the-money, as all companies in the sample set their exercise price to the closing price at grant date or the average of the highest and lowest price during the grant date. Value and incentive effects of premium and discount options have also been discussed in other studies (Hall & Murphy, 2000; Murphy, 2012).

The following chapter presents the valuation formulas used to calculate the risk-neutral cost of all the four option types and the number of options that would be granted if total cost is held constant. In 4.2 the option Greeks are presented, before 4.3 provide the formulas used to find the 2014-value of all options granted from 2010 to 2013.

4.1 Risk-neutral valuation

Following the common approach in executive compensation research I use option pricing models based on the risk-neutral valuation principle. For companies that have access to capital markets these values provide reasonable estimates for the cost of granting these options to employees. The Black-Scholes-Merton formula for European options with continuous dividends is also the one used by the vast majority of U.S companies for accounting purposes.

4.1.1 Traditional option

The value of the traditional option follows from the Black-Scholes-Merton model for European call options (Merton, 1973):

$$C_{BS} = S_t e^{-\delta\tau} N(d_1) - K e^{-r\tau} N(d_2)$$

Where S_t is the stock price at time t, K is the exercise price of the option and $N(x)$ is the standard normal cumulative probability distribution function. The current time to expiration τ, d_1 and d_2 is:

$$\tau = T - t$$

$$d_1 = \frac{ln\left(\frac{S_t}{K}\right) + \left(r - \delta + \frac{1}{2}\sigma^2\right)\tau}{\sigma\sqrt{\tau}}$$

$$d_2 = d_1 - \sigma\sqrt{\tau}$$

Where T is the option's exercisable period in years.

4.1.2 The indexed option

The indexed option is similar to the traditional, but has the exercise price tied to an industry, market or peer-group index. There are several propositions on how to design the indexed option. This paper uses S. A. Johnson and Tian (2000a) formula, which is based on the exchange option of Margrabe (1978). The exercise price is given by

$$H_t = K\left(\frac{I_t}{I_0}\right)^\beta e^{\gamma t}$$

where

$$\beta = \frac{\rho\sigma}{\sigma_I}$$

$$\gamma = (r - \delta) - \beta(r - \delta_I) + \frac{1}{2}\rho\sigma\sigma_I(1 - \beta)$$

I_0 and I_t are the values of the chosen index at time 0 and t. At $t = 0$, the exercise price is the same as for the traditional option. The risk-neutral value of the indexed option is given by

$$C_I = e^{-\delta\tau}[S_t N(d_{1I}) - H_t N(d_{2I})]$$

where

$$d_{1I} = \frac{ln\left(\frac{S_t}{H_t}\right) + \frac{1}{2}\sigma_a^2\tau}{\sigma_a\sqrt{\tau}}$$

$$d_{2I} = d_{1I} - \sigma_a\sqrt{\tau}$$

$$\sigma_a = \sigma\sqrt{1 - \rho^2}$$

4.1.3 The Asian option

Using the arithmetic average of the stock's closing prices from grant date ($t = 0$) to the 2014-grant date, the average stock price ($\hat{S}_t$) used in place of S_t is

$$\hat{S}_t = \frac{1}{n+1}\sum_{i=0}^{n} S_i$$

For the Asian option with fixed strike price and floating stock price, the risk-neutral value at time t is given by

$$C_A = \hat{S}_t e^{-\hat{\delta}\tau} N(d_{1A}) - Ke^{-r\tau}N(d_{2A})$$

where

$$d_{1A} = \frac{ln\left(\frac{\hat{S}_t}{K}\right) + \left(r - \delta + \frac{1}{2}\hat{\sigma}^2\right)\tau}{\hat{\sigma}\sqrt{\tau}}$$

$$d_{2A} = d_{1A} - \hat{\sigma}\sqrt{\tau}$$

The expressions for $\hat{\sigma}$ and $\hat{\delta}$ are as given in section 3.3.

4.1.4 The indexed Asian option

Tian (2013) also provides a formula for the indexed Asian option. The exercise price is given by

$$\hat{H}_t = K\left(\frac{\hat{I}_t}{I_0}\right)^{\hat{\beta}} e^{\hat{\gamma}t}$$

Where $\hat{I}_t$ is the average stock price from grant to t:

$$\hat{I}_t = \frac{1}{n+1}\sum_{i=0}^{n} I_i$$

and

$$\hat{\gamma} = (r - \hat{\delta}) - \hat{\beta}(r - \hat{\delta}_I) + \frac{1}{2}\rho\hat{\sigma}\hat{\sigma}_I(1 - \hat{\beta})$$

$$\hat{\beta} = \frac{\rho\hat{\sigma}}{\hat{\sigma}_I}$$

$\hat{\sigma}_I$ and $\hat{\delta}_I$ is as described in section 3.4 The risk-neutral value of the indexed option is then given by

$$C_{IA} = e^{-\hat{\delta}\tau}\left[\hat{S}_t N(d_{1IA}) - \hat{H}_t N(d_{2IA})\right]$$

where

$$d_{1IA} = \frac{ln\left(\frac{\hat{S}_t}{\hat{H}_t}\right) + \frac{1}{2}\hat{\sigma}^2(1-\rho^2)\tau}{\hat{\sigma}\sqrt{(1-\rho^2)\tau}}$$

$$d_{2IA} = d_{1IA} - \hat{\sigma}\sqrt{(1-\rho^2)\tau}$$

4.1.5 Adjusting the number of options granted

Denoting the number of traditional options granted with N_{BS}, the total risk-neutral value of the options package is $N_{BS}C_{BS}$. Using the calculated risk-neutral values for nontraditional options, the amount of these that holds total cost equal is given by

$$N_I = \frac{N_{BS}C_{BS}}{C_I}, N_A = \frac{N_{BS}C_{BS}}{C_A}, N_{IA} = \frac{N_{BS}C_{BS}}{C_{IA}},$$

These numbers are used for the calculation of accumulated value at last known grant date. For comparison purposes, the multiple for how many nontraditional options that can be granted per standard option is used. These are given by

$$q_I = \frac{N_I}{N_{BS}}, q_A = \frac{N_A}{N_{BS}}, q_{IA} = \frac{N_{IA}}{N_{BS}}$$

4.2 Incentives

Measuring the exact incentives that options create for each CEO is done by calculating how much their subjective valuation of the option reacts to a change in stock price or volatility. This requires knowledge on CEOs' risk preferences, personal wealth and investment in the firm, which requires assumptions and more data than the firms provide. Instead, the paper follows S. A. Johnson and Tian (2000b) and base inferences about incentives on the change of the risk-neutral values. These inferences are valid if the risk-neutrality assumption does not have radically different effect for the nontraditional options. The Deltas of the options are used to measure the change in risk-neutral value as stock price changes, and Vega for the change resulting from changing firm risk. As is common for incentive examination, Delta and Vega is adjusted by the multiple that makes the grants equal in cost. The Greeks are then comparable across option types, and measure the change in compensation value for each traditional option granted. In other words, I examine how much the executive's risk-neutral compensation value increases (decreases) with an increase (decrease) in stock price or volatility.

