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The executive compensation: Pay-for-performance or innovation in high-technology firms

BY

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A DISSERTATION

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BIOGRAFICAL NOTE

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Academically, driven by her early interest in economic studies, she obtained a degree in Economics at the University of Porto. In 2010, she obtained a Master's Degree in Finance and Taxation from the School of Economics and Management of the University of Porto.

Professionally, she has been working since 1990 at INESC's accounting and finance department. Over the years, she progressively was assigned tasks of department responsibility and she is responsible for INESC TEC's Accounting and Finance area since 1998, a position she holds to this day. Moreover, she is the President of INESC P&D Brasil's supervisory council.

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ABSTRACT

Chef Executive Officer (CEO) compensation has become a very interesting topic of debate in the finance literature. This work addresses several research topics, some of which are still unexplored, regarding the compensation related to performance and innovation, performance in high-tech firms, corporate innovation and risk taking in high-tech firms. In order to reduce this gap, this investigation analyzes different components of CEO compensation in high-technology firms, performance, innovation and risk taking, and different econometrics models are tested.

Firstly, executive compensation in high-technology firms in the US is studied and the S&P index is chosen in the period between 2000 and 2010. A panel data methodology is used to analyze the relationship between corporate performance and CEO compensation in high-technology firms. Total CEO compensation and short- and long-term compensations are tested according to corporate performance models. Total short- and long-term CEO compensation in high-technology firms is compared to other industrial sectors from standard classification codes and analyzed for each year.

Then, the analysis focuses on the effects of introducing the Standard Financial Accounting, statement 123 (R), on corporate performance, and all its accounting rules and underlying obligations. The effects of the statement 123 (R) are tested for the periods before and after implementation, and the importance of stock options accounting in high-technology firms is assessed. This study leads to a better understanding of the relationship between CEO compensation through its components and performance in high-technology firms.

Finally, this study analyzes the relationship between corporate performance and innovation in CEO compensation in high-technology firms in the same firm sample. Finance variables are used as return on assets to measure performance and R&D expenses, and the number of patents and brands is used to measure innovation in a system equation and test the econometric model.

The overall results confirm the importance of executive compensation in firm performance and the influence that executive compensation has on innovation. Moreover, the results show that innovation is selected as opposed to performance by the CEOs when they are responsible for promoting the firms' goals.

RESUMO

A compensação dos executivos tornou-se uma questão muito interessante em debate na literatura financeira. Este trabalho analisa vários tópicos de investigação, alguns dos quais ainda pouco explorados, como a relação da performance e inovação da empresa com a compensação dos executivos, a performance nas empresas de alta tecnologia, a inovação empresarial e a tomada do risco nessas empresas. Ao longo desta investigação, são usadas as empresas do índice S&P nos Estados Unidos, são analisadas diferentes componentes da remuneração do executivo, a performance da empresa é avaliado através de várias variáveis financeiras, a inovação é medida pela investigação e desenvolvimento (I&D), número de patentes e marcas, e são testados por diferentes modelos econométricos.

Em primeiro lugar, é estudada a compensação dos executivos em empresas de alta tecnologia nos Estados Unidos e escolhido o índice S&P no período entre 2000 e 2010, utilizando uma metodologia de dados em painel para analisar a relação entre a performance das empresas e a compensação do CEO em empresas de alta tecnologia. É testada a compensação total do executivo no curto e no longo prazo em relação à performance da empresa. A compensação total do executivo no curto e longo prazo nas empresas de alta tecnologia é comparada com outros setores industriais com o mesmo código de classificação e analisados para cada ano.

Em seguida, a análise centra-se nos efeitos da introdução da norma contabilística 123 (R) na performance das empresas, assim como na regra de contabilização e obrigações subjacentes. São testados os efeitos da norma contabilística 123 (R) antes e após a implementação, e a importância da contabilização das opções de ações em empresas de alta tecnologia. Deste estudo resulta uma melhor compreensão da relação entre a remuneração do CEO e as suas componentes e a performance das empresas de alta tecnologia.

Finalmente, é analisada a relação entre a performance das empresas e inovação na compensação do CEO em empresas de alta tecnologia para a mesma amostra. São usadas variáveis financeiras como a rentabilidade dos ativos para medir a performance e despesas de I&D, número de patentes e marcas para medir a inovação num sistema de equações para testar o modelo econométrico

Em suma, os resultados evidenciam a importância da compensação dos executivos na performance das empresas, a influência da compensação dos executivos na inovação, e ainda a preferência da inovação à performance quando o CEO tem responsabilidade na prossecução dos objetivos da empresa.

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CHAPTER 1

“That which is dreamed can never be lost, can never be undreamed.”

Neil Gaiman, The Sandman, Vol. 10: The Wake

1. General introduction

1.1 Motivation and purpose of this research

Chief Executive Officer (CEO) compensation has been strongly discussed in the literature since late 1970s and early 1980s up to the present days and there is no consensus. Following the world financial crisis, numerous stories have appeared recently in the financial press demonstrating how many executives define our contract remuneration. These news and striking reports have raised concerns on compensation. In most corporate scandals in history, such as Enron's, there has always been some underlying accusation of top executives and their management of the firm. Some critics argue that high levels of compensation and reciprocal relationships with the CEO might have compromised the directors' ability to monitor managers in the interest of shareholders. Nevertheless, no consensus view has emerged, and there is still much to learn about how CEO compensation is determined in firms, and particularly in high-technology firms.

Noting the hegemony of high-technologies firms in the last decades in terms of performance and innovation, the growing interest in issues about contractual conditions to compensate the executive and on the other hand the frequently shocking news that firms with poor performance have pay high compensations levels to their executives, these apparent paradoxical reasons are motivated this study. Understand the relation between performance and innovation in high-tech firms and the contractual conditions to compensate the executives when they are responsible for this fact.

The main goal of this study is to understand if high-tech CEOs are paid better when the firm´s value is increased through performance or by improving innovation, knowing that it may be difficult to achieve that for a particular period of a time. Improving innovation through research and development, patents and brands requires continuous investments that are not always compatible with the better profitability necessary for a good finance performance. To achieve this goal, this thesis addresses the problem in three phases: firstly, it studies the relation between

executive compensation and performance in high-tech firms. Then it tries to understand the components of compensation and their accounting, particularly stock options; finally, innovation accruals are included in order to analyze how total compensation is determined.

According to the Statement of Financial Accounting Standards No. 2 (SFAS 2), *Accounting for Research and Development Costs* (Financial Accounting Standards Board, 1974), research activity refers to the initial work done on a systematic basis in order to create new knowledge to develop a new product, service or process, or at least improve the existing product, service or process significantly. Development activity refers to the application of the knowledge resulting from the research activity in the actual design and construction of the product, service or process with the aim of selling or using it. Thus, research and development (R&D) activity deals with the creation and utilization of knowledge with the intention of improving the financial and economic outcomes of a firm. High-level R&D will encourage the adoption of new processes, systems and technology in firms in relation to their ability to innovate and perform. Even though various papers examine the determinants of innovation, how innovation affects corporate financial policies remains a promising understudied research area.

Because of these issues, this study first attempts to examine the relationship between executive pay, firm performance and innovation for a sample of US high-tech companies over a period of eleven years. At the same time, this dissertation examines the effects of introducing the Financial Accounting Standards Board (FASB) statement 123 (R) in corporate performance during the same period. Building on the agency view of corporate governance, this work proposes that technology-intensive firms use both outcome and behavior-based performance criteria for rewarding CEOs. Thirdly, in particular, it examines the dynamics between performance and innovation managed by the CEOs and their rewards when they legitimately pursue the ideals of the shareholders. These three issues were addressed in each essay included in the dissertation.

The purpose of this study is to examine the effects that CEO pay has on performance and innovation in high-technology firms when driving management goals. This research adds to a handful of similar studies published on corporate governance in the high-technology sector, and makes it possible to test whether the existing evidence holds for a market, such as the US, with

historically different managerial pay structures and heterogeneous corporate governance systems between different sectors. Specifically, this study contributes to building a better understanding of executive compensation, performance, innovation and corporate governance issues in the US high-tech industry in several ways. This dissertation fills this gap using data collected on executive compensation, performance and innovation in US high-tech firms over the period 2000-2010 using performance and innovation measurements collected in financial databases.

1.2 The role of CEO compensation in high-technology firms

Despite its long history and widespread application, the agency theory continues to foster a debate on the controversy of executive compensation. While some authors argue that the principal can design a contract based on the outcomes of the agent behavior, which aligns the preferences of the agent and the principal, others focus on the negative consequences of compensation, suggesting that greater agent risk causes executives to make decisions designed to reduce personal risk and not maximizing performance. The agency theory assumes that agents are self-serving individuals who are effort- and risk-averse (Jensen and Meckling, 1976).

The agency theory presents some problems. The directors are responsible for monitoring management in order to reduce the conflict between shareholders and executives. However, the mutual favor and interconnection between shareholders and executives cause the disciplining role to be more fragile (Bebchuk and Fried, 2003). Hunton and Rose (2008) also indicate that the CEO might pursue self-interests when making accounting choices. Moreover, shareholders might even ingratiate themselves with executives to have risk bearing incentives. Bebchuk and Fried (2003) suggest that CEO behavior is subject to an agency problem that in turn addresses agency problems in their compensation. Therefore, the compensation contracts for CEOs designed to resolve agency problems could contribute to agency conflict. (Bebchuk and Fried, 2003).

As Aboody and Lev (2000) and M. Jensen and Meckling (1976) suggest, CEOs should possess the highest knowledge of the firm, which implies that CEOs should have a better understanding than owners about the optimal level of R&D spending, thus allowing for more

informed, timely actions by the CEO. This asymmetry in information allows CEOs to make adequate reductions in R&D spending, which Joseph P. O'Connor, Jr., Joseph E. Coombs, and Gilley (2006) believe is problematic because decisions that benefit short-term performance often do not lead to long-term benefits for shareholders. These consequences make reductions in R&D spending relevant because shareholders generally find R&D spending desirable due to their interests in greater risk-taking, as opposed to CEOs and their interests in long-term firm performance.

As Makri et al. (2006) report, CEO total pay was associated with innovation behavior in high-technology firms, while Balkin et al. (2000) suggest that compensation is more likely to align CEO pay with behaviors towards R&D in high rather than low R&D intensive firms. Therefore, reductions in R&D spending in high R&D intensive firms may not lead to short-term pay increases for underpaid CEOs. Managers in high-tech firms are faced with different sets of performance expectations such as innovation, new product development, integration of technology and research and development management (Shim et al., 2009).

High-technology firms have their own special features which separate them from other firms. That poses unique corporate governance problems not only for managers, but also for claimants on R&D activity to create and use knowledge with the intention of improving a firm’s financial position (Belloc, F. 2013)

In high-technology firms it is possible to find innovation, R&D investments and some assets with essential competitive advantage and there are, at the same time, some risks. Different R&D spending in firms is indication of a large variance in firm performance. The returns on high-tech investment are skewed and highly uncertain, in part because R&D projects have a low probability of succeeding financially and because there is asymmetric information shared between firms and potential investors (Percival, J., & Mcgrath, C., 2013). This happens because it is difficult to increase high-tech investments and often insiders will have much better information than outsiders about the prospects of the firm's investments. High-tech investments often have limited value R&D investment, which is predominantly salary payments (Carpenter & Petersen, 2002). For these reasons, it is pertinent and interesting to examine the role of the CEOs and their

compensation for managing high-tech firms, thus contributing to improving research in this area, as well as the understanding of CEO compensation.

1.3 The methodology

This study uses a sample of US firms listed on the stock exchange, the S&P index. The classification for high-technology firms is the Standard Industrial Classification (SIC). The industry groups such as computer & office equipment, computer storage devices, terminals, services-computer programming services, services-prepackaged software and services-computer integrated systems design.

The period under analysis is the period between 2000 and 2010. The data were collected from the same firm every year and the sample was organized as panel data. With panel data it is possible to combine time and cross-sectional data and make more credible statistical inferences. One of the advantages of panel data estimation is the fact that it point out individual heterogeneity. Thus, panel data suggest the existence of differentiating characteristics in the individuals studied and these features may or may not be constant over time. The second advantage of panel data is that it provides a larger amount of information, the data are more variable, the variables are not as collinear, the degrees of freedom are higher and the estimation is more efficient. Furthermore, it not only makes it possible to identify and measure effects that cannot be detected in pure cross-sectional or time studies, but also to build and test complex behavioral patterns, particularly using models with distributed lags with few restrictions.

Different econometric estimation methods are used according to the sample and according to the specification of the performance, innovation and executive compensation equation that best explains the research question presented in each essay.

1.4 Plan of presentation

This dissertation is the result of three essays developed over the last four years, and it is divided into five chapters. After a brief introduction addressing the main purposes of this work (provided in Chapter 1), Chapter 2 presents the first essay on CEO compensation and its relation to performance. The second essay is an extension of the first as it addresses the total compensation model for the short- and long-term. Panel data generalized least squares (GLS) and Seemingly Unrelated Regression (SUR) methods were estimated to create two other models, one for total compensation, and another for both total and cash compensation in the period between 2000 and 2010.

Chapter 3 examines the effects of introducing the financial accounts standard, the statement 123 (R), and exploits the change in the accounting treatment of stock-option compensation, as well as the fair-value report which entered into force in December 2005, in the period of analysis. A Panel data SUR model is used to estimate total compensation and cash compensation as a proportion of total pay for the period between 2000 and 2010. It was found that there is an increase in CEO compensation after introducing the SFAS 123 (R). Although the change in the plan design was not analyzed, a new accommodation of CEO compensation was found as a result of the new rules of the SFAS 123 (R).

To complete the main purpose of this dissertation, Chapter 4 investigates the relation between CEO compensation in high-tech firms and their choice between performance and innovation when managing high-tech firms. The literature on high-technology firms is examined, and the relationship between the CEO behaviors on corporate governance is discussed, along with the aggregate innovation activity of corporations. Innovation is measured as R&D expenses, number of patents and brands. After a brief review of the inter-relationship between CEO compensation, performance and innovation suggested that, from an econometric point of view, a system of three simultaneous equations should be formulated that specify the relationship between the abovementioned variables. Panel data Seemingly Unrelated Regression (SUR) and General Method of Moments (GMM) methods were used to estimate total compensation as function of performance and innovation.

Finally, Chapter 5 summarizes the results of the four essays, pointing out their limitations and presenting some topics for future research.

CHAPTER 2[1]

Executive Compensation for the long- and short-term in High-Technology Firms

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We are grateful to Professor Jerry Haar at Florida International University for discussing this paper at the International Academy of Management and Business, 15th Conference in Lisbon, in April 2013 and Contemporary Issues in Business, Management and Education '2013, in November. We are also grateful to anonymous attendees and professors present at this conference for their helpful comments.

1. Introduction

While most management scholars would agree that technological innovation is a key source for competitive advantage in high-technology firms and that top executives in those firms should be rewarded accordingly, little is known about which executive pay policies are more appropriate for those organizations to promote such goals. The high-technology sector plays a pivotal role in the new economy and has become the major source of employment and productivity growth over the last years. Innovativeness is also one of the fundamental instruments for growth strategies to enter new markets and to provide the company with a competitive edge.

The purpose of this study is to investigate the relation between the Chief Executive Officer (CEO) pay and the value, performance, and behavior of the firms in terms of innovation in high-technologies. This work will contribute to this subject as it introduces a new measurement pertaining to the relationship between the CEO and the other members of the top executive team. Furthermore, this paper studies the relation between this measurement and the performance and behavior of firms in terms of innovation. For that, this paper will use a new data sample of high-tech companies in the S&P for the period between 2000 and 2010.

In their paper, entitled "The CEO pay slice", Bebchuk, Cremers, and Peyer (2011) studied the relation between the CEO pay slice and the value, performance, and behavior of public firms, demonstrating a rich set of relations between these aspects. Furthermore, Makri, Lane, and Gomez-Mejia (2006) reported empirical evidence that high-technology firms that use outcome-based and behavior-based performance criteria to reward executives exhibit better market performance than those that do not. Their research on innovation CEO pay linkages in high-technology firms has focused on aligning pay with the quantity of innovation inputs (R&D spending) and outputs (number of patents). In fact, authors show the importance of the quality of innovation outputs. They argue that for CEO pay-performance relations in high-technology firms these views are not incompatible, but represent two sides of the same coin (Makri, Lane, & Gomez-Mejia, 2006). Moreover, as pointed out by Makri, Lane and Gomez-Mejia to engage in innovative projects leading to innovations, the incentive schemes play a pivotal role in inducing

senior organizational managers. Furthermore, to secure the stream of innovations a firm needs to enhance its economic performance with a proper pay scheme to encourage executives (Makri et al., 2006). Appropriate incentives can be the tools in many cases, however, by basing compensation on changes in shareholder wealth. According to Graham (2012), managers often have better information than shareholders and boards in terms of identifying investment opportunities and assessing the profitability of potential projects. Furthermore, the fact that managers are expected to make higher investment decisions explains why shareholders relinquish decision rights over their assets by purchasing common stock (Graham et al., 2012).

The theory summarizes that executive pay should be designed by the board to maximize shareholder value. The level and structure of executive pay have already been discussed in the literature, resulting in three dominant views. One strand of literature studies the pay-to-performance sensitivity. Jensen and Murphy (1990a) showed that CEO wealth is only weakly related to firm performance. Subsequently, another view provides abundant evidence of a significant increase in CEO pay in both absolute and relative terms since 1990, which is consistent with a better alignment of interests between managers and shareholders (Murphy, 1999; Bebchuk & Fried, 2004; Frydman, 2009). Another important strand of literature explains the level and the functional form of pay as skimming issues rather than optimal contracting outcomes.

The inner workings of a top executive team and their importance for firm performance and innovation are hard to observe or quantify. As previously described, in order to promote firm growth, sustainable advantage, innovation and performance behavior, the role of the CEO is fundamental. Furthermore, over the last years, due to the effects of the global financial crisis, the role of the CEO has been called into question, as well as their behavior and their pay-compensation as a result of their performance and objectives. Moreover, it is essential to maintain confidence in the executive for there to be a balance between the institutions that foster the best conditions for their employees and maximize the profits of their shareholders. For these reasons, and because this subject is pertinent, it is interesting to examine these issues and contribute to the enrichment of research in this area.

This study explores the performance determinants of the high-tech and all other CEO pays for long-term and short-term periods. This work also attempts to examine the systematic difference in CEO pays and the performance expectations of high-tech firms and other firms. Furthermore, this paper attempts to examine how in high-tech and others sectors, CEO pays are related to various performance measurements, such as assets and employment in their specificity in high-tech firms, sales growth, operating income before depreciation, net income before extraordinary items and discontinued operations, and earnings per share (Epstein & Roy, 2005)..

This work is organized as follows: Section two contains a revision of the main theories in the literature, as well as an analysis of executive compensation in order to address agency problems. Furthermore, this section provides an analysis in order to examine CEO pays for performance and the appropriate measurements of corporate financial performance in high-technology firms. Section three explains the research hypotheses and section four presents the methodology, sample, and data collection for the regression estimation, as well as the results of the econometric model in order to assess the influence that firm performance has on executive compensation. Lastly, the main conclusions are discussed, as well as some limitations and new perspectives for future research.

2. Corporate Performance and CEO Compensation

In the period between 1970 and 2005, it was observed that executive compensations increased tremendously. The underlying reasons for these executive compensations need to be discussed and analyzed so as to provide a better understanding on this matter as we move into the future. Much literature on executive compensation has emerged since Jensen and Meckling (1976) published their work. According to Jensen and Murphy (1990b):

There are serious problems with CEO compensation, but “excessive” pay is not the biggest issue. The relentless focus on how much CEOs are paid diverts public attention from the real problem—how CEOs are paid. In most publicly held companies, the compensation of top

executives is virtually independent of performance (pp 138).

2.1 Executive Compensations to Address Agency Problems

The emergence and general acceptance of the agency theory and the parallel research on executive compensation began in the early 1980s. It was the evolution of the modern corporation with ownership separation and control that undermined the agency theory. Early studies in this area focused on documenting the relation between CEO pay and company performance.

The problem of managerial power is analyzed in modern finance as an agency problem. The discussion of executive compensation must proceed with the fundamental agency problem afflicting management decision-making as background. According to Jensen and Murphy (1990a), there are two approaches to agency problems. The authors state that there is an optimal contracting approach, which is when boards use design compensation schemes to maximize shareholder value with efficient incentives. To connect the agency problem and the executive compensation, the authors use the managerial power approach, when this connection is seen as an integral part of the agency problems. It is important to remember that the principal-agent problems treat the difficulties that arise under conditions where information is incomplete and asymmetric whenever a principal hires an agent (Jensen & Murphy, 1990a). The agency theory is directed as an agency relationship between principal and agent in which one part—the principal—delegates work to another—the agent—, who performs that work. It is created at any company that is not owned by its manager. This theory may be summarized as having two problems: firstly, the agency problems arise when the desires or goals of the principal and agent are conflicting and when it is difficult or expensive for the principle to verify what the agent is doing; the second is the problem of risk sharing that arises when the principal and agent have different attitudes towards risk. Maybe the agent and the principal prefer different actions and different risk choices. Jensen and Meckling (1976) suggested that the agents of a company have the tendency to expropriate from the company because the benefits are higher than the cost as such costs are shared or undertaken by various shareholders. Therefore, there should be a balance, and both parties' participation constraints should be satisfied. According to them, the

agency problem existed in all organizations and cooperatives, including universities (Jensen & Meckling 1976). The agency problem is a classic problem in corporate governance as a result to motivate executives to do what is best for their company when they themselves do not own the company. It is necessary to anticipate the agency problem as because of it company investors may try to specify how the manager should act. Furthermore, it is necessary to analyze this problem because the owner may not be able to predict the business and may not know the best action for their manager (Shleifer & Vishny, 1996). The contracts signed between shareholders and managers are usually general, specifying broad goals and the division of profits. These contracts do not specify how managers should behave in specific business situations.