For the traditional option, the Greeks are given by the partial derivatives with respect to underlying stock price, Delta (Δ), and volatility, Vega (denoted Λ). These are:

$$\Delta_{BS} = \frac{\partial C_{BS}}{\partial S_t} = e^{-\delta\tau} N(d_1)$$

$$\Lambda_{BS} = \frac{\partial C_{BS}}{\partial \sigma} = \sqrt{\tau} S_0 e^{-r\tau} N'(d_2)$$

where

$$N'(x) = \frac{1}{\sqrt{2\pi}} e^{-x^2/2}$$

The indexed option has two volatility terms, one with respect to index volatility and one with respect to firm volatility. The CEO is only able to affect the firm's volatility (for a reasonable index), so this is the Vega used in the analysis. The Greeks for the indexed option before adjusting for number of options is:

$$\breve{\Delta}_I = \frac{\partial C_I}{\partial S_t} = e^{-\delta\tau} N(d_{1I})$$

$$\breve{\Lambda}_I = \frac{\partial C_{BS}}{\partial \sigma} = H_t e^{-\delta\tau} \left\{ \sqrt{(1-\rho^2)\tau}\, N'(d_{2I}) \right.$$
$$\left. - \left[\frac{\rho}{\sigma_I} \ln\left(\frac{I_t}{I_0}\right) + t\left(\frac{1}{2}\rho\sigma_i - \rho^2\sigma - \frac{(r-\delta_I)\rho}{\sigma_I}\right) \right] N(d_{2I}) \right\}$$

For the Asian and indexed Asian option the Delta and Vega are approximated by numerical derivation. The adjusted Greeks are found by multiplying by the Delta and Vega for each option by the equal-cost multiplier, shown below for the indexed option:

$$\Delta_I = q_I \breve{\Delta}_I, \ \Lambda_I = q_I \breve{\Lambda}_I$$

4.3   Accumulated value

To get a realistic value of the options at a time $t > 0$ it is necessary to know the estimates the firm would have used for volatility, dividend yield and risk free rate at t. However, there is no shared approach to how companies calculate these estimates. Estimating the parameters in the same way for all sample companies would provide unrealistic results and comparison would be rendered pointless. To avoid this problem and get a realistic set of parameters, the parameters stated by the company in the 2014-grant is used in this

paper. Putting these parameters into the valuation formulas, we find the value of the option packages from 2010 to 2013 at the date of the 2014 grant (T_{2014}).

As executive stock options are not immediately exercisable, the vesting schedule of the company must be taken into account. It is assumed that executives have not exercised any options prior to the 2014 grant. This is a reasonable assumption as the average expected term is 5.95 years, 83% is between five and seven years for 83% and no grants have an expected term less than four years. Furthermore, Hall and Murphy (2002) calculate the likelihood that option are exercised on vesting date, and find that a CEO with risk-aversion of 2 and 50% of his wealth in stock has a 10.0% probability of immediately exercising the options that vest after four years.

The accumulated value consists of the current value of unexercised options and the intrinsic value of options that would be exercised at T_{2014}. Total accumulated value is calculated on the grants from 2010 to 2013. The value of the 2014 grants are not interesting for this discussion as their value will be equal to the risk-neutral cost for all option types. Note that accumulated value is not the same as realized value, as not all options have vested it combines the value of exercisable and unexercisable options. The formula also assumes that the CEO will exercise all the options that have vested if the intrinsic value is higher than the risk-neutral value. For options that have vested, the intrinsic value for the four option types are:

$$IV_{BS} = max\{S_t - K, 0\}$$

$$IV_I \ = max\{S_t - H_t, 0\}$$

$$IV_A \ = max\{\hat{S}_t - K, 0\}$$

$$IV_{IA} = max\{\hat{S}_t - \widehat{H}_t, 0\}$$

For each single CEO-year the value of the traditional option at T_{2014} is:

$$V_{BS} = \ N_{BS}[v\, max(IV_{BS}, C_{BS}) + (1 - v)C_{BS}]$$

The formula is the same for the nontraditional options, replacing N_{BS}, C_{BS} and IV_{BS} with the corresponding values for the option type. v is the fraction of options from the grant that has vested, and is given by

$$v = \frac{Years\ since\ grant}{Vesting\ period}$$

Accumulated value is the sum of values from each grant at T_{2014}, shown below for the Black-Scholes option:

$$AV_{BS} = V_{BS,2010} + V_{BS,2011} + V_{BS,2012} + V_{BS,2013}$$

Vesting schedules of the sample companies are shown in Table 2. Equal vesting means that an equal portion of the option vests at each anniversary of the grant for the given number of years. For a company with four year equal vesting, v is 1 for options granted in 2010, 0.75 for the 2011 grant, 0.5 for 2012, 0.25 for 2013 and 0 for 2014. Two companies, Home Depot and Johnson & Johnson, have unique vesting schedules. Home Depot employs equal vesting from year two to five, while Johnson & Johnson issue options that vest gradually over the ten years to maturity. Grants are generally given at the same time every year, so vesting for all prior years would happen at or a few days away from the 2014 grant for the majority of the sample CEO-years.

4 year equal vesting	5 year equal vesting	3 year equal vesting	100% after 3 years	Other schedules
14	3	6	3	2

Table 2 - Vesting schedules of the sample companies.

The value of the traditional and Asian option at T_{2014} is calculated with the risk-neutral formulas for C_{BS} and C_I from 4.1.1 and 4.1.3, using the parameters provided by the firm for the 2014 grant. The indexed and indexed Asian options need historical parameters to calculate the strike price. For the indexed option the exercise price at $t > 0$ is calculated with:

$$H_t = K \left(\frac{I_t}{I_0}\right)^{\bar{\beta}} e^{\bar{\gamma} t}$$

$$\bar{\gamma} = (\bar{r} - \delta) - \bar{\beta}(\bar{r} - \delta_I) + \frac{1}{2}\bar{\rho}\bar{\sigma}\bar{\sigma}_I(1 - \bar{\beta})$$

$$\bar{\beta} = \frac{\bar{\rho}\bar{\sigma}}{\bar{\sigma}_I}$$

where $\bar{\rho}, \bar{\sigma}$ and $\bar{\sigma}_I$ and are based on daily stock and index prices from January 1st of the grant year to December 31st of 2013, while $\bar{r}$ and $\bar{\delta}$ is the average of all r and δ estimates stated by the company in the years since the respective grant. The exercise price of the indexed Asian option changes the same way. Most companies issue their stock option

grants in the three first months of year, so these estimates for historical parameters should be close to what the CEOs would have used to calculate the risk-neutral value of their holdings in practice. The remaining parameters in the formula for C_I and C_{IA} are the expected dividend, volatility and correlation of the firm, all reported by the company.

5 Data

The sample consists of the largest S&P 500 companies that have granted options to their chief executive officer during the sample period. Out of the 57 companies with highest market capitalization on the S&P 500 (on the 21.05.2015), 32 companies issued stock options to their CEO once or more during the period. Four companies were removed because they stopped granting options early in the sample period. There are five CEO-years without grants, leaving 135 CEO-years in the full sample. Two more companies were removed from the analysis of accumulated value since no assumption data is available for 2014 for these companies. This left 26 firms with a market cap above $80 billion and an average of $138.6 billion, listed in the Appendix. The 2014 grant is not included for calculation of accumulated value as T_{2014} is the grant date of this year, so the values from this grant haven't changed. For this part of the analysis there are therefore 102 CEO-years.

Fifty percent of the sample companies had the same CEO between the 2010 and 2014 grants. Ideally, all firms would have the same CEO for the period, but this would imply sample companies with smaller market cap or a large reduction in sample size. Thus, the companies with two CEOs in the period are kept in the sample. Years when a new CEO was appointed are handled by choosing the CEO with total pay that is closest to the adjacent years' CEO pay. This is generally the one that had the position the longest in the year of the transition. To avoid large deviations linked to these changes, such as special one-time equity grants, golden parachutes or promotion bonuses, these are subtracted from the compensation. It is possible that two executives are valued differently by the company and thus not granted the same level of pay. Research has not reached a consensus whether CEO skill or tenure is significantly related to compensation size for large companies (Cremers & Grinstein, 2009; Daines, Nair, & Kornhauser, 2005; Gabaix & Landier, 2006; Rose & Shepard, 1994), so these companies are treated as if only one person was CEO in the period.

For firms with shifted fiscal years, the compensation data for grants in 2014 were not reported at the time of writing. These companies report their option grants as compensation for the following year. For example, an option grant in August 2010 would be reported in the 2011 proxy statement as 2011 compensation. These grants are treated as if they were granted in the year they are reported for the purposes of this paper. Daily

S&P 500 and stock prices for all firms from 02.01.2001 are used to calculate correlation and look up stock and index price at all grant dates. All stock prices, exercise prices, number of shares and stock options granted are adjusted for stock splits.

5.1 Compensation data

All compensation data was manually collected from the sample companies' Definitive Proxy Statements (DEF14A) for 2010-2015. This includes the nominal value of base salary, bonus, change in pension value and deferred compensation, non-equity incentive plan compensation and other compensation, and the grant date fair value of stock and option awards. Option details such as grant date, exercise price and number of options, maturity and vesting schedule, as well as the number of shares awarded and the performance requirements behind PSUs are also found in these statements.

For CEO-years with several grant dates for options, different maturities or stock with performance conditions, all stock options have been converted to the option type that have the highest grant date fair value in the respective year. This is the standard at-the-money option in all cases where more than one option type occurs. Out of the 135 CEO-years in the full sample there are only one grant with performance requirements and five grants with two different maturities. These special options are converted to the main option with the following formulas:

$$N_{BS} = \frac{Total\ fair\ value\ of\ options\ granted\ during\ year}{Grant\ date\ fair\ value\ of\ main\ option}$$

where the main option fair value is found with

$$Grant\ date\ fair\ value\ of\ main\ option = \frac{Grant\ date\ fair\ value\ of\ all\ main\ options}{Amount\ of\ main\ options\ granted}$$

The resulting amount of main options N_{BS} is then used to calculate the risk-neutral value of the option package and to find the amount of nontraditional options that give equivalent cost.
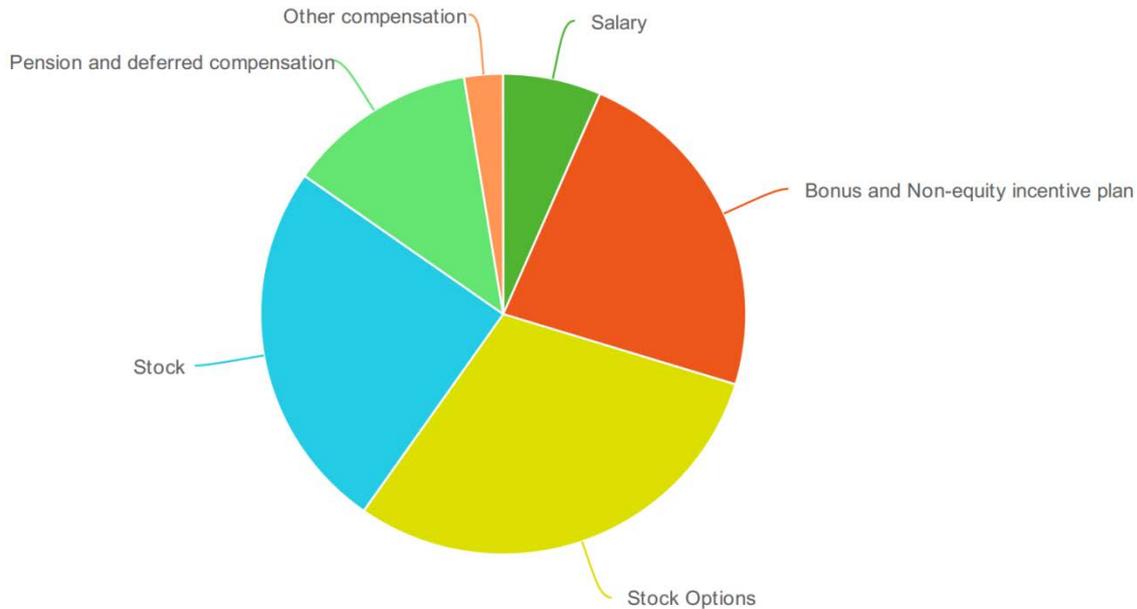
Figure 6 - Average compensation distribution of the sample companies.

The average, median and maximum values of each compensation type for the sample is shown in Table 3, and the average slice each type account for is depicted in Figure 6. As the sample in this paper is only comprised of option-granting companies, the average proportion represented by stock option awards would be lower if all the largest S&P 500 companies were included. There is one stand-out company in the sample, Oracle. Their CEO receives on 91% of his total compensation in the period in the form of options. His compensation has an average total value of $78 145 439 and option value of $71 436 260. Removing Oracle from the sample would reduce average grant-date fair value of options to $4 349 486 (-35.8%), total compensation to $19 790 177 (-9.5%), and the maximum total and option value to $46 497 018 and $14 816 000 respectively.

Average company	Average	Median	Max
Salary	$ 1 476 785	$ 1 497 107	$ 2 857 315
Bonus	$ 830 197	$ 0	$ 7 400 000
Stock awards	$ 5 648 387	$ 5 273 300	$ 18 864 985
Fair value options	$ 6 780 166	$ 3 999 998	$ 90 693 400
Non-equity incentive plan	$ 4 408 363	$ 3 325 936	$ 22 810 000
Change in pension and deferred compensation	$ 2 857 618	$ 1 558 583	$ 16 968 206
Other compensation	$ 585 291	$ 320 221	$ 4 966 774
Total compensation	$ 21 874 293	$ 19 124 592	$ 96 160 696

Table 3 - Average compensation distribution in the sample companies.

5.2   Assumption data

Companies are required to report the assumptions they use to estimate grant-date fair value of each option. The dividend yield, volatility, risk-free interest rate and expected term of the option are all reported, commonly found in the Annual Report's Notes to Consolidated Financial Statements. This gives the information required to calculate risk-neutral value. Companies with several grant dates commonly report the weighted-average of assumptions used. A small number of firms choose to report the range of the assumptions they have used throughout the year, or combine the weighted-average assumptions of options and other grants such as stock purchasing rights. The stock option grants to the executive team typically falls on the same date. As these also constitute the majority of the employee stock options a company grants it is realistic that the weighted-average parameters is close to the input used when the company determines fair value.

In the cases where a range of values is the only available information, the midpoint of the interval is used as a best estimate. These ranges are relatively small, so a deviation from the parameters used by the company will only lead to small changes on the risk-neutral value and Greeks. Companies also report the expected term of the option they use as T in the Black-Scholes model, which is used to determine the appropriate risk-free rate. There is only one exception to this, Disney, using a binomial option-valuation model and replacing expected term expected termination rate and exercise multiple.

5.3   Index parameters and correlation

Index volatility and dividend yield is set to 15% and 2% respectively. S&P 500 has 14.6% annualized volatility since 1990, and 10-year volatility ranges between 14.6% and 16.4% in the sample period. Dividend yields have been relatively stable around 2% the last 15 years (see S&P 500 dividend yield in the Appendix). Implementation of indexed options would give companies the possibility to set their own estimates for index parameters. Some deviations would likely be observed in practice, depending on the weighting of historical and implied volatility used by each company. However, these values provide a realistic estimate for what values companies would use for index parameters.