Some authors see the weakness of shareholder rights more generally and warn shareholders and their advisers to focus on the corporate governance provisions that really matter for the firm's value (Bebchuk, Cohen, & Ferrell, 2009; Cremers & Nair, 2005). To help solve the apparent theoretical paradox in agency predictions on the normative consequences of performance-based pay, it is possible to create a common fate for the principal and the agent, or to make the agent overly conservative. The agency theory has been the foundation for both positive and negative answers to the key question: Does incentive compensation help high-technology firms attain higher subsequent performance levels (Makri, Lane, & Gomez-Mejia, 2006)?

Some authors assume CEOs to be more powerful when they serve as chair of the board, when they are the only member of the board, and when they have the status of a founder (Adams, Almeida, & Ferreira, 2005).

2.2 Examining CEO Pay-for-Performance

For Murphy (1999), the components of CEO pay are substantially heterogeneous in pay practices across firms and industries. Most executive pay packages contain four basic components: a base salary, an annual bonus linked to accounting performance, stock options, and long-term incentive plans. Moreover, executives participate in employee benefit plans and also

receive special benefits, such as life insurance and supplemental executive retirement plans. Today the packages of most CEO compensations have many components, which include payouts for long-run incentive plans, restrict option grants and restrict stock grants, pension plans, various perquisites and, in some cases, severance payments. Perquisites, pensions, and severance pay are important, and yet less understood components (Frydman & Jenter, 2010; Jensen & Murphy, 1990a). It is difficult to obtain information on these components because of insufficient disclosure. Some authors suggest that the perks may be a signal of weak corporate governance, particularly when firms find ways to conceal the re-porting of perks (Grinstein, Weinbaum, & Yehuda, 2011). For pensions, the evidence is similar to that of the perquisites (Sundaram & Yermack, 2007). Executive pay substantial attention to the salary-determination process because salaries comprise a declining percentage of total compensation. Base salaries are key components of executive employment contracts and represent the fixed component in executive contracts. Executives will naturally prefer a dollar increase in base salary to a dollar increase in target bonus or variable compensation, and so the target bonuses, for example, are typically expressed as a percentage of base salary. Each dollar increase in the base salary has positive implications on many other compensation components. Most compensation components are measured relatively to base salary levels, for example, the option grants are expressed as a multiple of base salary.

In the 1980s and 1990s, there was a steady increase in stock option grants within executive compensation, which on a Black-Scholes basis now constitutes the single largest component of CEO pay. Stock options are contracts which give the recipient the right to buy a share of stock at a pre-specified exercise price for a pre-specified term. In other words, the recipient has the option to buy a certain number of company shares for a specified price. Therefore, there is a direct link between managerial rewards and share-price appreciation. The incentives from stock options do not, however, mimic the incentives from stock ownership because only stock-price appreciation is rewarded, as opposed to total shareholder returns. Therefore, the value of options increases with stock-price volatility. Other reason for this is that the options lose incentive value once the stock price falls sufficiently below the exercise price.

The literature focuses on equity-based compensation paid in the form of restricted stocks, stock options, and other instruments whose value is tied to future equity returns. Equity-based

compensation is widely documented in the research examining pay versus performance (Jensen & Meckling, 1976). Murphy (2003) and Jensen (2004) stated that the increase in stock options pay is the result of the boards' inability to evaluate the true cost of this form of compensation. The controversy over CEO compensation reflects a perception that CEOs effectively set their own pay levels. In most companies, the last decisions over executive pay are made by members outside the board of directors who are keenly aware of the conflicts of interest between managers and shareholders over the level of pay. However, the CEOs and other top managers exert at least some influence on the level and on the structure of their pay (Jensen & Murphy, 1990a; Murphy, 1999).

In the substantial heterogeneity across companies and industries, executive bonus plans can be categorized in terms of three basic components: performance measurements, performance standards, and the structure of the pay-performance relation. Hall and Liebman (1998) showed that CEOs are, in fact, not paid like bureaucrats, but that there is a strong relationship between firm performance and CEO compensation. The annual bonus contracts are characterized by discretion. In some firms, boards can use discretion while allocating a fixed bonus, but discretion in this case only affects individual allocations and not the overall amount of the executive payouts. A percentage of their bonus depends on individual performance. Nevertheless, this is a subjective issue because individual performance sometimes includes performance pertaining to some pre-determined objectives or strategic mile-stones. Often the non-financial performance measurement used in annual incentive plans is individual performance with performance measured relatively to pre-established objectives, as well as subjective assessments of individual performance. Other non-financial measurements include customer satisfaction, operational and strategic objectives.

Some research highlights the importance of debt-based compensation as an element of top management contracts, and also the underlying incentive and governance implications of these schemes. Debt-base compensation provides managers with research that includes interesting incentives to reduce the agency cost or debt. Inside debt in the form of pensions also exerts strong influence on the patterns of CEO turnover and other types of compensation (Sundaram & Yermack, 2007). All this research is based on the assumption that managerial compensations

consist of only two components, cash and equity-linked instruments. These authors argue that top managers receive significant compensations from “inside debt” that are pensions and deferred compensations.

In recent years, the use of restricted stock has been increasing due to a combination of reasons. Firstly, a compelling advantage held by stock options was eliminated as companies were required to recognize a charge to earnings on fixed option grants at fair market value. Secondly, publicly traded companies became concerned about the excessive dilution that resulted when the majority of long-term incentives were granted in options. Restricted stock plans offer companies much more design flexibility. Restricted stocks can be criticized mainly because of the dividend equivalents which have to be paid on these stocks prior to the vesting of the stocks. Some authors draw attention to the complete elimination of dividend equivalents, while others insist on its continued use as a way to align the interests of management and shareholders in order to solve agency problems.

Earnings Per Share (EPS) are a popular performance metric used in executive compensation contracts (Murphy, 1999; Conyon et al., 2000). As it is commonly known, this ratio is influenced and directly punished by the increase in restricted stocks and dividend equivalents. Compensation contracts that tie managerial rewards to EPS create explicit incentives for executives to manage the EPS denominator using stock repurchases (over and above any implicit market-based incentives associated with increasing stock-based wealth and improving job security). However, these direct incentives are still absent in compensation contracts that employ non-per-share-based earning metrics, such as return on assets, and non-accounting measurements, such as stock price or qualitative targets linked to personal objectives. Accordingly, the stock repurchases activity will be positively associated with the incidence of EPS-based performance conditions in executive compensation contracts (Core, Guay, & Verrecchia, 2003; Young & Jing, 2011). The author argues that the level of dividend payments and the choice between dividends and stock are sensitive to the executives’ compensation arrangements. Furthermore, a statistically and economically strong link between stock repurchase activity and the presence of EPS performance conditions in executive compensation contracts is documented. Additionally, if stock options are a sub-optimal incentive contract, Sesil et al. (2006) expect that, in terms of firm performance,

there will be a decrease in earnings or an increase in earnings with a reduction in the rate of return on assets (Sesil et al., 2006).

For Murphy (1999), the levels of pay are higher and pay-performance sensitivities are lower in larger firms. However, the levels of pay and pay-performance sensitivities are lower in regulated utilities than in industrial firms. With that analysis, it was also possible to understand that pay-performance sensitivities are driven primarily by stock options and stock ownership, and not by other forms of compensation.

Bebchuk and Fried (2004) advocated that managerial power has played a key role in shaping managers' pay arrangements. The pervasive role of managerial power can largely explain the contemporary landscape of executive compensation. The managers' influence over their own pay has been the focal point of the criticism on executive compensation in the media and by some shareholders. They argue, with supporting evidence, that when executives have more power, their pay is higher and less sensitive to performance. In their opinion, executive pay is much less sensitive to performance than has been commonly acknowledged (Bebchuk & Fried, 2004). Other authors study the opportunistic timing of option grants and their relation to firm governance and structure (Berger, Ofek, & Yermack, 1997; Bebchuk, Cremers, & Peyer, 2011; Bebchuk, Grinstein, & Peyer, 2010). Malmendier and Tate (2009), Bertrand and Schoar (2003) study how the type and style of a CEO affect the firm's outcomes. For that, the authors analyzed the CEOs' roles in achieving superstar status to the performance of their firms, and whether and how individual managers are affected by corporate behavior and by performance (Malmendier & Tate, 2009; Bertrand & Schoar, 2003). When other sectors were compared, it was possible to confirm that the success of high-tech firms depends more on managing intangible assets. Some of these assets were technology innovation, continuous improvement, software development, and knowledge-based management. High-tech firms must continuously innovate to survive and to sustain their firms' growth (Shim, Lee, & Joo, 2009).

2.3 Appropriate measurements of corporate financial performance in high-technology firms

This chapter provides an analysis on the different forms of measuring the firm's performance and how these engage to the level of CEO pay. The behavior of high-tech firms and its contribution to CEO compensation for the short- and long-term are also analyzed. Shim (2009) argues that it is possible to confirm that the success of high-tech firms depends more on managing intangible assets. Some of these assets are technology innovation, continuous improvement, software development and knowledge-based management. High-tech firms must continuously innovate to survive and to sustain their growth (Shim et al., 2009).

Equity-based compensation is widely documented in the research examining pay versus performance (Jensen & Meckling, 1976). Murphy (2003) and Jensen (2004) state that the increase in stock options pay is the result of the boards' inability to evaluate the true cost of this form of compensation. The use of equity-based compensation is encouraged by all stakeholders, such as investors, regulators and academics. The controversy over CEO compensation reflects a perception that CEOs effectively set their own pay levels. In most companies, the last decisions over executive pay are made by members outside the board of directors who are keenly aware of the conflicts of interest between managers and shareholders over the level of pay. However, the CEOs and other top managers exert at least some influence on the level and on the structure of their pay (K. J. Murphy, 1999).

In recent years, the use of restricted stocks in compensation executives has increased and has been widely criticized when these executives received dividend equivalents on restricted stocks before the vesting period. Agency cost benefits of dividend equivalent rights argue that this practice helps executives focus on the business, and rewards them for managing the business to produce cash. Therefore, this is encouraged because it is a way of distributing dividends by shareholders (Akpotaire, 2011).

Restricted stock awards are profitable for executives because the income tax consequences can be more favorable to employees than stock options. The special case of the USA and the consequences of a restricted stock mean that in some cases the award can be structured to allow for the deferral of all tax until the time of the stock sale, and for all appreciation to be taxed at capital gain rates, even if the stock is appreciated prior to vesting. In contrast, stock options can

result in ordinary income to the recipient the stock has appreciated prior to vesting, with only the post-exercise appreciation deferred to the time of sale at capital gains rates. Furthermore, the preferred stock usually carries no voting rights but may carry a dividend and may have priority over common stock in the payment of dividends and upon liquidation. The preferred share investor is entitled to a preset rate of dividend that must be paid out of earnings before any dividends are distributed to common shareholders. These dividends receive favorable tax treatment relatively to other forms of income.

The use of options at the executive level associated with an increase in performance is not clear in the literature. Some argue that it is associated with a higher profit and output (Core et al., 2003a), while others state the opposite (Hall & Murphy, 2003). The use of stock options reduces the agency cost and incentive to maximize value creation for shareholders, and encourages risk taking, then accounting is shown by measuring corporate finance (Sesil et al., 2006). They argue that adopting stock options has an impact on firm financial performance to increase operating income (OI) and investments in assets. However, there will be a significant decrease in return on assets (ROA). Others who have done previous research on stock options have focused on pay-for-performance elasticity (Hall & Murphy, 2003), while others have focused more on the determinants of share-based adoption (Core et al., 2003a). The adoption of stock options is associated to higher growth in income, but to significantly lower return on assets (ROA), which is evidence that options promote sub-optimal over investment.

The company's measurements are consistent with vision, mission and strategies for long-term performance and the financial criteria to monitor CEO compensation (Epstein & Roy, 2005). Usually in the USA, the compensation programs combine incentives for short- and long-term periods with a set of performance measurements.

In summary, it was found that firms are subjected to the agency problem in which the CEO may not work in favor of the shareholders to maximize their wealth by improving firm performance. Furthermore, the decisions related to CEO compensation are based on the firms' accounting and finance performance. Therefore, it is theorized that CEO compensation according to firm performance using variables such as assets,, return on assets, sales growth, operating income before depression, employees, changes in sales operating income before depreciation net

income before extraordinary items and discontinued operation and earning per share suited the high-technology firms, as presented above.

3. Research Hypotheses

As previously discussed, existing theories provide predictions on the outlined considerations related to firm value, allowing for two different selection hypotheses.
The first research question will be:

Hypothesis 1: The CEO compensation is positively correlated with firm performance for high-technology companies in the short-term.

Rejection of the null hypothesis would mean that the relative weight in terms of total compensation of each compensation component (such as salary, bonus, stock options and other compensations) are different goals for executives, as opposed to performance in the short-term. It might be argued that powerful incentive models are especially valuable for high value firms with high opportunities for growth that need to be decisively and vigorously pursued. It is possible that high value firms have CEOs interested in long-term performance and in obtaining personal benefits in terms of total compensation. It might be argued that powerful incentive models are especially valuable for high value firms with high opportunities for growth that need to be decisively and vigorously pursued. It might also be that high value firms are especially likely to attract star CEOs and pay gold parachutes.
The second research question will be:

Hypothesis 2: The CEO compensation is positively correlated with firm performance in high-technology companies in the long-term.

It is possible that high value firms have CEOs with an interest in long-term performance and with obtaining personal benefits in terms of total compensation. With less intensity and yet more persistent than long-term compensation, bonuses and salary are determinant and in the same effect related to accounting performance.

4. Methodology, Sample, and Data Collection

The sample chosen is the ExecuComp database, which was used to find the variables and to create a sample of firms between 2000 and 2010. The ExecuComp database provides yearly data on salary, bonus, stock options and restricted stock grants, as well as managerial stock and option holdings for top executives in firms within the Standard & Poor's Index (S&P 1500). Firstly, to test this hypothesis, the following specification is presented of the balanced panel of high-technology firms, between 2004 and 2010. High-Technology firms are the firms that operate in an industry with a four-digit Standard Industrial Classification (SIC) code using the Fama and French classification of 48 industry groups (Fama & French, 1997).

The ExecuComp database collects information about seven independent variables — total assets (ASSETS) and percentage change of assets (ASSETSCHG), employees (EMPL), total annual net sales (SALES) and yearly changes in sales (SALECHG), operating income before depreciation (OIBD), net income before extraordinary items and discontinued operation (NIBEX), earning per share (EPSEX) and return on assets (ROA) — and the independent, total compensation (TOTAL_COMP) cash compensation (CASH) variables are listed by each year and company. Several measurements were used in this study, such as control variables. Several measurements were used as control variables in this study. These include the number of employees, assets, increase in sales, net income, and the EPS, as a proxy of firm size, firm performance and wealth of the shareholder, which are the common predictors of executive pay.

The High-Tech Dummy (DHTECH) is equal to one if the firm operates in an industry with a four-digit SIC code of 3570, 3571, 3572, 3576, 3577, 3661, 3674, 4812, 4813, 5045, 5961, 7370, 7371, 7372, or 7373, instead of four-digit SIC codes, in the following industry groups: computer & office equipment, computer storage devices, communication terminals, equipment, peripheral equipment, NEC, telephone & telegraph apparatus, radiotelephone communications, telephone communications, wholesale-computers & peripheral equipment & software, retail-catalog & mail-order houses, services-computer programming, data processing, services-computer programming services, services-prepackaged software and services-computer integrated systems

design.

The main variable of the analysis is TOTAL_COMP and it is defined by the sum of the total compensations of the top executives in each company and it includes: salary, bonus, non-equity incentive plan compensation, grant-date fair value of option awards, grant-date fair value of stock awards, deferred compensation earnings reported as compensation, and other compensations.

The table below identifies the updated variables that were used, including their definitions, measurement units and the expected signs, as reported by the theory.

Table 1 - Executive Compensation Dependent and Independent Variables

Name	Expected variation	Definition	Units
Ln (TOTAL_COMP) Total compensation		Ln (the sum of the compensations of top executives includes: salary, bonus, non-equity incentive plan compensation, grant-date fair value of option awards, grant-date fair value of stock awards, deferred compensation earnings reported as compensation, and other compensations).	Thousands
Ln(CASH) Cash compensation		Ln (SALARY + Bonus) The dollar value of the base salary plus bonus earned by the named executive officer during the fiscal year .	Thousands
Ln (ASSETS)	(+)	Ln (the total assets as reported by the company).	Millions
Ln (EMPL)	(+)	Ln (employees, the total employees as reported by the company (#)).	Thousands
EPSEX	(-)	EPS (Primary) excluding extraordinary items and discontinued operations.	
SALECHG	(+)	The year to year percentage change in Sales.	Percentage
Ln (OIBD)	(+)	Ln (the operating income before depreciation as reported by the company).	Millions
ROA Return on assets	(+)	The Net Income Before Extraordinary Items and Discontinued Operations divided by Total Assets. This quotient is then multiplied by 100.	Percentage
Ln(COMMEQ)	(+)	The sum of Common Stock, Capital Surplus, Retained Earnings, and Treasury Stock adjustments.	Millions
(OIBD/ASSETS)*100	(+)	Ln (the Operating Income Before Depreciation as reported by the company/Assets).This quotient is then multiplied by 100.	Percentage
Ln(SALES)	(+)	Ln (The Net Annual Sales as reported by the company).	Millions
Ln(NIBEX)	(+)	Ln (the Net Income Before Extraordinary Items and Discontinued Operations).	Millions

SIC		Standard Industrial Classification Code.
SPCODE	(+) and (-)	Current S&P Index membership "SP" = S&P 500 "MD" = S&P Midcap Index "SM" = S&P Small cap Index "EX" = not on a major S&P Index

To test the research hypotheses, two models were used with a different approach to total compensation. The first is a total compensation model and the second is a total and cash compensation model. The first approach uses a dynamic model to explain total short- and long-term compensations. The second model divides the components of total compensation and analyzes total compensation and cash in two equations, which are used as a measurement of short-term compensation.

4.1 Total Compensation model

The model presented below was used to test whether firm performance is relevant to explain executive compensation. Firstly, the model for the short-term:

$$\ln (TOTAL\_COMP)_{it} = a + b_1 \ln(ASSETS)_{it} + b_2 \ln(OIBD)_{it} + b_3 \ln(NIBEX)_{it} + b_4 \ln(EMPL)_{it} + b_5 * ERPSEX_{it} + b_6 * SALECHG_{it} + u_{it} \quad \textbf{(1)}$$

and the secondly, the model for the long-term:

$$\ln (TOTAL\_COMP)_{it} = a + b_1 \ln(ASSETS)_{it} + b_2 \ln(OIBD)_{it} + b_3 \ln(NIBEX)_{it} + b_4 \ln(EMPL)_{it} + b_5 * ERPSEX_{it} + b_6 * SALECHG_{it} + c * \ln(TOTAL\_COMP)_{it-1} + u_{it} \quad \textbf{(2)}$$

where, *i* and *t* represent the year and the company, respectively.

The coefficient *a* is a constant denoting the base level from which the sum of the compensations of top executives vary according to the changes in performance variables.

The panel data model is used as it is the most suitable way of studying a large set of

repeated observations and because it assesses evolution over time. With panel data it is possible to simultaneously explore several variations over time and between different individuals. The use of such models has increased immensely and, in fact, combining time and cross-sectional data brings many advantages: it is possible to use a larger number of observations and the degree of freedom in estimates increases, thus making statistical inferences more credible. At the same time, the risk of multicollinearity is reduced since the data in companies present different structures. Moreover, this model provides access to further information and the efficiency and stability of the estimators increase, while enabling the introduction of dynamic adjustments (Gujarati, 2004, 2000; William, 2002, 2003).

According to Bebchuk et al. (2011), in order to test the variables and to assess the above-mentioned research hypotheses there are independent variables that will possibly be used by the regression model to perform the estimation. At an empirical level, this analysis focuses on a sample of 500 high-tech companies in the S&P index (S&P500), for the period between 2004 and 2010, which constitutes a sample of 3,356 observations.

Table 2 - Descriptive Statistics individual sample S&P500

	TOTAL_COMP	ASSETS	EPSEX	OIBD	NIBEX	EMPL	SALECHG	DHTECH
Mean	25,599.88	46,886.07	12.65983	3,249.064	1,215.441	46.30875	10.80346	0.121275
Median	19,561.74	10,698.19	2.090000	1,296.557	507.4820	17.59400	7.909000	0.000000
Maximum	264,964.7	2,264,909.	8,548.000	78,669.00	45,220.00	2,100.000	1,106.400	1.000000
Minimum	454.4000	182.7430	-37.84000	-76735.00	-99289.00	0.053000	-92.68800	0.000000
Std. Dev.	21,706.99	168,685.8	252.8151	6,878.305	3,586.554	110.5579	30.22776	0.326496
Skewness	3.365542	8.450905	26.43878	4.478257	-3.906328	11.92814	15.95401	2.320283
Observations	3,346	3,356	3,353	3,242	3,356	3,333	3,350	3,356

The descriptive statistics of the variables for total CEO compensation in high-tech firms are presented in Table 2. In the S&P500, in the period between 2004 and 2010, there are about 12% of high-technology firms, and it is possible to observe that the group of top executives in each company has a total average compensation around USD 25,600 million. Another interesting

finding is that in this period there was not always an increase in sales, but there was a 10.8% average growth in high-tech companies.

The regressions presented below (see table 3, and table 4) was estimated using the Generalized Least Squares (GLS) with a fixed effect model for time. This means that the regression coefficients which were used with the fixed effect model for explanatory variables do not vary over time. The estimation was conducted assuming that the company's heterogeneity is captured in the constant part and that it differs between companies. The fixed effect model is the most suitable when there is a correlation between errors and variables (Greene, William, 2003).