The correlation between stock price and S&P 500 is set equal to each stock's ten year historical correlation up to the beginning of the grant year. Due to the financial crisis the correlation for shorter periods varies more and likely deviates from what the company

would use in their expectations. As 89% of the sample companies issue executive options with ten year maturity it is reasonable to believe that ten year correlation would also be considered or used in practice.

6 Results

This chapter presents the results from the analysis performed on each sample company with the procedures described in Chapter 4. Section 6.1 presents the number of options that would be granted at equal cost for the nontraditional options. The two subsequent sections compare the incentive effect of all four option types, before the chapter finishes with a look on how accumulated value differs across the options, and how option value has developed after the grant date.

6.1 Number of options granted

One of the main arguments for why nontraditional options should be better than traditional options is that more options can be granted at equal cost. S. A. Johnson and Tian (2000b) find that 2.97 or 2.26 indexed options can be granted at an equal cost as a traditional at-the-money option with 20% and 30% volatility respectively. While their assumptions for dividend yield and index volatility have been stable in the years following their article, and are the same as in this paper, the risk-free rate at 8% makes the value gap between the two options larger than it is today. For the sample firms, the average q_I is 1.24, significantly different from Johnson and Tian's hypothetical firm. q_I ranges between 0.68 and 1.84, with $q_I < 1$ for 18.6% of the CEO-years. Low multiples are especially prevalent in companies with relatively high dividend yields and low volatility. These firms would issue fewer indexed options than traditional options holding the cost constant, making it highly unrealistic that indexed options will be implemented in these companies.

q_I	2010	2011	2012	2013	2014	All years
Average	1.307	1.281	1.196	1.157	1.269	1.242
Median	1.319	1.287	1.234	1.215	1.314	
Max	1.675	1.751	1.571	1.571	1.839	
Min	1.037	0.919	0.787	0.682	0.846	

Table 4 - q_I for the sample years.

A higher risk-free rate leads to higher q_I, as C_{BS} increases but C_I is unaffected by the risk-free rate. Lower dividend yield leads to an increase in both option values, but the traditional value changes more than the indexed so the multiple increases. This is as expected, as d_1 and d_2 includes the expected growth term $r - \delta$. Among the sample years the risk-free rate was highest in 2010, and decreased every year until it went up in 2014.

q_I follows the same pattern, and with the low risk-free rates in the sample period the multiple is consistently lower than in previous research. This might impact the suitability of indexed options and lead to lower payoff for the CEO. Additionally, higher correlation increases the multiple. C_I decreases when correlation increases due to a reduction in option volatility (σ_a). The difference between the lowest and highest correlation in the sample (0.46 and 0.80) corresponds to an approximate increase of 45% for q_I. The consequence from a change in volatility is ambiguous, and depend on the Vega of the options. If $\Lambda_I > \Lambda_{BS}$, a volatility increase will reduce the multiplier, and vice versa.

q_A	2010	2011	2012	2013	2014	All years
Average	2.158	2.082	2.003	1.956	1.992	2.038
Median	2.115	2.059	2.005	1.950	2.002	
Max	2.681	2.355	2.264	2.282	2.467	
Min	1.889	1.823	1.703	1.572	1.722	

Table 5 - q_A for the sample years.

For the Asian option, the multiples are higher than for the indexed options and close to the numbers presented by Tian (2013). The average q_A over all sample years is 2.04. The Asian multiple is also more stable across companies than the two indexed option types. A higher expected volatility or lower dividend yield increases the multiple, but the increase following a change in either of these are small, so firm-dependent parameters do not account for large changes. The Asian multiple is also sensitive to the risk-free rate, reducing the multiple with roughly 0.1 for every percent decrease in r. As expected q_A is highest in 2010, when the risk-free rate was highest.

q_{IA}	2010	2011	2012	2013	2014	All years
Average	2.499	2.384	2.126	2.017	2.286	2.263
Median	2.517	2.400	2.112	2.127	2.373	
Max	3.438	3.580	2.999	2.962	3.581	
Min	1.787	1.506	1.238	1.036	1.347	

Table 6 - q_{IA} for the sample years.

The indexed Asian multiple has the highest average, but also the biggest range of the three option types. The average q_{IA} is 2.26, but the lowest multiple is 71% lower than the highest. The multiplier is affected by the parameters in the same way as the indexed option. A higher correlation increases the multiplier, and also for the indexed Asian option the difference between minimum and maximum correlation in the sample amounts to about 45% higher q_{IA}. Higher risk-free rate or lower dividend yield leads to higher

multiple, and the response to a change in volatility depends on the Vega of the option compared to the traditional option Vega.

6.2 Delta

For the average CEO-year, a Delta of 1.0 corresponds to an increase (decrease) of approximately $655 563 in the risk-neutral option value when the stock price goes up (down) $1. The actual change will be slightly bigger (smaller) as Delta increases the further in-the-money the option is and decreases the further out-of-the-money it goes. The average Deltas for the sample years and the average improvement for the sample firms are presented in Table 7 and Table 8 below. Note that the Delta change is not the change of the average Delta reported in Table 7, but the average change for each sample company. The Delta of the Asian and the indexed Asian option is measured with respect to an increase in the average stock price. The price change would therefore have to be sustained until the option is exercised for the CEO to be able to reap the benefit of the price change.

Deltas	2010	2011	2012	2013	2014	All years
Traditional	0.567	0.547	0.512	0.492	0.514	0.526
Indexed	0.690	0.668	0.623	0.597	0.648	0.645
Asian	0.893	0.867	0.811	0.781	0.821	0.835
Indexed Asian	1.065	1.040	0.973	0.935	1.025	1.008

Table 7 - Average option Deltas for the sample companies.

Delta change	2010	2011	2012	2013	2014	All years
Indexed	21 %	21 %	21 %	20 %	25 %	22 %
Asian	58 %	59 %	59 %	59 %	60 %	59 %
Indexed Asian	88 %	89 %	89 %	89 %	98 %	91 %

Table 8 - Average Delta improvement for the sample companies.

All three nontraditional options provide higher Deltas than the traditional option for all CEO-years in the sample. Using the average price also improves the Delta of both traditional and indexed options for all sample companies. For 127 of the 128 CEO-years, the indexed Asian dominates the Asian, which in turn dominate the indexed option. The indexed option increases Delta by more than 10% for 87% of the grants. The Asian and indexed Asian options offer consistently higher Deltas, with a minimum increase of 47% and 57% respectively.

6.3 Vega

For the average CEO-year, a Vega of 50.0 corresponds to an increase (decrease) of approximately \$327 781 in the risk-neutral option value when volatility goes up (down) 1%. The actual change will be slightly smaller (bigger), since Vega decreases as volatility increases. Average Vegas for the sample years and the average differences from the traditional option are presented below in Table 9 and Table 10. Note that the Vega change is not the change of the average Vega reported in Table 9, but the average change for each sample company. Vega is measured with respect to the volatility of stock price returns for all option types.

Vegas	2010	2011	2012	2013	2014	All years
Traditional	36.1	43.4	50.2	59.0	74.5	52.8
Indexed	39.0	45.0	45.1	51.1	73.6	50.9
Asian	27.2	33.6	39.2	46.8	59.8	41.4
Indexed Asian	33.7	39.4	39.1	44.9	65.8	44.7

Table 9 - Average option Vega.

Vega change	2010	2011	2012	2013	2014	All years
Indexed	10 %	5 %	-9 %	-14 %	-4 %	-3 %
Asian	-26 %	-23 %	-22 %	-21 %	-19 %	-22 %
Indexed Asian	-6 %	-8 %	-21 %	-25 %	-14 %	-15 %

Table 10 - Average change in Vega with a switch to a nontraditional option.

56% of the option grants would have lower Vega with indexed options than with traditional, while 100% of the Asian options and 84% of the indexed Asian options would. The Vegas for all options increase over the sample period, but with the low risk-free rates during the period the differences in Vega is small for all years. As expected, the two Asian option types provide fewer incentives to increase volatility than the traditional and indexed option do.

Decomposition of the formula for Λ_{BS} by merging constants and setting the time to maturity to 10 gives the formula

$$\Lambda_{BS} = 1.2615 * S_0 e^{-10r - d_2^2/2}$$

at grant date. The exponential components d_2^2 (d_2 squared) and $10r$ are responsible for some small changes in Vega, as the risk-free rate changes over the years and d_2 differs in all grants. However, the initial stock price has a much stronger impact on Vega. For the indexed option, Vega at grant date for the option with 10 year maturity can be reduced to

$$\Lambda_I = q_I * \frac{S_0}{\sqrt{2\pi}} * e^{-10\delta - d_{2I}^2/2} * \sqrt{(1 - \rho^2)10}$$

The correlation component ranges between 1.9 and 2.8 for the maximum and minimum correlation in the sample respectively, while the exponential component depends more on firm-specific parameters than in Λ_{BS} as dividend yield takes the place of the risk-free rate. q_I is also included, which differ greatly between companies. The sample companies' stock price increases for almost all companies throughout the period (See Table 11), which leads to an increase in average Vega each year also for the indexed option. The indexed option's Vega is higher than the traditional for 2010 and 2011, but is lower for the other sample years.

6.4 Accumulated value

The average accumulated value for the executive stock options granted from 2010 to 2013 is \$55 751 392, 94.24% higher than the sum of risk-neutral grant date values of \$28 702 676. Compared to the average grant date fair value at \$27 865 961, the options are worth twice as much at T_{2014}. This large gain is not surprising, as the S&P 500 increased from 51% to 80% in the years between the first and last grants of the companies. S&P 500 grew steadily throughout the sample period, with 2011 being the only year with lower than 13% annual return. While the sample period is not as bullish as the late 1990s, when annual returns ranged between 20.9% and 37.2%, the value of granted options was at its peak and there was widespread compensation criticism, the sustained growth of the stock market has a strong impact on the results in this section. Data on stock price returns of the sample companies from grant date in each year until T_{2014} is shown in Table 11.

Stock price increase	2010	2011	2012	2013
Average	100.4 %	76.3 %	51.0 %	27.2 %
Median	79.2 %	62.0 %	49.4 %	24.6 %
Max	239.5 %	322.6 %	232.0 %	98.8 %
Min	20.2 %	3.9 %	-11.0 %	-1.1 %
Average index increase	65.9 %	41.3 %	35.1 %	20.6 %

Table 11 - Stock and index price gains for the sample companies from grant date in respective year until T_{2014}.

95% of the traditional options are in-the-money at T_{2014}. The five exceptions are grants from either 2012 or 2013. For 49% of the grants, intrinsic value is higher than C_{BS}. For these grants, all vested options would be exercised under the assumptions for accumulated value (Table 15). Furthermore, 91.2% of the options have a higher risk-

neutral value than at grant date. Table 12 shows the average and median increase from risk-neutral grant cost to the accumulated value at T_{2014} for each of the sample years. Total increase is measured by total accumulated value divided by the grant date risk-neutral value, $AV_{BS}/ \sum N_{BS}C_{BS}$.

Average	2010	2011	2012	2013	Total increase
Traditional	224 %	172 %	118 %	69 %	140 %
Indexed	126 %	122 %	64 %	28 %	79 %
Asian	173 %	122 %	85 %	62 %	104 %
Indexed Asian	77 %	88 %	36 %	17 %	49 %
Median					
Traditional	200 %	152 %	122 %	59 %	144 %
Indexed	70 %	91 %	54 %	17 %	70 %
Asian	157 %	107 %	68 %	47 %	99 %
Indexed Asian	53 %	55 %	19 %	6 %	31 %

Table 12 - Growth of option value from the risk-neutral value at grant until T_{2014}.

Table 13 shows the average difference between the accumulated value of the traditional and the nontraditional options. All three options have lower accumulated value than the traditional, and the indexed option types have significantly lower value. Table 14 shows the average difference between intrinsic value of the nontraditional options and the standard option.

	Average difference in accumulated value from traditional option		Median difference in accumulated from traditional option	
Indexed	$ -16 497 903	-29.5%	$ -10 346 708	-33.8%
Asian	$ -2 788 014	-7.8%	$ -6 790 856	-15.5%
Indexed Asian	$ -19 986 359	-35.1%	$ -15 335 114	-34.0%

Table 13 - Average difference in accumulated value at T_{2014} between the nontraditional options and the traditional option, which has an accumulated value of $55 751 392. All grants from 2010 to 2013 are included in the calculation.

	Average difference in intrinsic value from traditional option		Median difference in intrinsic value from traditional option	
Indexed	$ -21 552 301	-56.1 %	$ -16 006 244	-54.2 %
Asian	$ 847 388	1.4 %	$ -4 877 195	-11.4 %
Indexed Asian	$ -24 941 493	-52.3 %	$ -19 369 750	-49.0 %

Table 14 - Average difference in intrinsic value at T_{2014} of the traditional and nontraditional options. All grants from 2010 to 2013 are included.

6.4.1 The indexed option

A change to indexed options would make the CEO's lose \$16 497 903 dollar on average. The lower value is as expected with the properties of the indexed option. It is however very surprising that only one CEO, the CEO of Gilead Sciences, benefit from changing to indexed options. His accumulated value with indexed options is \$7 884 535 (4.92%) higher than with traditional options. This small gain is startling as the company vastly outperforms the S&P 500 in all grant years, with as high as 323% return on the stock from the 2011 grant while the index price increased 39% in the same period.

The intention behind indexed options is to only have a payoff when the company outperforms the index. In a sample including every firm the index is based on it would be expected that about 50% of the indexed options have an intrinsic value of zero. In the sample, 72.5% of the grants have positive intrinsic value at T_{2014}. The intrinsic value is higher than the C_I-value for 37% of the grants, so all the vested options would be exercised for these grants. However, the average loss in intrinsic value of all options at T_{2014} is substantial (\$21 552 301, down 56.1% compared to the traditional option), which makes it the option with lowest average intrinsic value.

Traditional	Indexed	Asian	Indexed Asian
49 %	37 %	25 %	4 %

Table 15 - Percentage of the grants where the maximum possible amount of options would be exercised.

6.4.2 The Asian option

The Asian option has a slightly higher average intrinsic value than the traditional, but the median is negative at -11.40%. A change to Asian options would increase accumulated value for 30.7% of the sample companies. This suggests that Asian options could have a chance to be supported by some CEOs if they have power to affect the design of their compensation package. Oracle, with grant date fair values 9-13 times higher than average and an increase in accumulated value by \$172 927 007 (137.09%), is responsible for most of this deviation. Removing this company from the sample changes the average intrinsic value difference from positive to -\$6 035 796 (-4.02%), and increases the average loss in accumulated value from -\$2 788 014 (-7.78%) to -\$7 920 638 (-10.03%).