For each short- and long-term model two scenarios were tested to confirm and show the internal stability between them concerning the influence that high-technology firms have on the set of variables for total compensation.

Table 3 - Total Executive Compensation Estimation

Ln (TOTAL_COMP)	Coefficient	Prob.
Constant	7,279,001	0.0000
Ln(ASSETS)	0.054566	0.0002
EPSEX	-0.000620	0.0000
Ln(OIBD)	0.204273	0.0000
Ln(NIBEX)	0.069080	0.0003
Ln(EMPL)	0.044388	0.0000
SALECHG	0.002650	0.0000
DHTECH	0.140800	0.0000
Period fixed effects (dummy variables)		
	Weighted Statistics	
R-squared	0.403318	
Adjusted R-squared	0.400693	
S.E. of regression	0.553285	
F-statistic	1,536,448	
Prob(F-statistic)	0.000000	
Total panel (unbalanced) observations: 2969		

Ln (TOTAL_COMP)	Coefficient	Prob.
Constant	7,302,197	0.0000
Ln(ASSETS)	0.054500	0.0002
Ln(ASSETS)*DHTECH	0.014395	0.0000
EPSEX	-0.000619	0.0000
Ln(OIBD)	0.200525	0.0000
Ln(NIBEX)	0.070401	0.0002
Ln(EMPL)	0.043644	0.0000
SALECHG	0.002667	0.0000
Period fixed effects(dummy variables)		
	Weighted Statistics	
R-squared	0.402732	
Adjusted R-squared	0.400104	
S.E. of regression	0.553552	
F-statistic	1,532,713	
Prob(F-statistic)	0.000000	
Total panel (unbalanced) observations: 2969		

In order to assess the abovementioned research hypotheses, the regression model was used and estimated with fixed effects. The first hypothesis for the positive influence of the CEO

compensation in firm performance is presented in Table 3. As it is possible to observe, the regressions are globally significant, with a 5% significance level. The following table presents the results of the estimation conducted by the generalized method using the fixed effect model for the studied data. The statistics are computed based on a panel data set of 484 firm-year observations, a total of about 2,969 companies that represent 14.08% of high-technology firms between 2004 and 2010. The total assets, the operating income before depreciation and the net income before extraordinary items and discontinued operations, the growth sales and employment, as reported by companies, are positive (see table 1 – expected variation) and significantly related to total executive compensations.

Table 4 - Total Executive Compensation Estimation in long-term

Ln (TOTAL_COMP)	Coefficient	Prob.
Constant	3,372,131	0.0000
Ln(TOTAL_COMP(-1))	0.545348	0.0000
Ln(ASSETS)	0.026126	0.0388
EPSEX	-0.000275	0.0000
Ln(OIBD)	0.085650	0.0006
Ln(NIBEX)	0.029623	0.0787
Ln(EMPL)	0.021974	0.0086
SALECHG	0.003060	0.0000
DHTECH	0.066078	0.0138
Period fixed effects (dummy variables)		
	Weighted Statistics	
R-squared	0.606381	
Adjusted R-squared	0.604336	
S.E. of regression	0.440828	
F-statistic	2,966,106	
Prob(F-statistic)	0.000000	
Total panel (unbalanced) observations: 2517		

Ln (TOTAL_COMP)	Coefficient	Prob.
Constant	3,379,249	0.0000
Ln(TOTAL_COMP(-1))	0.545797	0.0000
Ln(ASSETS)	0.026164	0.0387
Ln(ASSETS)*DHTECH	0.006955	0.0177
EPSEX	-0.000274	0.0000
Ln(OIBD)	0.083758	0.0007
Ln(NIBEX)	0.030160	0.0733
Ln(EMPL)	0.021637	0.0096
SALECHG	0.003064	0.0000
Period fixed effects (dummy variables)		
	Weighted Statistics	
R-squared	0.606318	
Adjusted R-squared	0.604273	
S.E. of regression	0.440872	
F-statistic	2,965,326	
Prob(F-statistic)	0.000000	
Total panel (unbalanced) observations: 2517		

As expected, the EPS are negative and significantly related to total compensation in high-tech companies. This indicates that there are no explicit contractual arrangements linking compensations and EPS. The performance ratio of firms measured by return has a negative influence. Note that around 40.4% (R2 = 0.404) of the variance in degree of CEO compensation

can be explained by the group of variables for the short-term (see Table 3). However, it is important to highlight that around 60.6% (R2 = 0.606) of variance in the degree of CEO compensation for the long-term can be explained by the group of variables (see Table 4). These indicate that the variables addressed here play a significant role in explaining executive compensation for short- and long-term periods, as stated by the Chi-Square test (P-value = 0).

4.2 Total compensation and cash compensation models

The two primary measurements of CEO compensation were used. The short-term compensation consisted of annual salary and bonus, which represents the total cash compensation received during a specific year. Annual salary and bonus for 2000 and 2010 (in thousands of dollars) were taken from the ExecuComp data set. The long-term compensation represents the equity-based compensation of a CEO, as reported by Frydman, C (2008). As she reported in the case study of General Electric, salary and bonus are defined as the level of salaries and current bonuses, both awarded and paid out during the year. Long-term bonus measures the amount paid out during the year according to long-term bonuses awarded in prior years. Total compensation is the sum of salary, bonus, long-term bonus and the Black–Scholes value of stock options granted (Frydman, 2009).

Other dummy variables are used, such as YEAR for the period between 2000 and 2010. The main variables of the analysis in the system equation are T_COMP (defined by the sum of Salary, Bonus, Non-Equity Incentive Plan Compensation, Grant-Date Fair Value of Option Awards, Grant-Date Fair Value of Stock Awards, Deferred Compensation Earnings Reported as Compensation and Other Compensations) and CASH (Salary plus bonus) of all top executives in each company. The models introduced by the system equation presented below were used to test whether firm performance is relevant to explain executive compensation for the long and short-term. Firstly, the model for the long-term,

$$Ln\ (T\_COMP)_{ij} = b_{11} + b_{12}*ln(ASSETS)_{ij} + b_{13}*ASSETCHG_{ij} + b_{14}*ROA_{ij} + b_{15}*ln(OIBD/ASSETS*100)_{ij} + b_{16}*ln(SALES)_{ij} + b_{17}*ln(NIBEX)_{ij} + b_{18}*ERPSEX_{ij} + b_{19}*SPCODE_{ij} + b_{10}*DHTECH_{ij} + b_{31}*ln(COMMEQ)_{ij} + \sum_{2001}^{2010} \partial j * Yearj + u_{ij} \quad \textbf{(1)}$$

and for the short-term

$$Ln\ (CASH)_{ij} = b_{21} + b_{22}*ln(ASSETS)_{ij} + b_{23}*ASSETCHG_{ij} + b_{24}*ROA_{ij} + b_{25}*ln(OIBD/ASSETS*100)_{ij} + b_{26}*ln(SALES)_{ij} + b_{27}*ln(NIBEX)_{ij} + b_{29}*SPCODE_{ij} + b_{20}*DHTECH_{ij} + b_{32}*ln(COMMEQ)_{ij} + \sum_{2001}^{2010} \partial j * Yearj + v_{ij} \quad \textbf{(2)}$$

Where *i* and *j* represent the year and the company, respectively. The coefficients b_{11} and b_{21} are constants denoting the base level from which the sum of the compensations of top executive varies according to the changes in performance variables.

Table 5 presents the descriptive statistics of the variables observed for the firms of the S&P1500 during 2000-2010, which constitutes a sample of 15,265 observations. Some interesting outcomes were found as a result of this study.

Table 5 - Descriptive statistics individual sample S&P 1500

	TOTAL_COMP	CASH	ROA	NIBEX	EPSEX	SALES	ASSETCHG	ASSETS	COMMEQ	OIBD	DHTECH
Mean	13727.19	4156.375	1.577071	288.9755	3.47042	5488.187	39.96929	15205.21	2714.774	1000.633	0.14415
Median	8089.794	2937.509	3.874000	58.40650	1.20000	1239.655	6.03400	1746.966	637.0890	176.3185	0.00000
Maximum	641446.2	199115.9	3551.351	45220.00	8548.00	425071.0	522050.0	3221972.	211686.0	124840.0	1.00000
Minimum	0.0000	0.0000	-10300.00	-99289.00	-231.670	-4,234.47	-99.4270	0.00000	-111403.0	-76735.00	0.00000
Std. Dev.	20478.12	5100.74	82.6438	2018.437	113.869	16956.91	3705.640	88055.59	9044.259	3833.163	0.35125
Skewness	8.7409	9.9984	-94.4612	-9.3868	55.3268	10.6209	140.802	15.88214	8.80257	9.601327	2.02623
Observ.	19678	19889	19869	19870	19842	19870	19855	19872	19872	19606	19889

The descriptive statistics of the variables for total CEO compensation in high-tech firms are presented in Table 5. In the S&P1500, in the period between 2000 and 2010, there are about 14.415% high-technology firms, and it is possible to observe that the group of top executives in

each company has an average total compensation around USD 13,727 million and earn around USD 4,156 million in cash. Another interesting finding is that, in this period and in this group of companies, there is an increase in assets and returns on assets around 39.96% and 1.57 %, respectively.

To compare results of this model with the model presented in section 4.1, it was tested with the sample of the S&P 500 (see table 6) and then the sample was extended to the S&P1500 (see table 7) to understand the behavior in other dimensions of the firms.

Table 6 - Total compensation and cash compensation estimations using the SUR method for S&P500

Ln (T_COMP)	Coefficient	Prob.	Ln (CASH)	Coefficient	Prob.
Constant	6.2794	0.000	Constant	6.096	0.000
Ln(ASSETS)	0.1748	0.000	Ln(ASSETS)	0.198	0.000
ASSETCHG	0.0011	0.000	ASSETCHG	0.000	0.041
ROA	0.0118	0.007	ROA	0.007	0.066
OIBD/ASSETS*100	0.0086	0.000	OIBD/ASSETS*100	0.005	0.005
Ln(SALES)	0.0855	0.000	Ln(SALES)	0.054	0.000
Ln(NIBEX)	0.0563	0.010	Ln(NIBEX)	0.034	0.048
EPSEX	-0.0004	0.000	-		
DHTECH	0.2927	0.000	DHTECH	-4.890	0.335
Ln (COMMEQ)	0.0693	0.000	-		
2001	-0.0126	0.784	2001	-1.110	0.267
2002	-0.0651	0.153	2002	0.501	0.616
2003	-0.0763	0.086	2003	3.239	0.001
2004	-0.0157	0.719	2004	4.617	0.000
2005	-0.0392	0.366	2005	3.329	0.001
2006	0.0240	0.574	2006	-12.016	0.000
2007	0.0531	0.214	2007	-13.805	0.000
2008	0.0161	0.714	2008	-13.973	0.000
2009	-0.0208	0.634	2009	-13.646	0.000
2010	0.0834	0.056	2010	-13.890	0.000
R-squared	0.3920		R-squared	0.4280	
Adjusted R-squared	0.3894		Adjusted R-squared	0.4258	
S.E. of regression	0.6069		S.E. of regression	0.4964	
Durbin-Watson stat	0.8438		Durbin-Watson stat	0.5778	
Included observations:4421			Included observations:4421		

Operations and growth sales, as confirmed by this sample, are positive and significantly related to total executive. The system equation presented was estimated using the Seemingly Unrelated Regression (SUR) method. The SUR is a generalization of a linear regression model that consists of several regression equations, each having its own dependent variable and potentially different sets of exogenous explanatory variables. The main motivations for using the SUR are: improving estimation efficiency by combining information on different equations; and imposing and testing restrictions that involve parameters in different equations. The model can be estimated to each equation considering the interdependence of distribution (SUR). The SUR model can be further generalized into the multiple regressions, where the regressor on the right-hand side can also function as endogenous variables. The multiple-equation model is a system of equations where the assumptions made for the single-equation model apply to each equation. The regression coefficient, year, does not vary over time because the estimation was conducted using dummy variables for year, and assuming that the company's heterogeneity is captured in the constant part. (Greene, William, 2002).

Almost all results are obtained when testing the model with the S&P 1500. A positive and significant relation is found between performance measured by return on assets related total and cash compensation and, as expected, the EPS are negative and significantly related to total compensation in high-tech companies. Note that around 39.2% (R^2 = 0.392) of variance in the degree of total CEO compensation can be explained by the group of variables for the long-term, and it is important to highlight that there is around 42.8% (R^2 = 0.428) of variance in degree of cash CEO compensation for the short-term (see Table 6). These results show that the variables addressed here play a significant role in explaining executive compensation for short- and long-term periods, as stated by the Chi-Square test (P-value = 0).

The first hypothesis for the positive influence of CEO compensation (total and cash compensation) on firm performance is presented in Table 7. As it is possible to observe, the regressions are globally significant, with a 5% significance level. The following table presents the results of the estimation for the studied data.

Table 7 - Total compensation and cash compensation estimations using the SUR method for S&P1500 – SM, MD and SP

Ln (T_COMP)	Coefficient	Prob.	Ln (CASH)	Coefficient	Prob.
Constant	6,022,018	0.0000	Constant	5.941700	0.0000
Ln(ASSETS)	0.072140	0.0000	Ln(ASSETS)	0.123158	0.0000
ASSETCHG	0.001383	0.0000	ASSETCHG	0.000403	0.0000
ROA	0.000859	0.1045	ROA	0.000798	0.0385
OIBD/ASSETS*100	0.007541	0.0000	OIBD/ASSETS*100	0.003945	0.0000
Ln(SALES)	0.143398	0.0000	Ln(SALES)	0.135561	0.0000
Ln(NIBEX)	0.111439	0.0000	Ln(NIBEX)	0.053986	0.0000
EPSEX	-0.000400	0.0000	-		
SPCODE=SP	0.057757	0.0001	SPCODE=SP	-0.046676	0.0000
SPCODE=SM	-0.167486	0.0000	SPCODE=SM	-0.016045	0.1047
DHTECH	0.313173	0.0000	DHTECH	0.011091	0.3353
Ln (COMMEQ)	0.112421	0.0000	-		
2001	0.010864	0.6572	2001	-0.028642	0.1061
2002	-0.045589	0.0611	2002	0.051824	0.0033
2003	-0.051240	0.0290	2003	0.107735	0.0000
2004	0.021421	0.3570	2004	0.152258	0.0000
2005	0.018350	0.4379	2005	0.134210	0.0000
2006	-0.007390	0.7480	2006	-0.242996	0.0000
2007	0.045311	0.0495	2007	-0.306410	0.0000
2008	0.051967	0.0328	2008	-0.301458	0.0000
2009	0.044238	0.0698	2009	-0.283819	0.0000
2010	0.151203	0.0000	2010	-0.304708	0.0000
R-squared	0.565742		R-squared	0.547052	
Adjusted R-squared	0.565137		Adjusted R-squared	0.546487	
S.E. of regression	0.624388		S.E. of regression	0.455708	
Durbin-Watson stat	0.950250		Durbin-Watson stat	0.682381	
Included observations: 15265			Included observations: 15265		

The statistics are computed based on a panel data set of 1,500 firm-year observations, a total of about 15, 625 companies that represent 14.415% of high-technology firms between 2000 and 2010. They represent a difference around 31.31% in long-term compensation and about 11.1% in the short-term compensation. Other control financial performance measurements are used, such as total assets, operating income before depreciation, net income before extraordinary items and discontinued and cash compensations. It is important to highlight that around 56.57% (R2 =

0.5657) and 54.7% (R2 = 0.547) of the variance in degree of CEO compensation for each equation, respectively, can be explained by the group of variables (see Table 3). These indicate that the variables addressed here play a significant role in explaining executive compensation for short- and long-term periods, as stated by the Chi-Square test (p-value=0).

In Table 7, the coefficient signs are similar in both specifications. However, the magnitudes of the coefficients are sensitive to the specification. As expected, earnings per share are negative and significantly related to total compensation for the long-term. This indicates that there are no explicit contractual arrangements linking compensations and earnings per share. The performance ratio of firms measured by return has a negative influence on CEO compensation (Young & Jing, 2011, Core et al., 2003b).

A positive and statistically significant relationship was found between sales, asset growth and return on assets. Adding the same level of total CEO compensation and cash compensation (Gabaix & Landier, 2008) also empirically tests the relation between the level of pay and firm size. Log (assets), a variable proxy for firm size, is positively related to pay with a coefficient total compensation and cash compensation in the regression. When the adjustment is performed for the long-term compensation, it is possible to understand that when firm sizes are compared using the denominated current S&P index membership, S&P500 firms have an increase around 5.7% and for the S&P small caps 600 there is a decrease around 16.7%, comparatively to the S&P Midcaps 400 firms. In terms of cash compensation, the S&P 500 firms are 4.7% below midcaps, and the S&P small caps 600 firms are 1.6% below, comparatively to the same group of S&P Midcaps 400 firms.

S&P small caps 600 firms have less cash compensation and total compensation than S&P Midcaps 400 firms. Furthermore, S&P500 firms have more total compensation than S&P small caps 600 firms. However, the latter exhibit more cash compensation, which reflects a better contractual negotiation with firm performance efficiency or market conditions.

Another finding is that the influence on CEO pay for the short-term between the year 2006 and 2008 does not have the same meaning in long-term compensations. There is an increase around 5% for each year between 2007 and 2010, as opposed to the year 2000. Furthermore,

there is a decrease of about 30% in short-term incentives for the same period comparatively to the year 2000, which was possibly influenced by the beginning of the financial crisis, and it is not reflected in the long-term incentives. As Henry et al. (2011) suggest, CEO compensation increases the probability of effective internal controls after the Sarbanes–Oxley Act of 2002 (Henry et al., 2011). Moreover, as expected, the increase in financial performance measurements, such as operating income before depreciation/assets and net income, has a double impact on the increase in long-term compensation, which is more positive than the increase in short-term compensations.

5. Conclusion and Future Research

The main purpose of this study was to examine whether the total remuneration paid to CEOs in high-technology firms in the S&P 500 and S&P 1500 is related to corporate finance. This work aims at contributing to explain the influence that performance has on CEO compensation for short- and long-term periods in these groups of companies. It was found that there is a strong and positive relation between CEO compensation and firm performance.

In conclusion, according to the results that were obtained there is empirical evidence to state that in high-technology firms in the S&P, during the period between 2000 and 2010, performance determined total CEO compensation in short- and long-term periods together with accruals of financial performance measurements. Results suggest that high-tech firms tend to use more sophisticated performance measurements to determine CEO compensation. The method use here has potential implications in finance and accounting, for instance, where it is preferable to separately capture the specific effects of firm and performance.

However, this work is not without limitations. This study focuses only on high-technology firms in the S&P in the period between 2000 and 2010. The definition of high-technology used in this study can be extended, as performed by Shim et al. (2009), and other important item measurements should be included, such as value of R&D expenditures, number of patents by firm and citation of patents (Gomez-Mejia et al., 2000, Shim et al., 2009). The level of R&D

expenditures and new product introductions are viewed as proxies for innovation, risk-taking and long-term decision-making, which are crucial to characterize high-technology firms. Furthermore, innovation constitutes an indispensable component of corporate strategies. For these reasons, the results of this study may not be generalized by other sectors due the specificity of high-tech firms. Additionally, the findings of this study could only be generalized to other sectors at an international level similarly to those in the research that was conducted. Furthermore, it will be necessary to focus on the comparison between high-technology firms from other sectors at an international level.

In the future, it will be important to analyze other developments, such as the effect of managerial attributes for the short- and long-term in executive compensation (Graham et al., 2012). Furthermore, it will also be important to desegregate the data sample for the period between 2000 and 2010 in order to broaden the period of analysis and to investigate the effect of the USA financial crisis, which started in 2007, and to understand the effectiveness of internal control structures under the 2002 Sarbanes–Oxley Act (SOX, Section 404) before and after implementation.

Innovation constitutes an indispensable component of corporate strategies. For that, further considerations on innovation measurements may be incorporated in order to analyze the real motivation of the CEO. Further developments on this work will include new variables for the other research hypotheses, including returns to measure firm performance, firm expenditures on research and development, number of patents granted, and degree of openness. These variables and others may be the best proxies to measure the behavior of innovation and the link between executive compensation and firm performance. This paper will provide a better understanding of the relationship between compensation and performance in high-technology firms, something which is often discussed in the literature.

6. References

Adams, R. B., Almeida, H., & Ferreira, D. (2005). Powerful CEOs and their impact on corporate performance. *Review of Financial Studies, 18*(4), 1403-1432.

Akpotaire, B. U. (2011). Agency Cost Problems in Executive Compensation: An Evaluation of Dividend Equivalent Rights on Restricted Stocks. Social Science Research Network.

Bebchuk, L. A. & Jesse, M. F. (2003). Executive Compensation As An Agency Problem, Journal of Economic Perspectives, 2003, v17 (3, Summer), 71-92.

Bebchuk, L. A., & Fried, J. M. (2004). *Pay without performance: The unfulfilled promise of executive compensation*. Cambridge, M.A.: Harvard University Press.

Bebchuk, L. A., Cremers, M., & Peyer, U. (2011). The CEO pay slice. *Journal of Financial Economics, 102,* 199-221.

Bebchuk, L. A., Grinstein, Y., & Peyer, U. R. S. (2010). Lucky CEOs and lucky directors. *The Journal of Finance, 65*(6), 2363-2401.

Bebchuk, L., Cohen, A., & Ferrell, A. (2009). What matters in corporate governance? *Review of Financial Studies, 22*(2), 783-827.

Berger, P. G., Ofek, E., & Yermack, D. L. (1997). Managerial entrenchment and capital structure decisions. *The Journal of Finance, 52*(4), 1411-1438.

Bertrand, M., & Schoar, A. (2003). Managing with style: The effect of managers on firm policies. *Quarterly Journal of Economics, 118*(4), 1169-1208.

Boycko, Maxim, Andrei Shleifer, and Robert W. Vishny, (1996), A theory of privatisation, The Economic Journal 106, 309-319.

Carpenter, Robert E., & Petersen, Bruce C. (2002). Capital market imperfections, high-tech, and new equity financing. The Economic Journal, 112(477), F54-F72.

Conyon, Martin J., and Kevin J. Murphy, 2000, The prince and the pauper? Ceo pay in the united

states and united kingdom, The Economic Journal 110, 640-671.

Core, J. E., Guay, W. R., & Larcker, D. F. (2003). Executive Equity Compensation and Incentives: A Survey. Economic Policy Review, Vol. 9, No. 1, April 2003.

Core, J. E., Guay, W. R., & Verrecchia, R. E. (2003). Price versus non-price performance measures in optimal CEO compensation contracts. *The Accounting Review, 78*(4), 957-981.

Cremers, K. J. M., & Nair, V. B. (2005). Governance Mechanisms and Equity Prices. The Journal of Finance, 60(6), 2859-2894.

Eisenhardt, K. M. (1989). Agency Theory: An Assessment and Review. The Academy of Management Review, 14(1), 57-74.

Epstein, M. J., & Roy, M. (2005). Evaluating and monitoring CEO performance: evidence from US compensation committee reports. Corporate Governance, 5(4), 75 - 87.

Fama, E. F., & French, K. R. (1997). Industry costs of equity. *Journal of Financial Economics, 43*(2), 153-193.

Fama, E. F., & French, K. R. (1997). Industry costs of equity. Journal of Financial Economics,

Frydman, C. (2009). Learning from the past: Trends in executive compensation over the 20th century. *CESifo Economic Studies, 55*(3-4), 458-481.

Frydman, C., & Jenter, D. (2010). CEO compensation. National Bureau of Economic Research Working Paper Series.

Gabaix, X., & Landier, A. (2008). Why has CEO Pay Increased So Much? The Quarterly Journal of Economics, 123(1), 49-100.

Gomez-Mejia, L. R, Gideon, D. M., & Balkin, D. B. (2000). Is CEO Pay in High-Technology Firms Related to Innovation? The Academy of Management Journal, 43(6), 1118-1129.

Graham, J. R., Li, S., & Qiu, J.. (2012). Managerial Attributes and Executive Compensation. Review of Financial Studies, 25(1), 144-186.

Greene, William H., 2003. *Econometric analysis.* (Prentice hall)

Grinstein, Y., Weinbaum, D., & Yehuda, N. (2011). The economic consequences of perk disclosure. SSRN eLibrary.

Gujarati, Damodar N., 2004. Basic econometrics.

Hall, B. J., & Liebman, J. B. (1998). Are CEOS really paid like bureaucrats?. *Quarterly Journal of Economics, 113*(3), 653-691.

Hall, B. J., & Murphy, K. J. (2003). The Trouble with Stock Options. Journal of Economic Perspectives, 17(3), 49-70.

Henry, T. F., Shon, J. J., & Weiss, R. E. (2011). Does executive compensation incentivize managers to create effective internal control systems? Research in Accounting Regulation, 23(1), 46-59.

Jensen, M. C., & Murphy, K. J. (1990). Performance Pay and Top-Management Incentives. Journal of Political Economy, 98(2), 225-264.

Jensen, M. C., & Murphy, K. J. (1990a). Performance pay and top-management incentives. *Journal of Political Economy, 98*(2), 225-264.

Jensen, M. C., & Murphy, K. J. (1990b). CEO incentives: It's not how much you pay, but how. *Harvard Business Review, 3*, 138-153.

Jensen, M., & Meckling, W. (1976). Theory of the firm: Managerial behaviour, agency costs, and ownership structure. *Journal of Financial Economics, 3*(4), 308-360.

Jensen, Michael C., (2004), Agency costs of overvalued equity, ECGI - Finance Working Paper No. 39/2004.

Makri, M., Lane, P. J., & Gomez-Mejia, L. R. (2006). CEO incentives, innovation, and performance in technology-intensive firms: A reconciliation of outcome and behavior-

based incentive schemes. *Strategic Management Journal, 27*(11), 1057-1080.

Malmendier, U., & Tate, G. (2009). Superstar CEOs. *The Quarterly Journal of Economics, 124*(4), 1593-1638.

Murphy, K. J. (1999). Chapter 38 executive compensation. In C. A. Orley, & C. David (Eds.). *Handbook of Labor Economics, 3*, 2485-2563.

Sesil, J., Lin, Y., & , Steven M. (2006). Stock Option Adoption and Irrational Exuberance: The Impact On Profitability. working papers series

Shim, E. S., Lee, J., & Joo, I. K (2009). CEO compensation and US high-tech and low-tech firms' corporate performance. Contemporary Management Research, 5, 93-106.

Sundaram, R. K., & Yermack, D. (2007). Pay me later: Inside debt and its role in managerial compensation. Journal of Finance, 62, 1551-1588.

Young, S., & Jing, Y. (2011). Stock repurchases and executive compensation contract design: The role of earnings per share performance conditions. *Accounting Review, 86*(2), 703-733.

CHAPTER 3

CEO compensation in high-tech firms and changes in the Financial Accounting Standard SFAS No 123 (R)

1. Introduction

Chief Executive Officer (CEO) compensation became common in the late 1970s and early 1980s and is often discussed in the literature ever since. Numerous stories have appeared recently in the financial press pointing out how many executives define contract remunerations. These news and striking reports have raised concerns on compensation. Nevertheless, no consensus view has emerged, and there is still much to learn about the determinants of CEO compensation. Appropriate incentives can be the tools in many cases, however, by basing compensation on changes in shareholder wealth. According to Graham (2012), managers often have better information than shareholders and boards in terms of identifying investment opportunities and assessing the profitability of potential projects. Furthermore, the fact that managers are expected to make higher investment decisions explains why shareholders relinquish decision rights over their assets by purchasing common stock (Graham, Li, & Qiu, 2012) .

This study explores how the Financial Accounting Standards (FAS) Statement 123 (R) affects the performance determinants of CEO pays for long-term and short-term periods and points out the influence of high-tech firms. Furthermore, this paper examines how high-tech firms behave facing the cash based compensations and total CEO pays related to various performance measurements. The performance measurements pointed in this work are the usual accounting ratios of corporate finance.

In 1990, Jensen and Murphy wrote that it is possible that CEO bonuses are strongly tied to an unexamined and/or unobservable performance measurement. When referring to the swings in CEO pay from year to year, the authors explain that the variations are consistent with the existence of an overlooked and yet important performance measurement, and that increase suggests that CEO pay is essentially unrelated to all relevant performance measurements (M. C. Jensen & Murphy, 1990, 1990b; K. J. Murphy, 1999). In many Standard & Poor´s (S&P) firms, employee stock option plans are an important component of employee remuneration. In 1999, 94% of companies in the S&P 500 offered stock options to their top employees (Brian J. Hall & Murphy, 2002; K. J. Murphy, 1999). In order to better understand this argument, this study

investigates the relation between the CEO pay and the performance against high-technology firms with the balance cash compensation and total compensation. The combination of salary, incentives and bonuses is often referred to as cash compensation for executives. The CEO behavior is different when we think in short-term and long-term periods. The main goal of this paper is to provide a broader perspective on the relationship between CEO pay and firm performance and how high-technology can improve that performance while analyzing the behavior with the implementation of the SFAS 123 (R) and all its accounting rules underlying obligations. The change in the accounting treatment of stock-option compensation is exploited as well as the fair-value report under the SFAS 123 (R), which was issued by the Financial Accounting Standard Board (FASB) and entered into force in December 2005. This paper contributes to the under-studied empirical literature on the accounting treatment of equity-based compensation, influenced by the change in accounting rules and its influence on executive pay of high-tech firms.

This work is organized as follows: Section 2 contains a revision of the main theories in the literature, as well as an analysis of accounting treatment of equity-based compensation before and after the SFAS 123 (R), an analysis on executive compensation in order to address agency problems and the income strategy impact on CEO compensation. Furthermore, this section examines the appropriate measurements for corporate financial performance in high-technology firms. Section 3 explains the research hypotheses and section 4 presents the methodology, sample and data collection for the regression estimation, as well as the results of the econometric model to assess the influence that firm performance has on executive compensation before and after SFAS 123 (R). Lastly, the main conclusions are discussed, as well as some limitations and new perspectives for future research.

2. Literature review

Based on the literature, a study was conducted in order to understand CEO compensation in high-technology firms.

2.1 Accounting treatment of equity-based compensation before and after SFAS 123 (R)

In December 2004, FASB issued the FASB Statement No. 123 (revised 2004), *Accounting for Stock-Based Compensation*, to amend and replace the Financial Accounting Standards Statement No 123, which became mandatory for all firms toward the end of 2005 and supersedes the APB Opinion No. 25, *Accounting for Stock Issued to Employees.* Statement 123 as originally issued in 1995, which established that a fair-value-based method of accounting for share-based payment transactions with employees was preferable. The SFAS 123 (R) requires the use of a fair value accounting method to compute the value of option compensation. A similar approach is followed by international standards International Financial Reporting Standards (IFRS2) that states the same principle. Both standards require employee stock option to be recognized as an expense and measured at the fair value of the employee stock option determined at the time of grant.

Prior to implementing the SFAS 123 (R), firms were required to report compensation expense due to stock options in an amount equal to the excess of the stock price at the grant date over the exercise price. This is allowed to as the intrinsic value method. Most options have an exercise price at least equal to the grant date stock price and so this method did not usually result in an expense reported on the income statement. In the originally issued SFAS 123, a company could choose to either report in its income statement the stock compensation expense calculated per the fair value method or the stock compensation expense calculated per the intrinsic value method and disclosing the impact in their footnotes. The SFAS 123 (R) covers a wide range of share-based compensation arrangements including share options, restricted share plans, performance based awards, share appreciation rights, and employee share purchase plans.

The SFAS 123 (R) leads to greater expenses as it increases the overall conservatism income. According to Heltzer (2010), different forms of conservatism have different implications on the quality of income. The author found that the SFAS 123 (R) causes an increased negative relation between economic gains and income, but it is mix on the quality of earnings in terms of conservatism (Heltzer, 2010). Since the publication of the SFAS 123(R) Share-Based Payment, which eliminates the alternative of using the intrinsic value based method, the IFRS and the US

GAAP have similar requirements for accounting for share-based payments. With this statement, the convergence between the IFRS in Europe and the GAAP in the US started.

2.2 Executive compensations to address agency problems and the income strategy impact

The general acceptance of the agency theory and the parallel research on executive compensation began in the early 1980s. It was the evolution of the modern corporation with ownership separation and control that undermined the agency theory. Early studies in this area focused on documenting the relation between CEO pay and firm performance. The discussion of executive compensation must proceed with the fundamental agency problem afflicting management decision-making as background. According to Jensen and Murphy (1990), there is an optimal contracting approach, which is when boards use design compensation schemes to maximize shareholder value with efficient incentives (M. C. Jensen & Murphy, 1990). To connect the agency problem and the executive compensation, the authors use the managerial power approach when this connection is seen as an integral part of the agency problems. It is important to remember that the principal-agent problems treat the difficulties that arise under conditions where information is incomplete and asymmetric whenever a principal hires an agent (Murphy, 1999, Eisenhardt (1989); Lucian Arye Bebchuk and Fried (2003)). Furthermore, the agency theory aims at solving two problems that can occur in agency relationships. The first is the desires or goals of the principal and agent conflict and it is difficult or expensive for the principal to verify what the agent is actually doing. The problem is that the principal is unable to check if the agent has behaved correctly. Secondly, it is the problem of risk sharing facing the different attitudes toward risk, because the principal and the agent have different actions according to different risk preferences (Eisenhardt, 1989).

Hall and Liebman (1998) argue that the solution to the agency problem is aligning the incentives of executives with the interests of shareholders by granting (or selling) stock and stock options to the CEOs. The CEOs have the correct incentives on every margin, including effort, perquisites and project choice, and support that the optimal contract is a one-to-one

correspondence between firm value and CEO pay (Brian J. Hall & Liebman, 1998). In their work, Hall and Liebman (1998) conclude that the relationship between pay and performance is much larger than has previously been recognized, and that this includes both gains and losses in CEO wealth. The salary and bonus vary so little because corporate board members are often reluctant to reduce CEO pay, even in response to poor performance and that may attract unwanted media attention. Using salary and bonuses to reward and penalize CEOs may only be possible to create high-powered incentives that align CEO pay with shareholder objectives (Hall and Liebman, 1998). A large part of the executive pay literature argues that compensation and managerial interests should be aligned with shareholder interests in order to solve agency problems (see, for example, the surveys by Murphy and by Core et al. (2003a).

Equity-based compensation is widely documented in the research examining pay versus performance. M. Jensen and Meckling (1976), Murphy (2003) and Jensen (2004) state that the increase in stock options pay is the result of the boards' inability to evaluate the true cost of this form of compensation. The use of equity-based compensation is encouraged by all stakeholders, such as investors, regulators and academics. The controversy over CEO compensation reflects a perception that CEOs effectively set their own pay levels. In most companies, the last decisions over executive pay are made by members outside the board of directors who are keenly aware of the conflicts of interest between managers and shareholders over the level of pay. However, the CEOs and other top managers exert at least some influence on the level and on the structure of their pay (K. J. Murphy, 1999).

In recent years, the use of restricted stocks in compensation executives has increased and has been widely criticized when these executives received dividend equivalents on restricted stocks before the vesting period. Agency cost benefits of dividend equivalent rights argue that this practice helps executives focus on the business, and rewards them for managing the business to produce cash. Therefore, this is encouraged because it is a way of distributing dividends by shareholders (Akpotaire, 2011).

The SFAS 123 (R) is a change in accounting policy and represents an exogenous shock to the accounting benefits, and restricts the choice of accounting principles by managers (Zmijewski &

Hagerman, 1981). There are economic incentives to determine and motivate the managers' concern with a set of accounting principal utilized to generate the firms' financial statements. Under economic factors which influence the decision, managers will attempt to archive the optimal reported net income over time and will choose a set of income policies according to theirs goals. There are many variables that induce managers to use deflating policies while other variables encourage managers to choose income inflating solutions. That infers a conservative or liberal firm income strategy. This trade-off means that any combination of Generally Accepted Accounting Practice (GAAP) variables may be optimal for each firm. However, the SAF 123(R) prevents this income strategy by the imposing and restricting some variables as accounting treatment of stock-options compensation and the fair-value report. In their study, Zmijewski and Hagerman (1981) suggest that individual accounting choice decisions are part of an overall firm strategy and applicable in larger firms and in more concentrated industries. In this sense, Matsunaga (1995) suggests that some change in the financial reporting of treatment of stock options, as proposed by the FASB, is likely to reduce the use of the employees' stock option for some firms (Matsunaga, 1995).

2.3 Financial performance in high-technology firms

This chapter provides an analysis on the different forms of measuring performance in high-tech firms and how these engage to the level of CEO pay. The behavior of high-tech firms and its contribution to CEO compensation for the short- and long-term are also analyzed. This is consistent with Shim (2009), who argues that it is possible to confirm that high-tech firms that depend more on managing assets are more successful. Some of these assets are technology innovation, continuous improvement, software development and knowledge-based management. High-tech firms must continuously innovate to survive and to sustain their growth (Shim et al., 2009). In high-technology firms it is possible to find innovation, R&D investments and some assets with an essential competitive advantage and there are, at the same time, some risks. Different R&D spending in the firms is indicative of a large variance in the firms' performance. High-tech investment is particularly important because the returns on high-tech investment are

skewed and highly uncertain, in part because R&D projects have a low probability of succeeding financially. Another reason is the existing asymmetry in information shared between firms and potential investors. This happens because it is difficult to increase high-tech investments and often insiders will have much better information than outsiders about the prospects of the firm's investments. Moreover, as pointed out by Makri, Lane and Gomez-Mejia, to engage in innovative projects leading to innovations the incentive schemes play a pivotal role in inducing senior organizational managers. Furthermore, to secure the stream of innovations a firm needs to enhance its economic performance with a proper pay scheme to encourage executives (Makri, Lane, & Gomez-Mejia, 2006). The study by Gomez-Mejia et al. (2000) was taken into consideration in this paper, especially their conclusion that high-technology industry executives may be more rewarded for innovation activity than for the firm's financial performance. The executive incentives induce higher risk and cannot bear the associated financial risk as a consequence of those actions (Gomez-Mejia, Gideon, & Balkin, 2000).

In summary, it was found that firms are subjected to the agency problem in which the CEO may not work in favor of the shareholders to maximize their wealth by improving firm performance. Furthermore, the decisions related to CEO compensation are based on the firms' accounting and finance performance. Therefore, the change in the rules of the SFAS 123 (R) forces managers to make decisions and to overtake the limitations of their income goals.

2.4 Developing a hypothesis

The role that accounting plays on CEO compensation in high-tech firms is still little known. Some possibilities have been identified to find some relations with pay compensation and to understand how it is possible to improve firm performance and in turn the shareholder wealth. As previously discussed, existing theories provide predictions on the outlined considerations related to firm performance, allowing for two different selection hypotheses.

The first research question, that the CEO compensation for the long-term is determinant and positively related to firm performance. High-technology companies support and enhance this evidence. Rejecting the null hypothesis would mean that the relative weight in terms of total compensation of each compensation component (such as salary, bonus, stock options and other compensations)are different goals for executives, as opposed to performance for the short-term. It is possible that high value firms have CEOs are interested in long-term performance and in obtaining personal benefits in terms of total compensation. It might be argued that powerful incentive models are especially valuable for high value firms with high opportunities for growth that need to be decisively and vigorously pursued. It might also be that high value firms are especially likely to attract star CEOs and pay gold parachutes. Furthermore, the CEO compensation for the short-term is determinant and positively correlated with firm performance. With less intensity and yet more persistent than long-term compensation, bonuses and salary are determinant and in the same effect related to accounting performance. Hypotheses 1a and 1b are formulated accordingly.

Hypothesis 1a: CEO compensation in high-technology firms is positively related to firm performance for the long-term.

Hypothesis 1b: CEO compensation in high-technology firms is positively related to firm performance for the short-term.

The second question is the SFAS 123 (R) has an influence on CEO compensation in high-technology firms. Human capital intensive industries rely heavily on stock options as compensation relatively to other firms. The impact of fair value reporting is examined for stock option compensation on their income statements and on CEO compensation. In line with this, hypothesis 2 is formulated.

Hypothesis 2: CEO compensation in high-technology firms is positively related to firm performance after the implementation of the SFAS 123 (R).

The purpose of this paper is to examine this impact on CEO compensation. The effect on CEO compensation is analyzed for the long- and short-term using high-tech firm performance before and after SFAS 123 (R) implementations.

3. Empirical approach

The models introduced by the system equation presented below were used to test whether firm performance is relevant to explain executive compensation for the long- and short-term. Firstly, the model for the long-term,

$$\text{Ln (T\_COMP)}_{ij} = \beta_{11} + \beta_{12}*\ln(\text{ASSETS})_{ij} + \beta_{13}*\Delta\text{ASSETS}_{ij} + \beta_{14}*\text{ROA}_{ij} + \beta_{15}*\ln(\text{OIBD/ASSETS}*100)_{ij} + \beta_{16}*\ln(\text{SALES})_{ij} + \beta_{17}*\ln(\text{NIBEX})_{ij} + \beta_{18}*\text{ERPSEX}_{ij} + \beta_{19}*\text{SPCODE}_{ij} + \beta_{10}*\text{DHTECH}_{ij} + \beta_{31}*\ln(\text{COMMEQ})_{ij} + \beta \sum_{2001}^{2010} \partial j * Yearj + u_{ij}$$

and for the short-term

$$\text{Ln (CASH)}_{ij} = \beta_{21} + b_{22}*\ln(\text{ASSETS})_{ij} + \beta_{23}*\Delta\text{ASSETS}_{ij} + \beta_{24}*\text{ROA}_{ij} + \beta_{25}*\ln(\text{OIBD/ASSETS}*100)_{ij} + \beta_{26}*\ln(\text{SALES})_{ij} + \beta_{27}*\ln(\text{NIBEX})_{ij} + \beta_{29}*\text{SPCODE}_{ij} + \beta_{20}*\text{DHTECH}_{ij} + \beta_{32}*\ln(\text{COMMEQ})_{ij} + \beta \sum_{2001}^{2010} \partial j * Yearj + v_{ij}$$

Where, *i* and *j* represent the year and the company, respectively. The coefficients β_{11} and β_{21} are constants denoting the base level from which the sum of the compensations of top executive varies according to the changes in performance variables. The table 1 below identifies the variables that were used, including their definitions, measurement units and expected signs, as reported in the theory.

Table1 – Executive compensation dependent and independent variables

Name	Definition	Units
T_COMP	The sum of the compensations of top executives includes: Salary, Bonus, Non-Equity Incentive Plan Compensation, Grant-Date Fair Value of Option Awards, Grant-Date Fair Value of Stock Awards, Deferred Compensation Earnings Reported as Compensation, and Other Compensations.	Thousands
CASH	Salary + Bonus The dollar value of the base salary plus bonus earned by the named executive officer during the fiscal year.	Thousands
ROA	Return on assets. The Net Income Before Extraordinary Items and Discontinued Operations divided by Total Assets. This quotient is then multiplied by 100.	Percentage
ASSETS	The Total Assets as reported by the company.	Millions
ΔASSETS	The year to year percentage change in Total Assets.	Percentage
COMMEQ	The sum of Common Stock, Capital Surplus, Retained Earnings, and Treasury Stock adjustments.	Millions
EPSEX	Earnings per Share (Primary) Excluding Extraordinary Items and Discontinued Operations.	
(OIBD/ASSETS)*100	The Operating Income Before Depreciation/Assets as reported by the company. This quotient is then multiplied by 100.	Percentage
NIBEX	The Net Income Before Extraordinary Items and Discontinued Operations.	Millions
SALES	The Net Annual Sales as reported by the company.	Millions
SIC	Standard Industrial Classification Code.	
SPCODE	Current S&P Index membership "SP" = S&P 500 "MD" = S&P Midcap Index "SM" = S&P Small cap Index	

The High-Tech Dummy (DHTECH) is equal to one if the firm operates in an industry with a four-digit SIC code of 3570, 3571, 3572, 3576, 3577, 3661, 3674, 4812, 4813, 5045, 5961, 7370, 7371, 7372, or 7373, instead of four-digit Standard Industrial Classification (SIC) codes (Fama & French, 1997). Other dummy variables are used, YEAR for the period between 2000 and 2010.