As is the case for the traditional option, the majority (96%) of Asian options have positive intrinsic value at T_{2014}. The four grants that are out-of-the money were granted before relatively large drops in the firm's stock price which were followed by slow recovery. While these options are likely to end up in-the-money before maturity (they all have

seven or more years to expiration), the two to three years with average stock price below exercise price requires the stock price to be higher than exercise price for a sustained period of time for the option to have a realized value that is higher than the grant date risk-neutral value.

6.4.3 The indexed Asian option

The indexed Asian option has the lowest average accumulated value of all four option types, and for 73% of the sample firms it is the option type that gives lowest accumulated value. Similar to the indexed option, a surprisingly high percentage of the grants have positive intrinsic value with indexed Asian options (78.4%). However, the average intrinsic value is 52.3% lower than the traditional option, and only four grants have high enough intrinsic value for them to be exercised.

Coca-Cola is the only company in the sample where the CEO would achieve higher accumulated value with the indexed Asian options. His gain is only \$1 446 025 (3.16%), and just one of the four grant years have a positive change. He would also be better off with Asian options, which have a gain of \$18 330 014 (50.34%), so none of the CEOs in the sample would have been best off with the indexed Asian option.

6.4.4 The 2010 grant

The 2010 grant is the most interesting grant in the analysis, as all the options from this grant is exercisable for 21 out of the 26 CEOs, and the options are getting close to their expected term. For the five CEOs that still have some unvested options 75% or 80% of the options have vested. With a return between 51% and 80% for the S&P 500 between the 2010 grant date and T_{2014}, this grant represents large values for the CEOs. None of the sample firms have negative stock return for the period, and the average (median) company's return is 100% (79%). The 2010 grant might also contain information on how the other grants can be expected to develop, and isolated results from this grant should be more pronounced than the total accumulated value reveal. 2010 is also the sample year with highest risk-free rate. As found in Chapter 6.1, the grant number multiples are highly sensitive to changes in risk-free rate, and the number of options that are granted have a significant effect on incentives and expected payoff for the CEO.

	Traditional	Indexed	Asian	Indexed Asian
Average	224 %	126 %	173 %	77 %
Median	200 %	70 %	157 %	53 %
Max	464 %	460 %	415 %	360 %
Min	-7 %	-64 %	9 %	-51 %
Grants with negative development	1	4	0	9

Table 16 - Value of 2010 grant at T_{2014}.

The value of the 2010 grant at T_{2014} is shown in Table 16. For this grant, nine grants have a higher value with Asian options than with the traditional, while the indexed and indexed Asian values are lower for all companies. Apart from one firm, all the options granted in 2010 were worth more at T_{2014} than at grant date. With the indexed or indexed Asian option, four and nine option grants respectively would have decreased in value in the period. For the intrinsic value of the grant, all traditional and Asian options are in-the-money at T_{2014}, while 23.1% of the indexed options and 30.8% of the indexed Asian options are out-of-the-money.

7 Feasibility and Implications of a Change in Option Design

This chapter examines the feasibility of nontraditional options being used in practice, and reviews the incentive effects over time. First, I compare the incentive results from the analysis to results from past research, and discuss the implications of the deviations. The results on accumulated value and number of options granted from Chapter 6 has important consequences for the feasibility of a change in option design, which is discussed in chapter 7.2.

7.1   Changes in incentives

The steady increase in stock prices over the sample period has important implications for the incentive effects of the options. As shown in Figure 7, the incentive to increase stock price improves as the options become more in-the-money. This effect is stronger for all three nontraditional options. Due to tax considerations, granting options in-the-money is not normal in the U.S., and virtually all options are granted at-the-money (Hall & Murphy, 2000). In bullish markets such as the sample period, the incentive to increase stock price is therefore likely to increase after the grant date. In periods like this, incorporating average stock price does not only provide better incentives at grant date, the incentives are also expected to increase at a faster rate than the traditional and indexed options.
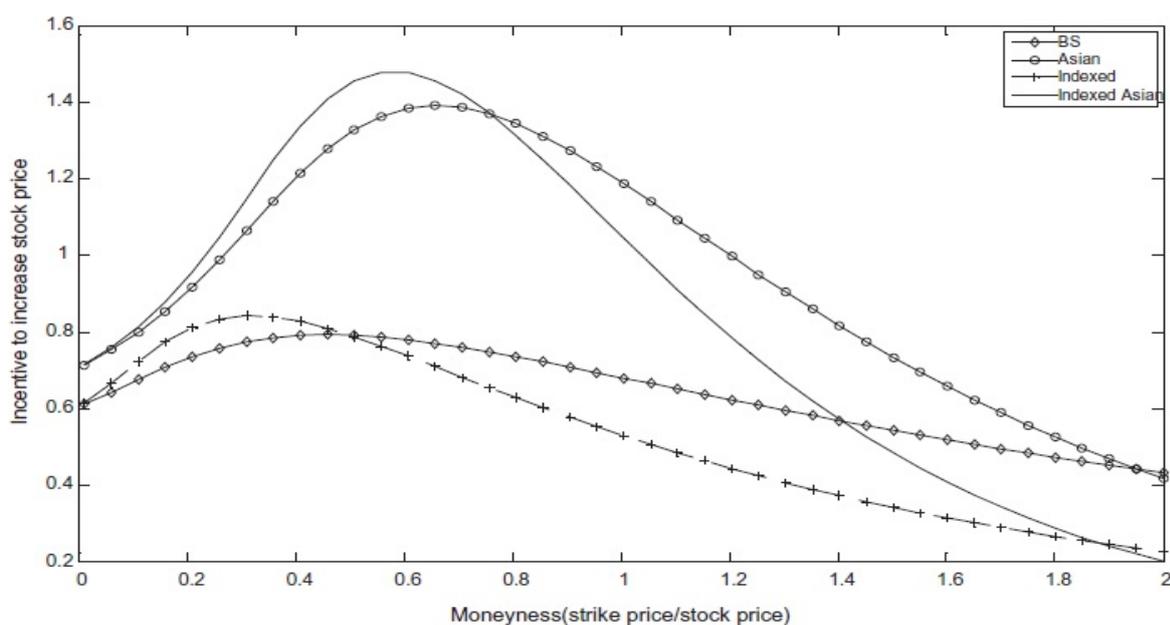

Figure 7 - Incentives to increase stock price with different stock prices (Tian, 2013). The incentive to increase stock price is here measured with pay-to-performance sensitivity.

Chapter 6.2 showed that all CEOs would have higher incentives to increase stock price with any of the three nontraditional options. The average improvement for Δ_I is 22%, significantly smaller than the 93% found by S. A. Johnson and Tian (2000b), but it is still higher than the traditional option. Academics have described the lack of indexation in practice as a puzzle (Hall & Liebman, 1997), but the small Delta increase observed in the sample might not provide sufficient motivation to change to indexed options. Tian (2013) examines the incentives to increase stock price using pay-to-performance sensitivity, and finds that the indexed option is rarely better than the traditional option, although the differences are not large. On the other hand, the Asian option types are consistently better with his parameters and for the CEOs in this paper's sample. Shareholders prefer steady growth to volatile swings, but the path the stock price takes is not important to an executive with traditional options as long as the option pays off in the end (Clark-Murphy & Soutar, 2005). As these two option types are linked to average stock price, they provide better incentive alignment by focusing on long-term gains instead of motivating the executive to increase stock price over a specific horizon. Thus, with respect to incentives to increase stock price, it seems like the Asian and indexed Asian options are better suited for use in executive compensation than the traditional option and the often proposed indexed option.