The proxies for financial reporting concerns expand on variables used prior to research by encompassing corporate performance and CEO compensation documented in the literature.

Earnings per share (EPS) are a popular performance metric used in executive compensation contracts (Murphy 1999, 2000). As it is commonly known, this ratio is influenced and directly punished by the increase in restricted stocks and dividend equivalents. Compensation contracts that tie managerial rewards to EPS create explicit incentives for executives to manage the EPS. Young and Jing (2011) argue that there is a net benefit to shareholders in executive compensation contracts when they use stock repurchases by EPS targets (Young & Jing, 2011). Additionally, if stock options are a sub-optimal incentive contract, Sesil et al. (2006) expect that, in terms of firm performance, there will be a decrease in earnings or an increase in earnings with a reduction in the rate of return on assets (Sesil, Lin, & Director, 2006).

The use of options at executive level associated with an increase in performance is not clear in the literature. Some argue that it is associated with a higher profit and output (Core et al., 2003a), while others state the opposite (Brian J. Hall & Murphy, 2002). The use of stock options reduces the agency cost and incentive to maximize value creation for shareholders, and encourages risk taking, and then accounting is shown by measuring corporate finance (Sesil et al., 2006). They argue that adopting stock options has an impact on firm financial performance to increase operating income (OI) and investments in assets. However, there will be a significant decrease in return on assets (ROA). Others who have previously conducted research on stock options have focused on pay-for-performance elasticity (Brian J. Hall & Murphy, 2003), while others have focused more on the determinants of share-based adoption (Core, Guay, & Larcker, 2003). The adoption of stock options is associated with higher growth in income, but to a significantly lower return on assets (ROA), which is evidence that options promote sub-optimal over investment.

The company's measurements are consistent with vision, mission and strategies for long-term performance and the financial criteria to monitor CEO compensation (Epstein & Roy, 2005). Usually in the USA the compensation programs combine incentives for short- and long-term periods with a set of performance measurements.

For these reasons, and because this subject is pertinent, it is interesting to examine these issues using these performance measurements and to contribute to enrich research in this area, improving the understanding on CEO compensation how and that influence before and after SFAS 123 (R) implementations.

4. Data and summary statistics

The chosen database was the ExecuComp, which was used to find the variables and to create a sample of firms between 2000 and 2010. The ExecuComp database provides yearly data on salary, bonus, stock option and restricted stock grants, as well as managerial stock and option holdings for top executives in firms within the Standard & Poor's Index (S&P 1500).To test this hypothesis, the following specification is run on the balanced panel of high-technology firms. High-Technology firms are the firms that operate in an industry with a four-digit SIC code of 3570, 3571, 3572, 3576, 3577, 3661, 3674, 4812, 4813, 5045, 5961, 7370, 7371, 7372, or 7373, using the Fama and French classification of 48 industry groups, instead of four-digit Standard Industrial Classification (SIC) codes (Fama & French, 1997).

According to Lucian A. Bebchuk, Cremers, and Peyer (2011), in order to test the variables and to assess the abovementioned research hypotheses there are independent variables that will possibly be used by the regression model to perform the estimation. The total compensation and cash compensation are analyzed depending on some firm performance metrics.

At an empirical level, this analysis focuses on a sample of 1500 companies in the Standard & Poor's (stock market index based on the common stock prices) index (S&P1500), for the period between 2000 and 2010, which constitutes a sample of about 19800 observations. The SFAS 123 (R) was beginning of the first annual reporting period after December 15, 2005. Thus, all firms' observations during 2006 were excluded because this is a transition year and the quality of the statements is lower. After this restriction, the final sample comprises 1500 firm-year observations with 2000-2005 as the period before SFAS 123 (R) and 2007-2010 as the period after SFAS 123 (R).

The ExecuComp database collects information on seven independent variables – Assets and year to year percentage change of assets (ΔASSETS), sales, operation income before depreciation (OIDB), net items and discontinued operation (NIBEX), earning per share (EPSEX), The sum of Common Stock Capital Surplus (COMMEQ), net annual sales (SALES) – and dependent total compensation (T_COMP) and cash compensation (CASH) variables are listed by each year and company. Several measurements were used in this study, such as control variables. These include assets, increase in sales, the net Income and the earning per share, as a proxy of firm size, firm performance and shareholder wealth, the common predictors of executive pay. The two primary measurements of CEO pay were used. The short-term compensation consisted of annual salary and bonus, which represents the total cash compensation received during a specific year. Annual salary and bonus for 2000 and 2010 (in thousands of dollars) were taken from the ExecuComp data set. The long-term compensation represents the equity-based compensation of a CEO, as reported by Frydman (2009). As she reported in the case study of General Electric, salary and bonus are defined as the level of salaries and current bonuses, both awarded and paid out throughout the year. Long-term bonus measures the amount paid out during the year according to long-term bonuses awarded in prior years. Total compensation is the sum of salary, bonus, long-term bonus and the Black–Scholes value of stock options granted (Frydman, 2009).

The main variables of the analysis in the system equation are T_COMP (defined by the sum of salary, bonus, non-equity incentive plan compensation and other compensations) and CASH (Salary plus bonus) of all top executives in each company. Table 2 presents the descriptive statistics and correlations for variables used in the CEO compensation analysis. Some interesting outcomes were found as a result of this study.

Table 2 - Descriptive statistics and correlations for the sample of 1500 S&P over the period 2000-2010

Panel A: Descriptive statistics - Full time period

Variable	Mean	Median	Min	Max	Stdev	N
T_COMP	13,727.19	8,089.79	0	641,446.20	20,478.12	19678
CASH	4,156.38	2,937.51	0	199,115.90	5,100.74	19889
ASSETS	15,205.21	1,746.97	0	3,221,972.00	88,055.59	19872
Δ ASSETS	39.96	6.03	-99.43	522,050.00	3,705.64	19855
ROA	10.79	11.54	-1,000.00	138.87	76.41	19563
OIBD	1,000.63	176.32	-76,735.00	124,840.00	3,833.16	19606
SALES	5,488.19	1,239.66	-4,234.47	425,071.00	16,956.91	19870
NIBEX	2,889.75	58.41	-99,289.00	42,220.00	2,018.44	19870
EPSEX	3.47	1.2	-231.67	8,548.00	113.87	19842
COMMEQ	2,714.77	637.08	-111,403.00	211,686.00	9,044.26	19842
DHTECH	0.144	-	-	-	-	18889

Panel B: Descriptive statistics pre and post SFAS 123 (R)

	Pre SFAS 123 (R)				Post SFAS 123 (R)				Difference	
Variable	Mean	Median	Stdev	N	Mean	Median	Stdev	N	T-Test	Med Chi-Squa
T_COMP	13,635.58	7,440.77	23,140.38	10687	13,762.41	8,973.70	16,254.54	7156	(-0,402)	(100,22)***
CASH	4,751.23	3,352.65	5,594.83	10854	3,357.93	2,630.00	3,877.08	7159	(18,362)***	(502,02)***
ASSETS	13,008.18	1,491.48	64,758.39	10837	18,230.98	2,104.52	114,006.40	7159	(-3,909)***	(101,94)***
Δ ASSETS	65	7.04	5,019.63	10820	8.56	4.18	36.72	7159	(-0,951)	(153,64)***
ROA	10.67	11.68	98.73	10571	10.61	11.26	39.15	7124	(-0,040)	(7,75)***
OIBD	899.67	165.58	3,197.82	10571	11,101.00	190	4,445.22	7159	(-3,506)***	(15,35)***
SALES	4,822.67	1,127.75	14,207.38	10835	6,367.19	1,430.13	20,034.76	7159	(-6,047)***	(56,15)***
NIBEX	256.65	51.98	1,525.50	10835	287.62	63.7	2,612.11	7159	(-1,002)	(25,26)***
EPSEX	3.11	1.17	94.12	10807	3.41	1.17	124.22	7159	(-0,186)	(-0,001)
COMMEQ	2,350.08	559.15	7,136.89	10837	3,182.20	753	1,153.48	7159	(-6,102)***	(100,43)***
DHTECH	0.148	-	-	10854	0.141	-	-	7159	-	-

Panel C : Correlation

	1	2	3	4	5	6	7	8	9	10
1 T_COMP	1									
2 CASH	**0.559**	1								
3 ASSETS	**0.305**	**0.391**	1							
4 Δ ASSETS	-0.002	-0.004	-0.004	1						
5 ROA	**0.013**	0.013	-0.002	-0.004	1					
6 OIBD	**0.398**	**0.432**	0.003	-0.001	0.01	1				
7 SALES	**0.354**	**0.333**	**0.476**	-0.002	0.008	**0.749**	1			
8 NIBEX	0.195	**0.176**	**0.205**	-0.001	**0.016**	**0.61**	**0.475**	1		
9 EPSEX	-0.009	-0.009	**0.049**	0	0.001	**0.082**	**0.1**	**0.103**	1	
10 COMMEQ	**0.409**	**0.387**	**0.631**	-0.001	0.002	**0.724**	**0.685**	**0.573**	**0.2**	1

Pearson´s correlations in bold are significant at the 0,05 level

The descriptive statistics of the variables for total compensation and cash compensation for high-tech firms are presented in Table 2. Panel A of table 2 provides descriptive statistics for the full sample. The firms in the sample are large with a mean of 15,201.20 million USD and median assets of 1,746.97 million USD.

In the S&P1500, before and after SFAS (R), for the period between 2000 and 2010, there are about 14.415% high-technology firms, and it is possible to observe that the group of top executives in each company has an average total compensation around 13,727 million USD and earn in cash around 4,156 million USD. Other interesting finding is that, in this period and in this group of companies, and consistent with the overall economic growth, there is an increase in assets and returns on assets around 39.96% and 10.79 %, respectively. Panel B of Table 2 reports the same descriptive statistic partitioned by time period. Consistent with the overall economic growth, it is possible to observe that almost all firm performance measurements increase in the period after SFAS 123 (R). Total compensations maintain an average around 13,727 million USD (value for full period) for the periods before and after SFAS 123 (R). The same cannot be said about the compensation for the short-term as variable cash presents a significant decrease in value after SFAS 123 (R). Panel C of table 2 presents correlations between variables. The performance variables, such as assets, return on assets, operating income, sales and the common stocks, are positively correlated with total compensation and for the short-term they are positively correlated with operating income and sales with cash.

5. Results

Using the sample presented above suggests that accounting played a significant role in the high-tech firms' choice of equity compensation. The panel data model is used because it is the most suitable way of studying a large set of repeated observations and due to the fact that it assesses evolution over time. With panel data it is possible to simultaneously explore several variations over time and between different individuals. The use of such models has increased

immensely and, in fact, combining time and cross-sectional data brings many advantages: it is possible to use a larger number of observations and the degree of freedom in estimates increases, thus making statistical inferences more credible. At the same time, the risk of multicollinearity is reduced since the data in companies present different structures. Moreover, this model provides access to further information and the efficiency and stability of the estimators increase, while enabling the introduction of dynamic adjustments (Gujarati, 2004; William, 2003).

The results are presented in table 3 and in Panel A the regression with full sample is analyzed in order to test the first hypothesis; the second hypothesis is tested in Panels B and C.

As expected, there is a significant and positive correlation between performance variables and total compensation (T_COMP) and between them and the short-term compensation presented by cash. Therefore, it is possible to state that firm performance measured by assets, return on assets, sales and net income have a positive influence on the executive compensation for long- and short–term periods.

Table 3 - Total compensation and cash compensation estimations using the SUR method

Dependent variable	Prediction Sign	Panel A - full sample		Panel B - Pre SFAS 123(R)		Panel C - Post SFAS 123(R)	
		Ln_T_COMP	Ln_CASH	Ln_T_COMP	Ln_CASH	Ln_T_COMP	Ln_CASH
Ln_ASSETS	+	0.069 (7,142)***	0.1202 (18,82)***	0.0616 (4,413)***	0.108 (12,36)***	0,071 (4,987)***	0,121 (12,42)***
Ln_Δ ASSETS	+	0.001 (10,234)***	0.0004 (4,090)***	0.0001 (8,867)***	0.0004 (3,46)***	0,001 (5,189)***	0,0003 (2,37)**
ROA	+	0.007 (9,061)***	0.004 (6,643)***	0.0102 (8,163)***	0.005 (6,592)***	0,006 (5,013)***	0,0002 (2,93)***
Ln_SALES	+	0.142 (20,241)***	0.134 (26,83)***	0.1238 (12,173)***	0.168 (11,53)***	0,157 (15,22)***	0,090 (11,54)***
Ln_NIBEX	+	0.115 (14,897)***	0.057 (10,49)***	0.123 (10,81)***	0.088 (11,53)***	0,084 (7,726)***	0,018 (2,258)
EPSEX	-	-0.0003 (-11,75)***		-0.0003 (-6,26)***		~0,004 (-8,866)***	
Ln_COMMEQ	+	0.111 (12,62)***		0.157 (12,42)***		0,068 (5,326)***	
DHTECH	+	0.314 (19,67)***	0.0119 (1,038)***	0.449 (19,05)***	0.053 (3,345)***	0.1520 (6,681)***	-0,063 (-3,654)***
SP	+ / -	0.057 (3,908)***	-0.047 (0-4,444)***	0.0198 (0,967)	-0.033 (-2,395)**	0.1401 (6,113)***	-0,015 (-0,912)
SM	+ / -	-0.167 (-12,30)***	-0.016 (-1,633)	-0.1531 (-7,536)***	-0.046 (-3,321)***	-0.207 (.10,44)***	-0,054 (-3,596)***
Year = 2001	+ / -	0.0108 (0,443)	-0.029 (-1,618)	0,020 (0,787)	-0,020 (-1,182)		
Year = 2002	+ / -	-0.045 (-1,865)**	0,052 (2,946)**	-0,035 (-1,376)	0,061 (3,478)***		
Year = 2003	+ / -	-0.0504 (-2,148)**	0,108 (6,342)***	-0,047 (-1,884)*	0,115 (6,714)***		
Year = 2004	+ / -	0.0214 (0,921)	0,152 (8,995)***	0,019 (0,770)	0,150 (8,841)***		
Year = 2005	+ / -	0.0183 (0,776)	0,134 (7,790)***	0,012 (0,470)	0,120 (6,960)***		
Year = 2006	+ / -	-0.0072 (-0314)	-0,243 -14,559)***				
Year = 2007	+ / -	.00454 (1,969)*	-0,306 (-18,217)***				
Year = 2008	+ / -	0.0521 (2,140)*	-0,301 (-16,968)***			0,001 (0,068)	0,007 (0,439)
Year = 2009	+ / -	0.0445 (1,824)*	-0,208 (-15,962)***			-0,006 (-0,288)	0,019 (1,203)
Year = 2010	+ / -	0.1514 (6,229)***	-0,305 (.17,208)***			0,111 (5,374)***	0,010 (0,686)
Adj R2		0.565	0.546	0.538	0.603	0.611	0.443
N		15109	15265	8103	8223	5433	5435

T-Statistics are reported in parenthesis below the coefficient and White´s corrected for heteroskedasticity *, **, *** indicate significance at the 0,10, 0,05 and 0,01 level, respectly

A system equation was used for the dependent variables natural logarithm of total compensation (Ln_T_COMP) and natural logarithm of cash compensation (Ln_CASH), which are explained by performance measurement for long- and short-term periods. The system equation presented was estimated using the Seemingly Unrelated Regression (SUR) method. The SUR is a generalization of a linear regression model that consists of several regression equations, each having its own dependent variable and potentially different sets of exogenous explanatory variables. The main motivations for using the SUR are: improving estimation efficiency by combining information on different equations; and imposing and testing restrictions that involve parameters in different equations. The model can be estimated for each equation considering the interdependence of distribution. The SUR model can be further generalized into the multiple regressions, where the variables on the right-hand side can also function as endogenous variables. The multiple-equation model is a system of equations where the assumptions made for the single-equation model apply to each equation. The regression coefficient, year, does not vary over time because the estimation was conducted using dummy variables for year, and assuming that the company's heterogeneity is captured in the constant part (William, 2003).

The results in table 3 reflect the estimation of equations (1) and (2). Panel A is consistent with hypothesis 1, the estimated coefficient for total compensation for long–term periods and cash compensation for short-term periods. As it is possible to observe the regressions are globally significant, with a 5% significance level. The following table presents the results of the estimation for the studied data.

The sample includes 15109 observations for full time, the period before SFAS 123 (R) represented by 8103 observations and period after SFAS 123 (R) represented by 5433 observations. The result of the SUR model is depicted for total compensation and cash compensation in the period between 2000 and 2010. Adjusted R^2 is 0.565, which means that the dependent variables total compensation is explained by this set of regressors present in the model. For the period after SFAS 123 (R), the adjusted R^2 is 0.611, meaning that the model can be explained by the group of variables and is higher than that the adjustment or the model is better for this sample. These indicate that the variables addressed here play a significant role in

explaining executive compensation for short- and long-term periods, as stated by Chi-Square test (Probability=0).

It is possible to note that in full period in high-tech firms CEO compensation is higher than in other firms of the S&P 1500 at about 31.4%, but in the period before SFAS 123(R) it was about 44.9% higher and dropped to 15.2% in the period after SFAS 123(R). CEO compensation in high-technology firms is higher than in the other firms but with a smaller difference than previously. It is important to highlight that the implementation of the SFAS 123 (R) has an influence on awards in the long-term, but not for short-term periods. Stock options represent awards for the long–term, and the negative influence on CEO compensation in high-tech firms after the SFAS 123 (R) is confirmed. However, for long-term S&P 500, for the biggest S&P firms, CEO compensations are higher than in S&P small firms. When the annual effects are analyzed, it is possible to find a decrease in CEO compensation for the long-term in 2002 and 2003 over 2000 and an increase in the period between 2007 and 2010.

In table 3, the coefficient signs are similar in both specifications. However, the magnitudes of the coefficients are sensitive to the specification. As expected, earnings per share are negative and significantly related to total compensation for the long-term. This indicates that there are no explicit contractual arrangements linking compensations and earnings per share. The performance ratio of firms measured by return has a negative influence on CEO Compensation (Core, Guay, & Verrecchia, 2003a; Young & Jing, 2011). According to Aboody, Barth, and Kasznik (2004), there is a significant negative relation between share price and the SFAS 123 expense when it is relevant to investors and well measured (Aboody et al., 2004). A positive and statistically significant relationship was found between sales, asset growth and return on assets, and for adding the same level of total CEO compensation and cash compensation Gabaix and Landier (2008) also empirically test the relation between the level of pay and firm size. Ln (assets), a variable proxy for firm size is positively related to pay with a coefficient total compensation and cash compensation in the regression.When the adjustment is performed for the long-term compensation, it is possible to understand that when firm sizes are compared using the current S&P index membership, S&P500 firms have an increase around 5.7% and for the S&P

Small caps 600 there is a decrease around 16.7%, comparatively to the S&P mid firms. In terms of cash compensation, the S&P 500 firms are 4.7% below mid cap, and the S&P small firms are 1.6% below, comparatively to the same group of S&P mid firms.

Another finding is that the influence on CEO pay for the short-term between the year 2006 and 2008 does not have the same meaning in long-term compensations. As expected, there is an increase around 5% for each year between 2007 and 2010 as a result of the introduction of the SFAS 123(R).

There is a positive relation between CEO compensation and firm performance in high-tech firms after the implementation of the SFAS 123 (R), but with less intensity than before. For the S&P 500 firms, the implementation of the SFAS 123 (R) is profitable to CEOs because it increases their compensations, while for high-tech CEOs it increases the value, although not as strongly, and it is possible to verify the normalization for all S&P 500 firms. Some authors, such as Hall and Murphy (2002), advocate that this adjustment of stock options is necessary to restrict options and to consequently increase CEO compensation. That suggests that firms find it difficult to downsize the executive pay packages and shift toward restricted options to provide more incentives for long-term CEO compensation (Carter, Lynch, & Tuna, 2007). Restricted stock awards are profitable for executives because the income tax consequences can be more favorable to employees than stock options. The special case of the USA and the consequences of a restricted stock mean that in some cases the award can be structured to allow for the deferral of all tax until the time of stock sale, and for all appreciation to be taxed at capital gain rates even if the stock is appreciated prior to vesting. In contrast, stock options can result in ordinary income to the recipient the stock has appreciated prior to vesting, with only the post-exercise appreciation being deferred to the time of sale at capital gain rates. Furthermore, the preferred stock usually carries no voting rights but may carry a dividend and may have priority over common stock in the payment of dividends and upon liquidation. The preferred share investor is entitled to a preset rate of dividend that must be paid out of earnings before any dividends are distributed to common shareholders.

6. Conclusion and future research

This paper will contribute to a better understanding of the relationship between compensation and performance in high-technology firms, and of the behavior caused by the new role of expensing stock options with the SFAS 123 (R).The main purpose of this study was to examine whether the total compensation paid to CEOs in high-technology firms in the S&P 1500 is related in corporate finance and how it is influenced by the introduction of the SFAS 123 (R).

The results presented are consistent with those achieved by Carter et al. (2007), who stated that the favorable accounting treatment for stock options possibly lead to overall higher CEO compensations. There is no evidence of a decrease in total compensation combined with the positive association between financial reporting. They find that after controlling standard economic determinants of compensation, expensing options in firms decrease compensation from options and increase compensation from restricted stock. These results suggest that accounting plays an important role in executives plan design (Carter et al., 2007).

There was an increase in CEO compensation after the introduction of the SFAS 123 (R). Although the change in the plan design was not analyzed, a new accommodation of CEO compensation was found as a result of the new rules of the SFAS 123 (R). The influence of firm performance on the CEO compensation is positive and consistent in this group of high-technology firms in the period between 2000 and 2010.

As concluded by Graham et al. (2012), there are differences in corporate culture and in the managers' latent traits, which are difficult to observe or measure. These latent traits could be an innate ability, personality, risk aversion or, in this case, propensity to innovation, managing uncertain times in order to boost (enhance) returns to the firm and reaction to stakeholders. The CEOs of high-tech firms had to maximize returns, facing a big competition with new technological solutions, thereby warranting a higher compensation than others.

However, this work is not without limitations. This study focuses only on high-technology firms in the S&P 1500 in the period between 2000 and 2010, and the results of this study may not be

generalized to include other sectors due the specificity of high-tech firms. Another limitation is the definition of high-technology used in this study that can be extended, as performed by Shim, Lee, and Joo (2009), to include other important item measurements, such as value of R&D expenditures, number of patents by firm and citation of patents (Gomez-Mejia et al., 2000; Shim et al., 2009). The level of R&D expenditures and new product introductions are viewed as proxies for innovation, risk-taking and long-term decision-making, which are crucial to characterize high-technology firms. Furthermore, innovation constitutes an indispensable component of corporate strategies.

In the future, it will be important to analyze other developments, such as the effect of managerial attributes for the short- and long-term in executive compensation (Graham et al., 2012). Furthermore, it will also be important to broaden the period of analysis in order to investigate the effect of the financial crisis in the USA, which started in 2007.

7. References

Aboody, D., M. E. Barth, and R. Kasznik. 2004. SFAS No. 123 Stock-Based Compensation Expense and Equity Market Values. *The Accounting Review* 79 (2):251-275.

Akpotaire, B. U. 2011. Agency Cost Problems in Executive Compensation: An Evaluation of Dividend Equivalent Rights on Restricted Stocks. *Social Science Research Network*.

Bebchuk, L. A., M. Cremers, and U. Peyer. 2011. The CEO pay slice. *Journal of Financial Economics* In Press, Accepted Manuscript.

Bebchuk, L. A., and J. M. Fried. 2003. Executive Compensation as an Agency Problem. *National Bureau of Economic Research Working Paper Series* No. 9813 (published as Bebchuk, Lucian Arye and Jesse M. Fried. "Executive Compensation As An Agency Problem," Journal of Economic Perspectives, 2003, v17(3,Summer), 71-92.).

Carter, M. E., L. J. Lynch, and İ. Tuna. 2007. The Role of Accounting in the Design of CEO Equity Compensation. *Accounting Review* 82 (2):327-357.

Core, J. E., W. R. Guay, and D. F. Larcker. 2003. Executive Equity Compensation and Incentives: A Survey. *Economic Policy Review, Vol. 9, No. 1, April 2003*.

Core, J. E., W. R. Guay, and R. E. Verrecchia. 2003a. Price versus Non-Price Performance Measures in Optimal CEO Compensation Contracts. *The Accounting Review* 78 (4):957-981.

Eisenhardt, K. M. 1989. Agency Theory: An Assessment and Review. *The Academy of Management Review* 14 (1):57-74.

Epstein, M. J., and M.-J. Roy. 2005. Evaluating and monitoring CEO performance: evidence from US compensation committee reports. *Corporate Governance* 5 (4):75 - 87.

Fama, E. F., and K. R. French. 1997. Industry costs of equity. *Journal of Financial Economics* 43 (2):153-193.

Frydman, C. 2009. Learning from the Past: Trends in Executive Compensation over the 20th Century. *CESifo Economic Studies* 55 (3-4):458-481.

Gabaix, X., and A. Landier. 2008. Why has CEO Pay Increased So Much? *The Quarterly Journal of Economics* 123 (1):49-100.

Gomez-Mejia, L. R., D. M. Gideon, and D. B. Balkin. 2000. Is CEO Pay in High-Technology Firms Related to Innovation? *The Academy of Management Journal* 43 (6):1118-1129.

Graham, J. R., S. Li, and J. Qiu. 2012. Managerial Attributes and Executive Compensation. *Review of Financial Studies* 25 (1):144-186.

Gujarati, D. N. 2004. *Basic Econometrics*. Vol. Fourth Edition.

Hall, B. J., and J. B. Liebman. 1998. Are CEOS Really Paid Like Bureaucrats?*. *Quarterly Journal of Economics* 113 (3):653-691.

Hall, B. J., and K. J. Murphy. 2002. Stock options for undiversified executives. *Journal of Accounting and Economics* 33 (1):3-42.

Hall, B. J., and K. J. Murphy. 2003. The Trouble with Stock Options. *Journal of Economic Perspectives* 17 (3):49-70.

Heltzer, W. 2010. The impact of SFAS No. 123(R) on financial statement conservatism. *Advances in Accounting* 26 (2):227-235.

Jensen, M., and W. Meckling. 1976. Theory of the firm: managerial behaviour, agency costs, and ownership structure. *Journal of Financial Economics* (3):308-360.

Jensen, M. C., and K. J. Murphy. 1990. Performance Pay and Top-Management Incentives. *Journal of Political Economy* 98 (2):225-264.

Jensen, M. C., and K. J. Murphy. 1990b. CEO Incentives: It's Not How Much You Pay, But How. *Harvard Business Review* 3:138-153.

Makri, M., P. J. Lane, and L. R. Gomez-Mejia. 2006. CEO incentives, innovation, and performance in technology-intensive firms: a reconciliation of outcome and behavior-based incentive schemes. *Strategic Management Journal* 27 (11):1057-1080.

Matsunaga, S. R. 1995. The Effects of Financial Reporting Costs on the Use of Employee Stock Options. *The Accounting Review* 70 (1):1-26.

Murphy, K. J. 1999. Chapter 38 Executive compensation. In *Handbook of Labor Economics*, edited by C. A. Orley and C. David: Elsevier, 2485-2563.

Sesil, J., Y.-P. Lin, and S. M. Director. 2006. Stock Option Adoption and Irrational Exuberance: The Impact On Profitability. *working papers series*.

Shim, D., J. Lee, and n. K. Joo. 2009. CEO Compensation and US High-tech and Low-tech Firms' Corporate Performance. *Contemporary Management Research* Vol. 5:93-106.

William, G. 2003. *Econometric analysis*. edited by t. ed. New Jersey: Prentice-Hall.

Young, S., and Y. Jing. 2011. Stock Repurchases and Executive Compensation Contract Design: The Role of Earnings per Share Performance Conditions. *Accounting Review* 86 (2):703-733.

Zmijewski, M. E., and R. L. Hagerman. 1981. An income strategy approach to the positive theory of accounting standard setting/choice. *Journal of Accounting and Economics* 3 (2):129-149.

CHAPTER 4[2]

CEO compensation in high-tech firms: The choice between performance and innovation

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1. Introduction

Chief Executive Officer (CEO) compensation became common in the late 1970s and early 1980s and has been widely discussed in the literature ever since. Numerous stories have appeared recently in the financial press pointing out how many executives define theirs goals in terms of remunerations. Given the expectation that chief executive officers play a major role in firm performance, a large stream of literature has been devoted to the motivational effects of CEO compensation relating to firm performance. Interestingly, most of these studies focus on the relationship between CEO pay and performance and assume that the CEO behavior will adhere to such alignment. Furthermore, a large set of research tools were devised to investigate the innovation of individual corporations, although not as a view on CEO compensation when managing corporate innovation. Innovation means technologies or practices that are new to a given society and they are not necessarily new in absolute terms. These technologies or practices are being disseminated in that economy or society. Innovation has always played a decisive role in the economic and social development of countries: it is responsible for economic growth, for improving productivity and welfare, and it is the foundation of competitiveness. Solid foundation than growth take a truly innovative evolution for economies and societies. Innovation is at the heart of economic development, social welfare and protection of the environment and leveraging innovation is particularly important today. Technological innovation is a key factor in a firm's competitiveness. Technological innovation is the ultimate source of productivity and growth (Solow, 1988).

Research and development (R&D) spending is a primary input for innovation, and R&D spending should immediately be affected by investment decisions while brand and patent are affected in the long-term. As reported by Percival and Mcgrath (2013), innovation is the most difficult aspect to measure. It is naturally assumed that innovation is not an immediate return for any practice upon implementation because innovation returns in the short-term are minimal.

Why is it interesting for the CEO to manage innovation policy? Are they compensated for doing this? Given that innovation is a primary requisite for survival in high technology industries, Balkin, Markman, and Gomez-Mejia (2000) show that compensation committees in high

technology industries are more likely to align short-term CEO pay, specifically CEO cash pay with R&D spending, than compensation in low technology industries. Makri et al. (2006) report that CEO total pay was associated with innovation behavior in high technology firms. Essentially, both Balkin et al. (2000) and Makri et al. (2006) suggest that compensation is more likely to align CEO pay with behaviors towards R&D in high than low R&D intensive firms, and thus reductions in R&D in high R&D intensive firms may not lead to short-term pay increases for underpaid CEOs. Managers in high-tech firms are faced with different sets of performance expectations such as innovation, new product development, integration of technology and research and development management (Shim et al., 2009).

In her work, Fong (2010) suggests that relative CEO underpayment is associated with reductions in R&D spending in low R&D intensive industries and with increases in R&D spending in high R&D intensive industries.

Nevertheless, the research gap is also potentially serious from a policy perspective: the same interest may have different effects on high-tech risk taking depending on the comparative power of shareholders within the corporate governance structure of each firm. More surprising is the fact that standard agency theories suggest that ownership structure influences corporate risk taking (M. Jensen & Meckling, 1976; John, Litov, & Yeung, 2008)

This paper analyzes the CEO's choice between performance and innovation policy in high-technologies firms when they drive the management. A different approach by Fong (2010) is provided as in her study she attempts to address such behavioral issues by examining the influence of relative CEO underpayment on reductions in R&D spending. Moreover, CEO behavior towards R&D spending may provide insights into CEO pay deviations and CEO behavioral issues given that R&D spending is directly influenced by the CEO and is related to both firm performance and CEO pay.

The empirical analysis is based on three theoretical keystones. The first empirical approach explains the research problem of CEO compensation to address agency problems; the second focuses on managing corporate innovation, and the third empirical approach is about the corporate risk taking in high-technology firms in order to explain CEO compensation and the link between performance and innovation. These theoretical keystones are combined to make three

testable predictions. The first prediction is about how the CEO is encouraged to promote the goals of maximizing the shareholder's wealth to increase firm performance and to improve innovation policy. The second prediction is about how R&D as measure of innovation is related to CEO compensation and performance. The third prediction is about how the CEO manages risk taking to promote innovation.

Surprisingly, unlike the other strands of study on the economics of innovation, this field of research has not benefited so far from a systematic discussion and review of its major contributions. This paper aims to fill this gap.

This work is organized as follows: Section 2 contains a revision of the main theories in the literature, as well as an analysis on executive compensation in order to address agency problems. Furthermore, this section provides an analysis which examines corporate innovation and risk taking in terms of performance and innovation. Section 3 explains the research hypotheses and section 4 presents the methodology, sample and data collection to estimate regression, as well as the results of the econometric models to assess the influence that firm performance and innovation has on executive compensation. Lastly, the main conclusions are discussed, as well as some limitations and new perspectives for future research.

2. Literature review and hypothesis development

2.1 Executive compensations to address agency problems

The general acceptance of the agency theory and the parallel research on executive compensation began in the early 1980s. It was the evolution of the modern corporation with ownership separation and control that undermined the agency theory. Early studies in this area focused on documenting the relation between CEO pay and firm performance. The discussion of executive compensation must proceed with the fundamental agency problem afflicting management decision-making as background.

The shareholders' primacy view of the firm, built on the principal–agent paradigm, states that shareholders (the principals) engage managers (the agents) to run the firm on the shareholders'

behalf (M. Jensen & Meckling, 1976). According to Jensen and Murphy (1990), there are two approaches to agency problems. The authors state that there is an optimal contracting approach, which is when boards use design compensation schemes to maximize shareholder value with efficient incentives (Jensen and Murphy, 1990). To connect the agency problem and the executive compensation, the authors use the managerial power approach when this connection is seen as an integral part of the agency problems. It is important to remember that the principal-agent problems treat the difficulties that arise under conditions where information is incomplete and asymmetric whenever a principal hires an agent (Eisenhardt (1989); Lucian Arye Bebchuk and Fried (2003); K. J. Murphy (1999)). The first is the desire or goal of the principal and agent conflict and it is difficult or expensive for the principal to verify what the agent is actually doing. The problem is that the principal is unable to check if the agent has behaved correctly. Secondly, there is the problem of risk sharing facing the different attitudes toward risk, because the principal and the agent have different actions according to different risk preferences (Eisenhardt, 1989).

Brian J. Hall and Liebman (1998) argue that the solution to the agency problem is aligning the incentives of executives with the interests of shareholders by granting (or selling) stock and stock options to the CEOs. The CEOs have the correct incentives on every margin, including effort, perquisites and project choice, and support that the optimal contract is a one-to-one correspondence between firm value and CEO pay (Brian J. Hall & Liebman, 1998). It is reasonable for small firms but it is not appropriate for large firms because optimal contracts represent a trade-off between incentives and risk-sharing (Eisenhardt, 1989). In their work, (Brian J. Hall & Liebman, 1998) conclude that the relationship between pay and performance is much larger than has previously been recognized, and that this includes both gains and losses in CEO wealth. The salary and bonus vary so little because corporate board members are often reluctant to reduce CEO pay, even in response to poor performance and that may attract unwanted media attention. Using salary and bonuses to reward and penalize CEOs may only be possible to create high-powered incentives that align CEO pay with shareholder objectives (Brian J. Hall and Liebman (1998)). A large part of the executive pay literature argues that compensation and managerial interests should be aligned with shareholder interests in order to

solve agency problems (see, for example, the surveys by ((Core et al., 2003) and by (K. J. Murphy, 1999)). Managers in high-technology firms have different goals, such as managing intangible assets, continuous improvement, and software and product development. As a result, they must continuously innovate and sustain growth in an increasingly competitive and global market (Shim et al., 2009).

Studies that link corporate governance to innovation form a corpus of research that is difficult to disentangle for two interrelated reasons. Firstly, a well-received theory of the innovative enterprise is still missing, which implies the absence of a single coherent conceptual framework for understanding the phenomenon of corporate technological innovation at firm level. Secondly, because such a theory is lacking, contributions to this issue have remained separate and relate to various and different aspects of corporate governance.

As previously discussed, existing theories to provide predictions on the outlined considerations related to CEO compensation, allowing for the hypotheses formulated, support and enhance this evidence:

H1: CEO compensation is determinant and negatively correlated with firm performance in high-technology firms.

2.2 Corporate innovation

This section briefly discusses how the most influential corporate innovation deals with technological innovation, in order to outline the theoretical ground on which the debate on this issue develops. The traditional economics of innovation treats firms as if they were similar and considers innovation as a direct consequence of profit-maximizing behavior (Nelson, 1991). Conversely, the literature on corporate governance and innovation recognizes that firms differ in their internal governments' structure and organization, and recognizes that differences are very important for a firm's economic performance. By definition 'innovation' means technologies or practices that are new to a given society and they are not necessarily new in absolute terms. These technologies or practices are being disseminated in that economy or society. Innovation has always played a decisive role in the economic and social development of countries: it is responsible for economic growth, for improving productivity and welfare, and it is the foundation

of competitiveness. As Belloc (2012) reports, technological innovation is the development of an original product or process, through the utilization of productive resources and the embodiment, combination or synthesis of knowledge in a new object or method. The author argues that innovation is generated through a collective and cumulative process of learning as R&D programs, which requires the commitment of resources for a prolonged period of time. He defines that technological innovation involves three elements: specificity of the investments, uncertainty about the result and impossibility of anticipating future returns. In most firms, if somewhere deep in the corporate hierarchy an innovator has a very daring and promising innovation idea, the traditional advice is to first obtain top management commitment in order to overcome the resistance that is to be expected later on during the innovation project. This is this the traditional approach; however, there are several issues associated: often there is only one chance to pitch an idea at the top management. If the idea is not convincing enough, not only are the executives going to say "no", they are probably going to remain negative indefinitely, due to anchoring bias and confirmation bias. Another issue associated is the political power played, when people are forced to follow extensive corporate procedures, distortion by certain stakeholders with differing procedures and pressure for short-term results.

A major difficulty in observing the effect of innovation on growth is that a firm may require a long period of time to convert economically valuable knowledge increases into economic performance (Coad, 2007). Leveraging innovation is particularly important today, in what is the most severe global economic crisis. History has shown that times of crisis are also times of innovation, when institutional, mental, and other obstacles are more easily removed. The time is thus ripe for mobilizing creativity and entrepreneurship to meet the challenges ahead. Government and other leaders play a key role in promoting innovation in public goods and in finding ways to conduct business more effectively. Most importantly, the government should help provide the right environment for innovation.

Dealing with innovation variables in econometric estimation can be problematic. The first problem involves measuring innovation. Generally, two indicators are used to measure innovative activity: an input measurement, R&D spending (Lanjouw & Schankerman, 2004), and an output measurement, the number of patents and brands. According to Belloc (2013), both of

these indicators have some disadvantages. R&D spending is an imperfect proxy for innovative activity, because not all innovations are generated within formal R&D programs and the net book value of brands, patents and trademarks does not capture all innovations. In our estimation, the aggregated number of net book value of brands, patents and trademarks awarded by the firms and R&D spending in high-tech are used as indexes of innovative performance. The second problem is the time around innovation programs. While R&D spending should be immediately affected by investment decisions, innovation programs take time to get to a patent, or the brand is awarded within one year after an investment decision and, on average, the duration of innovation projects is between five and 10 years. The finance for innovation usually comes from internal sources as cash flow, but when substantial investment is required, external investment may be necessary.
Reductions in R&D spending merits considerable attention because R&D spending is a primary input into innovation (Heeley, Matusik, & Jain, 2007) and thus a firm's competitive advantage (Makri et al., 2006).

As discussed in previous theories, providing predictions on the outlined considerations related to corporate innovation makes it possible to select a second hypothesis.
H2: R&D is determinant and positively correlated with firm performance and CEO compensation in high-technology firms.

2.3 Risk taking to performance and innovation

Agency research recognizes that the interests of CEOs and shareholders diverge with regard to firm risk, with CEOs preferring less firm risk and shareholders preferring more firm risk (Tosi & Gomez-Mejia, 1989). These differences occur because CEOs are less diversified than shareholders and both the CEO's pay and employment are tied to the firm. Therefore, CEOs prefer short-term outcomes that have inherently less risk than long-term outcomes. Furthermore, Hill and Snell (1988) argue that institutional investors are risk-averse and so when they are major stockholders they also wield pressure on management to obtain good short-term performance to the detriment of long-term projects and innovation. Only one party has both the right to make residual management decisions and the right to claim the residual profits of the production, and

the remaining parties lose the ability to make opportunistic threats. The firm as a centralized structure of governance is only a second-best solution to the extent that under a one-party-owner regime, the non-owner firm members lose the ability to hold up, as well as the incentive to invest. This deeply affects innovation activities because innovation is a process of collective and specific investment (Belloc, 2012).

The innovation literature reports high failure rates for innovation, ranging from 50% to 90% as reported by Spieth and Hedenreich (2013). They show that individuals will be less likely to adopt new technological products if they perceive a significant risk associated with such exploration. Offering warranties may also be effective in reducing perceived risk associated with innovations independent from the possibility of a new product trial or demonstration. Moreover, the problem is innovations that fail cannot generate future revenues and, therefore, they can hinder the competitiveness of companies in the long run.

Although innovation, and thus R&D expenses, is important for creating firm value and a sustainable competitive advantage, research shows that CEOs will opportunistically target R&D spending because R&D projects are associated with information asymmetry and risk (Aboody & Lev, 2000). Innovation is an inherent risk and reductions in R&D can quickly increase a firm's short-term market performance at the expense of innovation and long-term returns. R&D investments also inherently involve information asymmetry between principals and agents, even in high technology firms. Aboody and Lev (2000) and M. Jensen and Meckling (1976) suggest that CEOs should possess the highest knowledge about the firm, which implies that CEOs should have a better understanding than owners about the optimal level of R&D spending, thus allowing for more informed, opportunistic action by the CEO. This information asymmetry allows CEOs to make opportunistic reductions in R&D spending, which Joseph P. O'Connor, Jr., Joseph E. Coombs, and Gilley (2006) believe is problematic because decisions that benefit short-term performance often do not lead to long-term benefits for shareholders. These consequences make reductions in R&D spending relevant because shareholders generally find R&D spending desirable due to their interests in greater risk-taking than CEOs and their interests in long-term firm performance.