The average Vega of 50.9 for the indexed option differ greatly from the 198.8 found by S. A. Johnson and Tian (2000b). As seen in chapter 6.2, Vegas increase as grant-date stock price goes up. However, initial stock price does not affect the Vega-ratio between the four option types. Lower risk-free rate leads to a large reduction in Λ_I, while Λ_{BS} increases. Johnson and Tian use a risk-free rate of 8%, leading to about 45% reduction in Λ_{BS} and 40% increase in Λ_I compared to the level of the risk-free rate between 2010 and 2013. The risk-free rate also affects Λ_A and Λ_{IA}. The effect on the indexed Asian Vega is positive and changes by the same percentage as the indexed option's Vega, while the effect on Asian option Vega is negative and changes about twice as much as the traditional option's Vega. Different risk-free rate regimes therefore have important implications for the incentives to increase firm volatility. When the risk-free rate is high, the Asian option provides almost no risk incentives, and the indexed option types provide much higher risk incentives than the traditional option. When the risk-free rate is low, the incentive to increase volatility is almost the same for all four options. Thus, the decision

of which option to use to align risk incentives will depend heavily on risk-free rate in addition to the CEO's and firm's risk characteristics.

Boyle et al. (2011) have derived a contract removing the incentives to alter volatility, but a problem with their solution is that they use higher option levels which reduce the subjective value of options. The pay composition that is given by their model might therefore lead to a reduction in the incentives to increase stock price. The Asian option types could be another way to limit incentives to increase volatility without increasing the value of options granted, and would improve incentives to increase stock price if total cost is held constant.
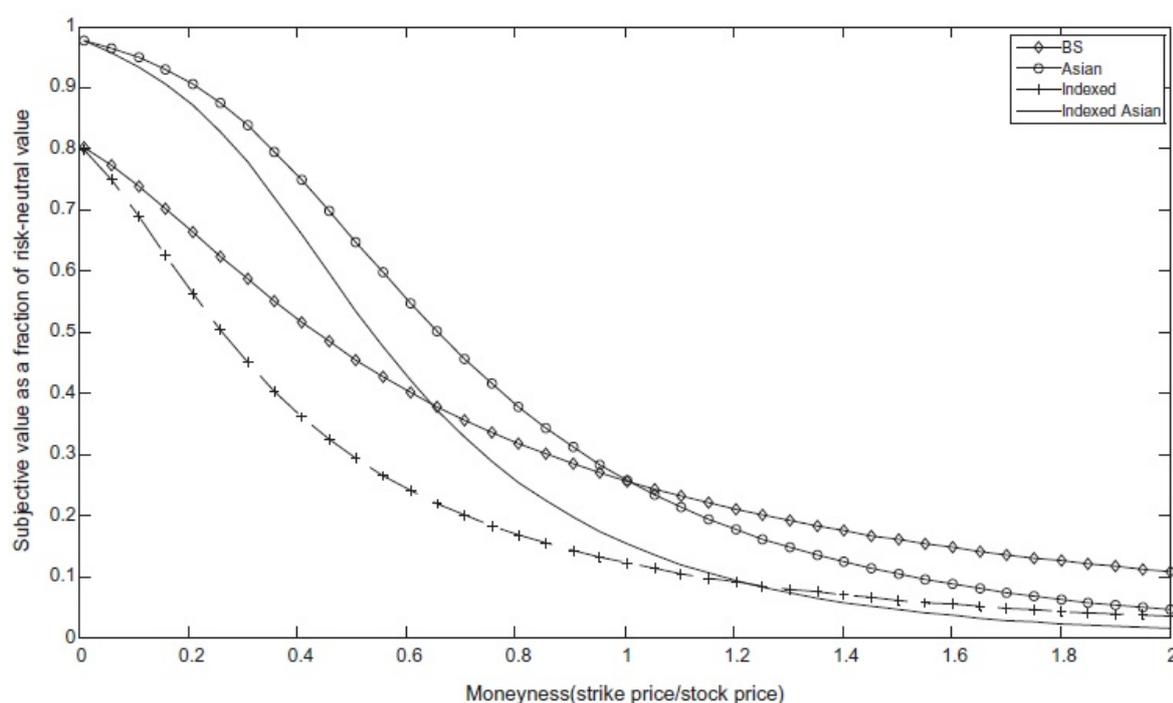

Figure 8 - The subjective value to the option recipient as the option moneyness changes (Tian, 2013). The CEO in the example has a risk aversion coefficient of 2 and 75% of his wealth tied to options. For CEOs with less wealth in stock options the subjective value will be higher.

Most option plans are multi-year plans, and different option granting plans have different incentives to increase stock price as changes in current stock price affect the value of future option grants in different ways. Empirical evidence suggests that the pay to performance relationship is stronger for fixed number plans relative to non-fixed number plans (Hall, 1998). Companies that fix stock option compensation to a dollar value will grant fewer options in the following year if current stock price increases. This factor is not affected by a change to any of the three nontraditional option types studied in this paper. All four option values have the same percentage increase from a change in initial stock price, so the effect on subsequent years will be the same for all options. However,

the Asian option types would benefit more from a stock price decrease occurring shortly before the new grant. The new grant would have a lower exercise price without affecting the payoff for past grants significantly (unless stock price remains low for a long time). Traditional and indexed option grants would also benefit from this, but only if the stock price recovers before their maturity. Perverse incentives to temporarily decrease stock price by timing information might therefore be higher with the Asian option types, which might mitigate the benefit from increased focus on the stock price path.

7.2   Feasibility of the nontraditional options

If CEOs are able to extract rents and affect the design of their pay as advocated by the managerial power perspective, indexed and indexed Asian options are not likely to be used by companies. In the sample period, with consistent increases in stock price across the board, the indexed option types would cause a large loss in accumulated value for the average CEO. In times with higher risk-free rates, the amount of options granted would be higher with these two options, and the accumulated value might perform better than in the sample period of this paper. However, a higher risk-free rate leads to lower subjective value and a higher threshold of acceptance due to the lower likelihood of expiring in-the-money. This makes it unrealistic that CEOs will desire a change to indexed options independent of the risk-free rate, without demanding a higher risk premium. Reducing the exposure to systematic risk could have a positive effect, but this is mainly an advantage in falling markets. The CEO will not be able to predict the future of the stock market, so this effect will depend on his risk preferences and the general opinion of which direction the stock market is expected to move. As evident from the calculated accumulated value in this paper, the traditional option is superior for the CEO in periods with high stock returns. If the CEO is overexposed to the risk of his own company, traditional options might also be better as it links option compensation to common risk, and the executive will demand a higher risk-premium if too much firm-specific risk is imposed. In total, it can be expected that CEOs will oppose indexing unless he expects a market decline or for other reasons desire a decrease in stock market exposure. Tax constraints have also been suggested as a possible reason that indexed options are not used (Schizer, 2000). The combination of lower incentive gains than previously assumed and tax constraints might help explain the lack in indexation in practice. The viability of the indexed option seems to have been higher in the late 1990s when the risk-free rate was higher and the value gap between the option types were bigger. However, as indexed options seem to increase less

than the traditional options in periods of good performance, it can provide means to reduce excessive pay levels during bull markets. Some firms might therefore be willing to accept a higher risk premium to tie parts or all options to a market index.