Another important argument is the US generally-accepted accounting practice (GAAP) that requires the immediate expensing of R&D spending, and thus a reduction in R&D spending increases short-term performance through increases in current market and accounting performance. Sometimes R&D spending has been found to be negatively associated with CEO pay. In fact, research on R&D spending shows that when a CEO approaches retirement or when the firm faces a potential reduction in firm performance CEOs tend to reduce R&D spending and suggest that compensation committees respond to, and effectively mitigate, potential opportunistic reductions in R&D spending (Cheng, 2004). CEOs approaching retirement no longer financially gain from the long-term benefits associated with current R&D spending; instead, they financially gain when R&D is reduced due to the immediate expensing of R&D based on generally accepted accounting principles (GAAP) requirements. Moreover, if firm performance decreases, the CEO could face termination, which again reduces the CEO's opportunity to gain from current R&D spending. Given the strategic importance of R&D spending on long-term firm performance, Cheng (2004) shows that compensation committees will adjust CEO compensation contracts to reduce opportunistic manipulations of R&D spending when the firm encounters the horizon problem or the myopia problem, conditions under which R&D manipulation is likely to occur. However, the arguments provided by the agency theory suggest that CEOs may be encouraged to behave opportunistically towards R&D spending outside the specific conditions presented by the horizon and myopia problems, which may be when the CEO pay deviates from the labor market rate.

As previously discussed, existing theories provide predictions on the outlined considerations related to risk taking, allowing for the hypotheses presented below.

H3: Risk taking positively influences firm performance and innovation in high-technology firms.

In summary, it was found that firms are subjected to the agency problem in which the CEO may not work in favor of the shareholders to maximize their wealth by improving firm performance and innovation. The risk taking to make decisions and theirs goals are important factors. Furthermore, the decisions related to CEO compensation are based on the firms' accounting performance and innovation in high-technologies firms.

3. Sample, Data and Method of Analysis

The ExecuComp and the DataStream databases were used to find finance performance and innovation variables and to create a sample of firms between 2000 and 2010. The ExecuComp database covers current, historic and total compensation data such as salary, bonus, stock options and restricted stock grants, as well as managerial stock and option holdings on top five executives of more than 2600 firms in the Standard & Poor's Index in the United States. The total sample collected was 5,500 observations for the five hundred companies of the S&P 500 for the eleven years. The DataStream provides access to a large variety of financial and economic data, such as financial statements, accounting ratios, price information of listed companies in the world; exchange rates, interest rates and thousands of economic time series from various countries in the world. The match between these two databases was made by comparing the same variables for each firm and year in order to confirm the values to the same firm. If the firm short name, number of employees and the asset value was equal in the two database, it is guaranteed that the firm is the same.

To test this hypothesis, the following specification is run on the balanced panel of high-technology firms. High-Technology firms are the firms that operate in an industry with a four-digit SIC code of 3570, 3571, 3572, 3576, 3577, 3661, 3674, 4812, 4813, 5045, 5961, 7370, 7371, 7372, or 7373, DHTECH variables using the Fama and French classification of 48 industry groups, instead of the four-digit Standard Industrial Classification (SIC) code (Fama & French, 1997). A new DHTEC economy dummy is also included to control for the possibility that opportunistic timing was more prevalent among new economy (hi-tech) firms (definition of the new economy follows Murphy (2003)).

Another classification about high-technology firms is the OECD's classification (stable since 1973), of R&D intensity, which is presented next. The definition of R&D intensity is the ratio of expenditures by a firm on research and development to the firm's sales. This classification defines high-technology firms when the value of R&D intensity is greater than 7%. The absolute levels of R&D expenditures indicate the level of effort dedicated to producing future products and process improvements while maintaining current market share and increasing operating

efficiency. By extension, such expenditures may reflect the firms' perceptions on market demand for new and improved technology. However, R&D intensity is the most frequently used measurement "to gauge the relative importance of R&D across industries and among firms in the same industry". William N. Leonard, Economics professor since 1971, found that research intensity is measured usually by ratios of scientific personnel to total employment or by R&D expenditures/sales, and gains in variables such as productivity, profits, sales, assets, and other variables (Leonard, 1971).

3.1 Dependent variables

The dependent variables used for the tests are CEO compensation as the total year pay for the top executives, return on asset to measure performance (G. B. Murphy, Trailer, & Hill, 1996) and the R&D expenses to measure innovation (Lanjouw & Schankerman, 2004) for each firm in the S&P 500 for the period between 2000 and 2010, as defined in table 4. Total compensation the sum of the compensations of top executives includes: salary, bonus, non-equity incentive plan compensation, grant-date fair value of option awards, grant-date fair value of stock awards, deferred compensation earnings reported as compensation, and other compensations. The return on assets in calculated for each firm and per year as the net income before extraordinary items and discontinued operations divided by total assets. Research and development expenses represent all direct and indirect costs related to the creation and development of new processes, techniques, applications and products with commercial possibilities.

3.2 Independent variables

The key independent variables are firm level factors reports by each firm, presented in table 4 in the appendix. A set of variables explain corporate finance as common equity that represents common shareholders' investment in a company, the number of employees give a perception of company sizes and the A return index shows a theoretical growth in value of a shareholding over a specified period, assuming that dividends are re-invested to purchase additional units of an equity or unit trust at the closing price applicable on the ex-dividend date. Market capitalization represents the total market value of the company based on year end price and number of shares

converted to U.S. dollars using the year end exchange rate, and for companies with more than one type of common/ordinary share, market capitalization represents the total market value of the company. Another set of variables to explain corporate innovation are patents/sales as total amount of patents owned in the current year for each firm divided by net sales or revenue in US dollars. The R&S/sales five-year average is the arithmetic average of the last five years of research and development by sales. Brands and patent net represent the net book value of brands, patents and trademarks. Cash-flow represents the net cash receipts and disbursements resulting from the operations of the company, fundamental to make investments. The tool to measure risky corporate policies is R&D expenses over total assets for each year, which is commonly employed (Bargeron, Lehn, and Zutter (2010) and Coles, Daniel, and Naveen (2006)).

3.3 Method of analysis

The archived sample has led to do the analysis of the panel partly because panel data provide such a rich environment for the development of estimation techniques and theoretical results. In more practical terms, however, researchers have been able to use time-series cross-sectional data to examine issues that could not be studied in either cross-sectional or time-series settings alone. The fundamental advantage of a panel data set over a cross section is that it will allow the researcher great flexibility in modeling differences in behavior across individuals. The panel data model is used because it is the most suitable way of studying a large set of repeated observations, and due to the fact that it assesses evolution over time, consisting of cross-section observations from different points in time. With panel data it is possible to simultaneously explore several variations over time and between different individuals. The use of such models has increased immensely and, in fact, combining time and cross-sectional data brings many advantages: it is possible to use a larger number of observations and the degree of freedom in estimates increases, thus making statistical inferences more credible. At the same time, the risk of multicollinearity is reduced since the data in companies present different structures. Moreover, this model provides access to further information and the efficiency and stability of the estimators increase, while enabling the introduction of dynamic adjustments (Gujarati (2004) and William (2003)). This study starts by using the Generalized Linear Square (GLS) to estimate the model, and then the

Generalized Method of Moments (GMM) is used in order to solve interdependence problems. For this kind of data on the observable variables, the GMM finds values for the model parameters such that the corresponding sample moment conditions are met as closely as possible (Hansen, 1982).

The first stage was estimating three equations using the EGLS fixed effects method to explain the research questions. Fixed effects model improves the estimation consistency. The models introduced by each equation presented below were used to test relevant variables and to explain executive compensation, return on assets and R&D, respectively. The model specification:

$$CEO\_comp_{ij}=b_{11}+b_{12}*ROA_{ij}+b_{13}*R\&D_{ij}+b_{14}*CEquity_{ij}+b_{15}*Cash\_Flow_{ij}+b_{16}*EMPL_{ij}+b_{17}*RI_{ij}+ b_{18}*MC_{ij}+b_{19}*R\&D/S5_{ij}+b_{10}*DHTECH_{ij}+u_{ij} \quad \textbf{(A)}$$

$$ROA_{ij}=b_{21}+b_{22}*CEO\_comp_{ij}+b_{23}*R\&D_{ij}+b_{24}*NIBEX_{ij}+b_{25}*Cash\_Flow_{ij}+b_{26}*SalesGr_{ij}+b_{27}*R\&D/S_{ij} + b_{28}*R\&D/A_{ij\ ij}+b_{29}*RI_{ij}+b_{30}*DHTECH_{ij}+v_{ij} \quad \textbf{(B)}$$

$$R\&D_{ij}=b_{31}+b_{32}*CEO\_comp_{ij}+b_{33}*ROA_{ij}+b_{34}*CEquity_{ij}+b_{35}*Cash\_Flow_{ij}+b_{36}*R\&D/A_{ij}+b_{37}*AssetsGr_{ij}+ b_{38}*ROA(-1)_{ij}+b_{39}*ROA(-2)_{ij}+b_{40}*Patent/sales_{ij}+b_{41}*BrandPatent_{ij}+z_{ij} \quad \textbf{(C)}$$

Where, i and j represent the year and the company, respectively. The coefficients b_{11}, b_{21} and b_{31} are constants denoting the base level from which the sum of the compensations of top executive, return on assets and R&D, respectively, varies according to the changes in explanatory variables.

In the second stage, the same set of equations was estimated using the GMM method in order to verify consistency. A brief review of the inter-relationship between CEO compensation, performance and innovation suggests that, from an econometric point of view, to study the relationship between corporate governance and performance it is necessary to formulate the three equations that specify the relationship between the abovementioned variables. The following system of three simultaneous equations is specified:

CEO compensation = f_1 (Performance, Innovation Z_1, ε_1) *(1)*
Performance = f_2 (CEO Compensation, Innovation, Risk-taking, Z_2, ε_2) *(2)*
Innovation = f_3 (CEO Compensation, Performance, Risk-taking, Z_3, ε_3) *(3)*

Where the Z_i are vectors of control variables and instruments influencing the dependent variables and the ε_i are the error terms associated with exogenous noise and the unobservable features of managerial behavior or risk taking that explain cross-sectorial variation in CEO compensation, performance and innovation. The estimation issues for the equation above are discussed in the next section.

4. Results

This section presents the descriptive statistics of variables and estimation results of equation specifications. The descriptive statistics of the variables for total CEO compensation for high-tech firms are presented in Table 1. In the S&P500, in the period between 2000 and 2010, there are about 11.2 % high-technology firms, and it is possible to observe that the group of top executives in each company has an average total compensation around USD 26,036 million. Other interesting finding is that, in this period and in this group of companies, R&D/Assets and the return on assets are around 3.74% and 5.35%, respectively. The number observations of patent/sales, brand and patent and R&D expenses are the lowest value reported by firms, demonstrating the difficulty of measuring financial accounting variables of corporate innovation.

Table 1 - Descriptive statistics of variables

Variable	Mean	Median	Max	Min	St.dev.	N
CEO_Comp	26036.93	18611.410	641446.2	206.394	28966.87	4730
ROA	5.351553	5.226	5.03E+01	-577.85	14.83626	4760
R&D	479792.8	94926	9379000	0.0	1121480	3033
Common Equity	7790622	3143000	2.11E+08	17311000	15668956	5261
Cash-Flow	1940758	769047.5	1.30E+08	-1.11E+08	6092504	5188
Employees	43130.53	15800	2100000	11	101901.5	5149
Return Index	13950.27	2211.17	4.87E+06	1.19	150097.8	4970
Market Capitalization	21975406	8961464	5.04E+08	2868	41403246	5096
R&D/Sales -5yr avg	51.81334	2.605	1.8E+04	0	7.69E+02	2644
DHTECH	0.112	0	1	0	0.315395	5500
NIBEX	1089.882	444.666	45220	-99289	3399.444	4760
Sales growth	12.51071	8.028	2152.032	-92.688	46.17325	4752
R&D/Sales	10.90584	2.18	8589.1	0	186.5726	3033
R&D/Assets	3.741279	1.89936	4.19E+01	0	4.95E+00	2969
Assets	43365.55	10109.3	2264909	91.581	151774.7	4760
Patents/Sales	507.6204	233	21458	0	1143.943	614
Brands patent net	785720.1	104215	40660000	0	2919333	1346

Table 2 reports the estimation results of the basic panel model specifications. The three equation parameters report the estimation results of the estimated generalized least square (EGLS) method one after the other. While the left column reports the variables, the remaining columns report the estimated parameters of the various model specifications. Equations (A), (B) and (C) are panel model specifications for CEO compensation, performance and innovation, respectively, and are consistent with the hypotheses presented in this study.

Table 2 - Estimation results of the Panel EGLS method

Method: Panel EGLS Period Fixed effects						
	(A)		**(B)**		**(C)**	
Sample	2000 2010		(ad): 2001 2010		(ad): 2004 2010	
Cross-sections incl.:	268		279		69	
Total panel observations	2377		2416		285	
Dependent Variables	**CEO_Comp**		**ROA**		**R&D**	
Variables	**Coefficient**	**Prob.**	**Coefficient**	**Prob.**	**Coefficient**	**Prob.**
C	18817.96	0.0000	5.57452	0.0000	-1026359	0.0000
CEO_Comp			-1.15E-05	0.1974	8.498181	0.0327
ROA	-141.6971	0.0002			20992.79	0.1273
R&D	0.001784	0.0000	4.17E-07	0.0067		
Common Equity	0.000464	0.0000			0.028445	0.0039
Cash-Flow	-0.00072	0.0001	-9.47E-07	0.0000	0.057398	0.0729
Employees	13.82775	0.0000				
Return Index	0.028673	0.1597	3.98E-05	0.0000		
Market Capitalization	8.39E-05	0.0000				
R&D/Sales -5yr avg	1.393987	0.0009				
Sales growth	150.2027	0.0000	0.045875	0.0000		
DHTECH	2156.27	0.0314	0.510833	0.2927		
NIBEX			0.001793	0.0000		
R&D/Sales			-0.430558	0.0000		
R&D/Assets			0.547473	0.0000	135765.2	0.0000
Assets growth					-7586.161	0.0219
ROA(-1)					24499.8	0.0842
ROA(-2)					29560.22	0.0221
Patents/Sales					555.0819	0.0000
Brands patent net					0.048499	0.0166
			Weighted Statistics			
R-squared	0.28672		0.21393		0.570793	
Adjusted R-squared	0.280668		0.208027		0.545169	
S.E. of regression	25556.92		14.54861		1455580	
F-statistic	47.35314		36.24148		22.27549	
Prob(F-statistic)	0		0		0	
			Unweighted Statistics			
R-squared	0.244415		0,189227		0.552584	

The statistics are computed based on a panel data set of 500 firm-year observations, a total of about 2377 observations when testing CEO compensation, 2416 observations for return on assets and 285 observations for R&D expenses.

Equation (A) tests CEO compensation.The hypothesis for the negative influence of CEO compensation on firm performance and the positive influence of CEO compensation on the innovation is presented in Table 2. As it is possible to observe, the regressions are globally significant, with a 5% significance level. The following table presents the results of the estimation for the studied data. The performance ratio of firms measured by return on assets and cash-flow have a negative influence on CEO Compensation ((Core et al., 2003) and (Young & Jing, 2011)). Gabaix and Landier (2008) also empirically test the relation between the level of pay and firm size. A positive and statistically significant relationship was found between R&D expenses, R&D/sales, common equity, market capitalization and employees for the same level of total CEO compensation. Equation (C) tests corporate innovation and R&D expense variables were used for measuring. All independent variables are statistically significant, with a 5% and 10% significance level. It is important highlight a positive and statistically significant relation between CEO compensation, return on assets for the year, previous year and second previous year and R&D expenses. In equations (B) and (C), it is possible to find the answers of the third hypothesis where the variables R&D/Assets, which are used as proxy for risk-taking in long-term corporate investments, have a significant and positive influence on performance and innovation.

Well suited econometric techniques should be used in empirical research, when corporate governance variables are placed in relation to innovation performance indicators. Some endogeneity problems are likely to occur in empirical corporate governance studies, because of the interrelation between the various dimensions of corporate governance and because of a nexus of reverse causality that might flow from a corporation's innovation to its governance structure. Single-equation linear regressions, largely used in the existing literature, may lead to incomplete or misleading results (Belloc, 2013), and for that reason another method was tested here to avoid this problem.

For the second stage of the study, in order to test the three research questions, the estimation results of the basic panel GMM model specifications (table 3) are reported. While the column on

the left reports the variables, the remaining columns report the estimated parameters of each equation (1), (2) and (3). It is possible to confirm that there is a positive and statistically significant relationship between CEO compensation and R&D expenses with regard to the *H1* research question. Cash flow has a negative and statistically significant relationship with CEO compensation and return on assets (1), but that relation is positive and statistically significant with R&D. Assets growth has a negative and statistically significant relationship with R&D (3). Also regarding equation (3) and answers to the *H2* research questions, it was possible to confirm that there is a positively and significantly relation between CEO_Comp and Performance and R&D expenses. Consistent with the *H3* research question, R&D/assets positively influence performance and R&D expenses, as observed in equations (2) and (3).

Table 3 - Estimation results of the basic panel GMM model specifications

Method: Panel GMM						
	(1)		**(2)**		**(3)**	
Sample	2000 2010		(ad): 2001 2010		(ad): 2004 2010	
Cross-sections incl.:	268		279		69	
Total panel observations	2377		2416		285	
2SLS instrument weighting matrix						
Dependent Variables	**CEO_Comp**		**ROA**		**R&D**	
Variables	**Coefficient**	**Prob.**	**Coefficient**	**Prob.**	**Coefficient**	**Prob.**
C	18340.91	0.0000	7.427593	0.0000	-899199.8	0.0001
CEO_Comp			-4.12E-05	0.0067	8.377301	0.0332
ROA	-255.0328	0.0000			21372.52	0.1067
R&D	0.001929	0.0006	1.29E-06	0.0002		
Common Equity	0.000728	0.0000			0.023661	0.0170
Cash-Flow	-0.001661	0.0000	-1.89E-06	0.0000	0.060841	0.0547
Employees	10.95048	0.0197				
Return Index	0.079935	0.0063	4.09E-05	0.0163		
Market Capitalization	1.42E-04	0.0000				
R&D/Sales -5yr avg	1.114226	0.1015				
Sales growth	267.4261	0.0000	0.023007	0.0939		
DHTECH	4998.71	0.0008	1.938346	0.0732		
NIBEX			0.003596	0.0000		
R&D/Sales			-0.867757	0.0000		
R&D/Assets			0.743603	0.0000	127029.9	0.0000
Assets growth					-7252.783	0.0246
ROA(-1)					24017.35	0.0850
ROA(-2)					25607.66	0.0455
Patents/Sales					585.5587	0.0000
Brands patent net					0.053496	0.0063

R-squared	0.25519	0.243557	0.548564
Adjusted R-squared	0.252042	0.240728	0.532088
S.E. of regression	26663.55	16.08757	1451614
Durbin-Watson stast.	1.027593	0.753336	0.170919
Instruments	11	10	11

A consistent result was found when testing three equations using the EGLS (table 2) and the GMM method (table 3). In this second set of tests, almost all explanatory variables statistically show that there is a significant relationship between CEO compensation, returns on assets and R&D. Only a DHTECH dummy variable was not statistically significant to explain return on assets. A negative relation between CEO compensation and return on assets and cash flow was found, although there is a positive relation with R&D as expected. When the three equations and the interdependency of their independent variables are observed together, it is possible to suggest that in terms of their compensation CEOs can choose between innovation and performance, influenced by risk-taking in long-term corporate investment.

Carpenter and Petersen (2002) have studied an unbalanced panel of about 2400 publicly traded US firms in the period between 1981 and 1998, and in their work they show that equity financing has a positive effect on firm investments in high-tech companies. Another finding is that return on assets for the previous year and previous two years, together with patent/sales and brand plus patent value, have an influence on R&D. Gomez-Mejia et al. (2000) have shown that CEO compensation was related to innovation as measured by the number of patents and R&D spending. Their findings are very interesting and show an important change in CEO compensation, which in the past has been heavily tied to accounting and stock performance measurements. Their study reports an important change and a new trend in managerial compensation that relies more on process (innovation) rather than on financial results, such as accounting and market performance measurements. Moreover, consistent with prior research that suggests that compensation in high technology industries is more likely to align CEO pay with R&D spending than compensation in low technology industries (Makri et al., 2006), the results show that such opportunistic reductions conditioned on underpayments are mitigated in high R&D intensive industries.

Table 5 (appendix) presents Pearson´s correlations (all coefficients in bold are statistically significant at 0.05 level). Employees and net Income before extraordinary items and discontinued operation are statistically significant and the positive correlation with CEO compensation, return of assets and R&D variables is high, and statistically significant but with relatively low correlations with dummy variables of high-technologies. Sales growth, brand, patent net have statistically significant low correlations with CEO compensation, return on assets and R&D.

5. Conclusion and future research

The main purpose of this study was to examine whether the total compensation paid to CEOs in high-technology firms in the S&P 500 is related to corporate innovation and performance. This work aims at contributing to explain the influence that innovation technologies and performance has on CEO compensation in these companies. In conclusion, according to the results that were obtained there is empirical evidence to state that in high-technology firms in the S&P500, during the period between 2000 and 2010, innovation determined total CEO compensation. Results suggest that in high-tech firms innovation determines CEO compensation and CEOs tend to use more sophisticated performance measurements. The findings indicate that CEO compensation in high-tech firms chooses innovation over performance, and that there is a strong and positive relation between CEO compensation and innovation. This econometric study provides a better understanding of the CEO risk taking and the relationship between CEO compensation, innovation and performance in high-technology firms.

In the future, to enhance this study it is necessary to analyze the short- and long-term period of CEO compensation to understand their goal throughout the duration of R&D projects, brands and patent processes. This study only focuses on high-technology firms in the S&P 500 in the period between 2000 and 2010, but an extended set of observations with different sectors or industries was important to confirm our conclusion. Another aspect would be understanding the influence that the 2007 crisis had in this period.

Organizing such a body of literature was difficult because studies on this issue form a heterogeneous puzzle that covers interrelated aspects of corporate organization. This study started

by briefly discussing how different approaches to the analysis of the firm deal with technological innovation, in order to outline the theoretical ground on which the various studies linking innovation to corporate governance are developed. This paper describes the main corporate risk taking through which a system of corporate governance shapes innovation activities, classifying them in the three dimensions of the agency problem, corporate innovation and risk taking. Finally, the literature on high-technology firms has been examined, and the relationship between the CEO behavior of corporate governance and aggregate innovation activity of corporations has been discussed.

As reported by Belloc (2012), the more recent and rather heterogeneous literature recognizes the importance of corporate governance for a firm's performance. The author states that differences in the various dimensions of a corporation's governance are important for its innovation activity. Contrasting with this opinion, it was found that in fact innovation in high-technology firms appears as a result of technological determinism in a context of profit-maximizing firms, and it can emerge because individuals decide to invest in innovative projects, where these investment decisions are shaped by the corporate governance system and by CEO decision.

6. References

Aboody, D., & Lev, B. (2000). Information Asymmetry, R&D, and Insider Gains. *The Journal of Finance, 55*(6), 2747-2766. doi: 10.1111/0022-1082.00305

Balkin, D. B., Markman, G. D., & Gomez-Mejia, L. R. (2000). Is CEO Pay in High-Technology Firms Related to Innovation? *The Academy of Management Journal, Vol. 43* (No. 6), 1118-1129.

Bargeron, L. L., Lehn, K. M., & Zutter, C. J. (2010). Sarbanes-Oxley and corporate risk-taking. *Journal of Accounting and Economics, 49*(1–2), 34-52. doi: http://dx.doi.org/10.1016/j.jacceco.2009.05.001

Bebchuk, L. A., & Fried, J. M. (2003). Executive Compensation as an Agency Problem. *Journal of Economic Perspectives, 17*((3,Summer), 71-92.).

Belloc, F. (2012). Corporate Governance and Innovation: A Survey. *Journal of Economic Surveys, 26*(5), 835-864. doi: 10.1111/j.1467-6419.2011.00681.x

Belloc, F. (2013). Law, finance and innovation: the dark side of shareholder protection. *Cambridge Journal of Economics, 37*(4), 863-888. doi: 10.1093/cje/bes068

Carpenter, R. E., & Petersen, B. C. (2002). Capital Market Imperfections, high-tech investiment, and new equity financing. *The Economic Journal, 112*(477), F54-F72. doi: 10.1111/1468-0297.00683

Cheng, S. (2004). R&D Expenditures and CEO Compensation. *The Accounting Review, 79*(2), 305-328. doi: 10.2308/accr.2004.79.2.305

Coad, A. (2007). Firm Growth: A Survey. *Papers on Economics and Evolution*.

Coles, J. L., Daniel, N. D., & Naveen, L. (2006). Managerial incentives and risk-taking. *Journal of Financial Economics, 79*(2), 431-468. doi: http://dx.doi.org/10.1016/j.jfineco.2004.09.004

Core, J. E., Guay, W. R., & Larcker, D. F. (2003). Executive Equity Compensation and Incentives: A Survey. *Economic Policy Review, Vol. 9, No. 1, April 2003*.

Eisenhardt, K. M. (1989). Agency Theory: An Assessment and Review. *The Academy of Management Review, 14*(1), 57-74.

Fama, E. F., & French, K. R. (1997). Industry costs of equity. *Journal of Financial Economics, 43*(2), 153-193. doi: 10.1016/s0304-405x(96)00896-3

Fong, E. A. (2010). Relative CEO Underpayment and CEO Behaviour Towards R&D Spending. *Journal of Management Studies, 47*(6), 1095-1122. doi: 10.1111/j.1467-6486.2009.00861.x

Gabaix, X., & Landier, A. (2008). Why has CEO Pay Increased So Much? *The Quarterly Journal of Economics, 123*(1), 49-100. doi: 10.1162/qjec.2008.123.1.49

Gomez-Mejia, L. R., Gideon, D. M., & Balkin, D. B. (2000). Is CEO Pay in High-Technology Firms Related to Innovation? *The Academy of Management Journal, 43*(6), 1118-1129.

Gujarati, D. N. (2004). *Basic Econometrics* (Vol. Fourth Edition).

Hall, B. J., & Liebman, J. B. (1998). Are CEOS Really Paid Like Bureaucrats?*. *Quarterly Journal of Economics, 113*(3), 653-691. doi: doi:10.1162/003355398555702

Hansen, L., Peter. (1982). Large sample properties of generalized method of moments estimators. *Econometrica, 50*, 1029--1054.

Heeley, M. B., Matusik, S. F., & Jain, N. (2007). Innovation, Appropriability, And The Underpricing Of Initial Public Offerings. *Academy of Management Journal, 50*(1), 209-225. doi: 10.5465/amj.2007.24162388

Hill, C. W. L., & Snell, S. A. (1988). External control, corporate strategy, and firm performance in research-intensive industries. *Strategic Management Journal, 9*(6), 577-590. doi: 10.1002/smj.4250090605

Jensen, M., & Meckling, W. (1976). Theory of the firm: managerial behaviour, agency costs, and ownership structure. *Journal of Financial Economics*(3), 308-360.

John, K., Litov, L., & Yeung, B. (2008). Corporate Governance and Risk-Taking. *The Journal of Finance, 63*(4), 1679-1728. doi: 10.1111/j.1540-6261.2008.01372.x

Joseph P. O'Connor, Jr., R. L. P., Joseph E. Coombs, & Gilley, K. M. (2006). Do CEO Stock Options Prevent or Promote Fraudulent Financial Reporting? *ACAD MANAGE J, 49*(3), 483-500.

Lanjouw, J. O., & Schankerman, M. (2004). Patent Quality and Research Productivity: Measuring Innovation with Multiple Indicators*. *The Economic Journal, 114*(495), 441-465. doi: 10.1111/j.1468-0297.2004.00216.x

Leonard, W. N. (1971). Research and development in industrial growth. *Journal of political economy., 79*(4).

Makri, M., Lane, P. J., & Gomez-Mejia, L. R. (2006). CEO incentives, innovation, and performance in technology-intensive firms: a reconciliation of outcome and behavior-based incentive schemes. *Strategic Management Journal, 27*(11), 1057-1080. doi: 10.1002/smj.560

Murphy, G. B., Trailer, J. W., & Hill, R. C. (1996). Measuring performance in entrepreneurship research. *Journal of Business Research, 36*(1), 15-23. doi: http://dx.doi.org/10.1016/0148-2963(95)00159-X

Murphy, K. J. (1999). Chapter 38 Executive compensation. In C. A. Orley & C. David (Eds.), *Handbook of Labor Economics* (Vol. Volume 3, Part 2, pp. 2485-2563): Elsevier.

Nelson, R. R. (1991). Why do firms differ, and how does it matter? *Strategic Management Journal, 12*(S2), 61-74. doi: 10.1002/smj.4250121006

Percival, J., & Mcgrath, C. (2013). Short-term and long-term returns to innovation from the aplication of technology and trading practices. *International Journal of Innovation Management, 17*(05), 1350023. doi: doi:10.1142/S1363919613500230

Shim, D., Lee, J., & Joo, n. K. (2009). CEO Compensation and US High-tech and Low-tech Firms' Corporate Performance. *Contemporary Management Research, Vol. 5*, 93-106.

Solow, R. M. (1988). Growth Theory and After. *The American Economic Review, 78*(3), 307-317.

Spieth, P., & Hedenreich, S. (2013). Why innovations fail - The case of passive and active innovation resistance. *International Journal of Innovation Management, 17*(05), 1350021. doi: doi:10.1142/S1363919613500217

Tosi, H. J., & Gomez-Mejia, L. R. (1989). The Decoupling of CEO Pay and Performance: An Agency Theory Perspective. *Administrative Science Quarterly*, *34*(2), 169-189.

William, G. (2003). *Econometric analysis*. New Jersey: Prentice-Hall.

Young, S., & Jing, Y. (2011). Stock Repurchases and Executive Compensation Contract Design: The Role of Earnings per Share Performance Conditions. *Accounting Review*, *86*(2), 703-733. doi: 10.2308/accr.00000024

Table 4 – Dependent and independent executive compensation

Name	Definition	Units
Assets	The Total Assets as reported by the company.	Millions
Brand and patent net	Represents the net book value of brands, patents and trademarks. This item is available in the annual original and annual restated time series for detailed companies, full update.	Millions
Cash flow	Represent the net cash receipts and disbursements resulting from the operations of the company. It is the sum of Funds from Operations, Funds From/Used for Other Operating Activities and Extraordinary Items	Millions
CEO_Comp	Total Compensation (Salary + Bonus + Other Annual + Restricted Stock Grants + LTIP Payouts + All Other + Value of Option Grants)	Thousands
Common equity	Represents common shareholders' investment in a company.	Millions
Employees	Number of employees as reported by companies	Millions
Market Capitalization	Represents the total market value of the company based on year end price and number of shares outstanding converted to U.S. dollars using the year end exchange rate. For companies with more than one type of common/ordinary share, market capitalization represents the total market value of the company.	Percentage
NIBEX	The Net Income Before Extraordinary Items and Discontinued Operations.	Millions
OIBD	The Operating Income Before Depreciation as reported by the company.	Millions
Patents/Sales	Total U.S. patents owned in the current year divided by net sales or revenue in US dollars	Percentage
R&D	Research and development expense, represents all direct and indirect costs related to the creation and development of new processes, techniques, applications and products with commercial possibilities.	Millions
R&D/Assets	R&D expenditures over total assets as a proxi for risk-taking in long-term corporate investments	Percentage
R&D/Sales	Research and Development Expense / Net Sales or Revenues * 100	Percentage
R&D/Sales - 5 yr avg	Arithmetic average of the last five years of Research and Development SALES	Percentage
Return Index	A return index (RI) is available for individual equities and unit trusts. This shows a theoretical growth in value of a shareholding over a specified period, assuming that dividends are re-invested to purchase additional units of an equity or unit trust at the closing price applicable on the ex-dividend date.	Percentage
ROA	The Net Income Before Extraordinary Items and Discontinued Operations divided by Total Assets. This quotient is then multiplied by 100.	Percentage
SALES	The Net Annual Sales as reported by the company.	Millions
SALES GROWTH	Annual growth of Sales as reported by the company.	Percentage

Table 5 - Correlations between variables

Correlation t-Statistic Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(14)	(15)	(16)	(17)
(1) CEO_Comp	1															
(2) ROA	0.573	1														
	(11.717)	-----														
(3) R&D	0.656	0.568	1													
	(14.568)	**(11.577)**	-----													
(4) Common Equity	0.672	0.430	0.753	1												
	(15.219)	**(7.980)**	**(19.193)**	-----												
(5) Cash-Flow	0.646	0.456	0.757	0.939	1											
	(14.177)	**(8.581)**	**(19.409)**	**(45.685)**	-----											
(6) Employees	0.720	0.451	0.688	0.775	0.838	1										
	(17.402)	**(8.469)**	**(15.875)**	**(20.562)**	**(25.777)**	-----										
(7) Return Index	0.540	0.558	0.546	0.385	0.413	0.378	1									
	(10.756)	**(11.284)**	**(10.913)**	**(7.002)**	**(7.611)**	**(6.837)**	-----									
(8) Market Capitali	0.696	0.559	0.847	0.894	0.903	0.765	0.513	1								
	(16.226)	**(11.312)**	**(26.734)**	**(33.414)**	**(35.314)**	**(19.916)**	**(10.022)**	-----								
(9) R&D/Sales -5yr	0.064	0.052	0.007	0.035	0.021	0.004	0.012	0.029	1							
	(1.081)	(0.870)	(0.110)	(0.585)	(0.359)	(0.073)	(0.207)	(0.477)	-----							
(11) NIBEX	0.6739	0.5861	0.8326	0.8963	0.9423	0.8147	0.4832	0.9462	0.0239	1						
	(15.288)	**(12.127)**	**(25.203)**	**(33.872)**	**(47.198)**	**(23.547)**	**(9.252)**	**(48.994)**	(0.400)	-----						
(12) Sales growth	0.415	0.256	0.253	0.257	0.223	0.232	0.327	0.273	0.018	0.216	1					
	(7.648)	**(4.430)**	**(4.385)**	**(4.460)**	**(3.829)**	**)4.003)**	**(5.799)**	**(4.758)**	(0.297)	**(3.712)**	-----					
(13) R&D/Sales	0.584	0.509	0.591	0.401	0.359	0.327	0.528	0.470	0.054	0.400	0.348	1				
	(12.045)	**(9.908)**	**(12.274)**	**(7.332)**	**(6.444)**	**(5.798)**	**(10.415)**	**(8.928)**	(0.913)	**(7.315)**	**(6.218)**	-----				
(14) R&D/Assets	0.549	0.559	0.564	0.342	0.339	0.349	0.527	0.441	0.010	0.387	0.327	0.947	1			
	(11.017)	**(11.305)**	**(11.452)**	**(6.095)**	**(6.044)**	**(6.238)**	**(10.399)**	**(8.246)**	(0.174)	**(7.037)**	**(5.791)**	**(49.223)**	-----			
(15) Assets	0.514	0.244	0.533	0.856	0.864	0.729	0.240	0.724	0.013	0.756	0.135	0.217	0.184	1		
	(10.038)	**(4.213)**	**(10.557)**	**(27.737)**	**(28.747)**	**(17.855)**	**(4.1458)**	**(17.573)**	(0.218)	**(19.375)**	**(2.278)**	**(3.723)**	**(3.141)**	-----		
(16) Patents/Sales	0.472	0.366	0.549	0.451	0.554	0.644	0.342	0.536	0.007	0.561	0.268	0.380	0.372	0.396	1	
	(8.983)	**(6.587)**	**(11.020)**	**(8.460)**	**(11.143)**	**(14.113)**	**(6.091)**	**(10.653)**	(0.117)	**(11.363)**	**(4.669)**	**(6.893)**	**(6.711)**	**-7.23**	-----	
(17) Brands patent n	0.381	0.210	0.422	0.553	0.415	0.360	0.120	0.485	0.012	0.479	0.187	0.204	0.148	0.341	0.119	1
	-6.916	**-3.606**	**-7.803**	**-11.123**	**-7.646**	**-6.465**	**-2.025**	**-9.293**	-0.199	**9.136878**	**-3.199**	**-3.495**	**-2.499**	**-6.072**	**-2.008**	-----

Pearson´s correlations in bold are significant at the 0,05 level

CHAPTER 5

1. General conclusions

The main purpose of this study was to examine whether the total remuneration paid to CEOs in high-technology firms in the S&P 1500 is related to corporate finance. This work tries to understand how CEOs are compensated when managing high-tech firms and how their performance and innovation are driven to improve shareholders' wealth and to promote their own goals.

The first essay aims at explaining the influence that performance has on CEO compensation for short- and long-term periods in these groups of companies. It was found that there is a strong and positive relation between CEO compensation and firm performance. According to the results obtained, there is empirical evidence to state that in high-technology firms in the S&P, during the period between 2000 and 2010, performance determined total CEO compensation in short- and long-term periods, together with accruals of financial performance measurements. Results suggest that high-tech firms tend to use more sophisticated performance measurements than other firms to determine CEO compensation. The method used has potential implications in finance and accounting, for instance, where it is preferable to separately capture the specific effects of firm and performance.

The main purpose of the second essay, included in chapter 3, is to examine whether the total compensation paid to CEOs in high-technology firms is related to corporate finance, and tries to understand how compensations are influenced by the introduction of the Standard Financial Accounting, SFAS 123 (R). This study will contribute to a better understanding of the relationship between compensation and performance in high-technology firms caused by the new role of expensing stock options with the SFAS 123 (R). This is consistent with the results achieved by Carter et al. (2007), who stated that the favorable accounting treatment for stock options possibly lead to overall higher CEO compensations. They state that there is no evidence of a decrease in total compensation combined with the positive association between financial reporting. The finding that after controlling standard economic determinants of compensation, expensing options in firms decrease compensation from options and increase compensation from

restricted stock suggest that accounting plays an important role in executive plan design. The results in this study indicate that was an increase in CEO compensation after the introduction of the SFAS 123 (R). Although the change in the plan design was not analyzed, a new accommodation of CEO compensation was found as a result of the new rules of the SFAS 123 (R). The influence of firm performance on CEO compensation was confirmed and it is positive and consistent in this group of high-technology firms in the period studied.

Finally, the main purpose of the third essay, in chapter 4, was to examine whether the total compensation paid to CEOs in high-technology firms in the S&P 500 is related to corporate innovation and performance. Furthermore, the essay tries to explain the influence that innovation technologies and performance have on CEO compensation in these companies. In conclusion, according to the results that were obtained there is empirical evidence to state that in high-technology firms innovation determined total CEO compensation. The essay also describes the main corporate risk taking through which a system of corporate governance shapes innovation activities, classifying them according to the three dimensions of the agency problem, corporate innovation and risk taking. The findings indicate that CEO compensation in high-tech firms chooses innovation over performance, and that there is a strong and positive relation between CEO compensation and innovation. This econometric study provides a better understanding of the CEO risk taking and the relationship between CEO compensation, innovation and performance in high-technology firms. As concluded by Graham et al. (2012), there are differences in corporate culture and in the managers' latent traits, which are difficult to observe or measure. These latent traits could be an innate ability, personality, risk aversion or, in this case, propensity to innovation, managing uncertain times in order to boost (enhance) returns to the firm and reaction to stakeholders. The CEOs of high-tech firms had to maximize returns, facing a big competition with new technological solutions, thereby warranting a higher compensation than other firms.

The title of this dissertation is "The executive compensation: Pay-for-performance or innovation in high-technology firms", and the main purpose of this research was to provide an answer to this question. After analyzing the databases, the findings show that for this set of US S&P companies CEOs choose to promote innovation instead of performance during the period

between 2000 and 2010. The financial accrual was used to measure innovation as R&D and to measure performance. Many questions around this theme are still unanswered, and for that reason there are certainly good topics for future research.

2. Limitations and suggestions for future research

After conducting the research, finding issues that could be further analyzed is always promising for that specific scientific area. What happened in this research was no different. This study can be enhanced by analyzing the short- and long-term period of CEO compensation to understand the goals of CEOs for the duration of R&D projects, brands and patent processes. Innovation is generated through a collective and cumulative learning process, such as in R&D programs, which requires the commitment of resources for a prolonged period of time. Identifying innovation for each firm will consider other expenses and make it possible to better classify different components of R&D in financial items. R&D expenses are the best measure of innovation and further research could analyze expenses to acquire disembodied technology and know-how, expenses with tools, industrial engineering, industrial design and production start-up, as well as and marketing expenses for technologically new or improved products.

This study only focuses on high-technology US firms in the S&P 500 in the period between 2000 and 2010, but an extended set of observations with different countries, such as European countries, and different sectors or industries, would be important to confirm the conclusions. It would also be interesting not only to understand the influence that the 2007-2008 crisis had on this period, but also to compare CEO compensation before and after this pivotal moment.

Understanding the Portuguese context in terms of CEO compensation and identifying performance and innovation measurements to study the relation between them would also be a scientific challenge that would enrich an area of knowledge that is key to national development.

References

Aboody, D., Barth, M. E., & Kasznik, R. (2004). SFAS No. 123 Stock-Based Compensation Expense and Equity Market Values. *The Accounting Review, 79*(2), 251-275. doi: 10.2308/accr.2004.79.2.251

Aboody, D., & Lev, B. (2000). Information Asymmetry, R&D, and Insider Gains. *The Journal of Finance, 55*(6), 2747-2766. doi: 10.1111/0022-1082.00305

Balkin, D. B., Markman, G. D., & Gomez-Mejia, L. R. (2000). Is CEO Pay in High-Technology Firms Related to Innovation? *The Academy of Management Journal, Vol. 43* (No. 6), 1118-1129.

Bebchuk, L. A., & Fried, J. M. (2003). Executive Compensation as an Agency Problem. *Journal of Economic Perspectives, 17*((3,Summer), 71-92.).

Belloc, F. (2013). Law, finance and innovation: the dark side of shareholder protection. *Cambridge Journal of Economics, 37*(4), 863-888. doi: 10.1093/cje/bes068

Carpenter, R. E., & Petersen, B. C. (2002). Capital Market Imperfections, high-tech investiment, and new equity financing. *The Economic Journal, 112*(477), F54-F72. doi: 10.1111/1468-0297.00683

Carter, M. E., Lynch, L. J., & Tuna, İ. (2007). The Role of Accounting in the Design of CEO Equity Compensation. *Accounting Review, 82*(2), 327-357.

Graham, J. R., Li, S., & Qiu, J. (2012). Managerial Attributes and Executive Compensation. *Review of Financial Studies, 25*(1), 144-186. doi: 10.1093/rfs/hhr076

Hunton, J. E., & Rose, J. M. (2008). Can directors' self-interests influence accounting choices? *Accounting, Organizations and Society, 33*(7–8), 783-800. doi: http://dx.doi.org/10.1016/j.aos.2007.10.001

Jensen, M., & Meckling, W. (1976). Theory of the firm: managerial behaviour, agency costs, and ownership structure. *Journal of Financial Economics*(3), 308-360.

Joseph P. O'Connor, Jr., R. L. P., Joseph E. Coombs, & Gilley, K. M. (2006). Do CEO Stock Options Prevent or Promote Fraudulent Financial Reporting? *ACAD MANAGE J, 49*(3), 483-500.

Makri, M., Lane, P. J., & Gomez-Mejia, L. R. (2006). CEO incentives, innovation, and performance in technology-intensive firms: a reconciliation of outcome and behavior-based incentive schemes. *Strategic Management Journal, 27*(11), 1057-1080. doi: 10.1002/smj.560

Percival, J., & Mcgrath, C. (2013). Short-term and long-term returns to innovation from the aplication of technology and trading practices. *International Journal of Innovation Management, 17*(05), 1350023. doi: doi:10.1142/S1363919613500230

Shim, D., Lee, J., & Joo, n. K. (2009). CEO Compensation and US High-tech and Low-tech Firms' Corporate Performance. *Contemporary Management Research, Vol. 5*, 93-106.