Many firms use relative performance evaluation for all or portions of their stock grants. Relative performance measures are commonly linked to a peer group of similar-sized firms in the same industry. Firms that use RPE on stock might be reluctant to provide similar arrangements for the stock option part of compensation, as portions of the equity-based compensation is already subject to change with peer group performance. For these firms, using industry or peer group performance in indexed or indexed Asian options exposes a high portion of the CEOs compensation to relative performance, increasing the potential loss from bad performance and thus decreasing the subjective value of both options and stock. However, when the indexed option types use market indexes to remove systematic risk, the relative performance measures work in a distinctly different way than PSUs and should not be considered as substitutes.

One company in the sample, Honeywell, have performance requirements for a portion of the 2014 stock option grant that determine how many of the options that are granted. Another possibility is to enable accelerated vesting when the company achieves the performance requirements (Bebchuk et al., 2002). These two features could provide an alternative to the indexed option types, linking a larger portion of the total equity compensation to relative performance, but it does not remove market movements from the option payoff. As companies already employ this method on PSUs, it should have a lower threshold for being adopted. A potential problem with this approach is the loss in compensation that can result from a small decrease in TSR. Peer groups used in relative evaluation often have few firms, and a slight decrease in TSR can lead to lower rank. If the percentage of equity that vests is linked to TSR-ranking in the peer group, even a 0.01% decrease in TSR can lead to a lower rank and make the CEO lose 10% or more of his PSUs. This could lead to frustration for the CEO, especially when the values at stake are high. Such small differences are not likely to be a result of the CEOs effort or performance. The vesting amount should therefore be linearly dependent on peer group rank in order to avoid a large loss for the CEO emanating from slight TSR differences.

Meulbroek's (2000) indexed option with fixed exercise-price and the underlying asset being a portfolio of the firm's stock hedged against market and industry price movements

should provide lower sensitivity to systematic risk than the indexed and indexed Asian options analyzed in this paper do. her indexed option provides better incentives to increase stock price than the traditional option, her recommendation is to grant fewer of this option than the traditional option due to the deadweight costs associated with the lower subjective value of indexed options. This may shift the optimal mix of cash and equity-based pay towards cash, increasing the value the CEO place on the total compensation package. This approach might be more viable for use in compensation than the indexed option studied in this paper. However, the Deltas reported by S. A. Johnson and Tian (2000b) from the same period is about twice the values for the sample companies of this paper. The incentive effects of Meulbroek's portfolio-indexed option may have changed in a similar fashion. Additionally, lowering stock option pay to increase cash compensation has tax implications for both the company and the executive, so this must be taken into account.

Meulbroek (2000) also argue that the indexed option do not work as intended, and remains highly sensitive to market or industry price movements. As found in 6.4.1, a surprisingly high percentage (72.5%) of indexed option grants would be in-the money at T_{2014}. This may be related to the choice of major companies for the sample. As the sample firms are chosen because of the high market capitalization in 2015, they might have had higher stock return over the sample period to achieve this position. More concerning is it that only one CEO would be better off with indexed options than with the traditional. That Gilead Sciences' 2010 grant would be less worth at T_{2014} with indexed options, after a stock price increase of 240% while the index changed 64% in the same period, is puzzling. The combination of many indexed option grants being in-the-money and almost all CEOs losing value with indexed option suggests that Meulbroek's criticism might be justified, but a bigger sample is needed to confirm if the indexed option is dysfunctional.

8 Conclusion

Looking at the incentive effects and value over time of the options in a more realistic setting than what has previously been done, some characteristics of the options appear distinctly different than other papers have suggested. These differences might help explain the absence of indexed and other nontraditional options in practice.

Firstly, the risk-free rate has a substantial impact on the amount of options granted, incentives to increase stock price and incentives to increase volatility. This has important consequences for when the options are viable. The indexed option, often proposed by academics, have often been studied in settings where it has a much lower value than the traditional option so more options could be granted at equal cost. In the sample of this paper, the average company would only grant 24.2% more indexed options, and the incentive to increase volatility is much lower than theoretical work has suggested. Options linked to average stock price provide better incentives to increase stock price than the indexed and traditional option. However, the lower incentives to increase volatility associated with these options might not be suitable for all companies.

Secondly, the value increase over time is higher for the traditional option than for the nontraditional for most CEOs. 30.7% of CEOs in the sample would benefit from a change to Asian options, while only one CEO would have been best off with indexed options. If executives are able to influence their own compensation as advocated by the managerial power perspective, it is highly unlikely that a change to indexed or indexed Asian options will occur without increasing the risk-neutral cost of the grant.

From the principals' perspective, a change to indexed options involves a tradeoff between the degree of change in incentives at the time and the increased risk premium demanded by the CEO. The lower accumulated value of the indexed option in bull markets might justify a higher risk premium. For the Asian option types, the improvement in incentives to increase stock price must be valued up against the lower incentive to increase volatility, which should be beneficial to some companies. The optimal arrangement will vary over time, so this is a decision the compensation committee should consider regularly.

Further research incorporating accumulated option value could expand the model to include stock awards and examine the incentive effects in a principal-agent framework.

This would also allow for analysis of subjective value for actual CEOs and provide more reliable information on the incentive effects of the options. Another interesting aspect of compensation practice is firm's ability to set estimates for volatility, dividend, risk-free rate and expected term without disclosing how these are calculated. It would be highly interesting to investigate whether companies set these estimates in order to get a lower grant-date fair value.

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Appendix

Sample companies

Sample companies listed alphabetically by the company ticker. Market cap is given in billion dollars on the 21.05.2015. Boeing and JPMorgan Chase were only included in the analysis of number of options and incentives.

Ticker	Company	Market cap	Sector
AXP	American Express	82.0	Financials
BA	Boeing	101.9	Industrials
CMCSA	Comcast	144.6	Consumer Discretionary
COP	ConocoPhillips	80.9	Energy
CVS	CVS Caremark	116.9	Consumer Staples
CVX	Chevron	198.4	Energy
DIS	Walt Disney	187.3	Consumer Discretionary
GILD	Gilead Sciences	163.4	Health Care
HD	Home Depot	146.4	Consumer Discretionary
HON	Honeywell	83.1	Industrials
INTC	Intel	159.2	Information Technology
JNJ	Johnson & Johnson	284.0	Health Care
JPM	JPMorgan Chase	247.3	Financials
KO	Coca-Cola	182.1	Consumer Staples
MA	MasterCard	105.9	Information Technology
MCD	McDonalds	95.2	Consumer Discretionary
MDT	Medtronic	114.7	Health Care
MMM	3M	102.8	Industrials
MRK	Merck	169.8	Health Care
NKE	Nike	89.8	Consumer Discretionary
ORCL	Oracle	193.4	Information Technology
PFE	Pfizer	211.6	Health Care
SLB	Schlumberger	116.9	Energy
UNH	UnitedHealth Group	114.7	Health Care
UNP	Union Pacific	91.9	Industrials
UPS	United Parcel Service	91.97	Industrials
UTX	United Technologies	106.0	Industrials
V	Visa	169.6	Information Technology

S&P 500 dividend yield

Yearly dividend yield of S&P 500 since 2001:

Year	δ_I
2001	1.37 %
2002	1.83 %
2003	1.61 %
2004	1.60 %
2005	1.79 %
2006	1.77 %
2007	1.89 %
2008	3.11 %
2009	2.00 %
2010	1.84 %
2011	2.07 %
2012	2.13 %
2013	1.89 %
2014	1.87 %

Companies with higher gain with nontraditional options

The companies with higher accumulated for one of the nontraditional options are:

- Asian option – Coca-Cola, Conoco Philips, Chevron, Intel, McDonalds, Nike, Oracle, United Health.
- Indexed Asian option – Coca-Cola (lower than Asian option value)
- Indexed option – Gilead Sciences.