

***The Influence of CEO Overconfidence
on Firm Value and Corporate Policies***

Master Thesis

Erasmus School of Economics

Study Program: Financial Economics

Author: Christos Leontis

Administration No: 542698

Supervisor: Dr. I. Dittmann



Colophon

Erasmus University Rotterdam

Erasmus School of Economics

Burgemeester Oudlaan 50

3062 PA Rotterdam - The Netherlands

E: info@ese.eur.nl

Author

Christos Leontis

Master Financial Economics

Administration number: 542698

E: leondis_chris@yahoo.com

Supervisor

Dr. Ingolf Dittmann

Professor in Finance at Erasmus Universiteit Rotterdam, The Netherlands

Abstract

This study examines the impact of overconfident CEOs on firm value and different corporate policies. The relationship of biased CEOs with leverage, investment, and R&D is empirically tested aiming to create a concrete framework and shed light on the decision-making process followed by CEOs. This study focuses on U.S firms for the period of 2006 to 2019 and uses a panel of data consisting of 1.816 firms and 12.528 firm years. I follow the line of thinking of Malmendier and Tate (2005), and construct the overconfidence proxies, Holder 67, High Overconfidence, Low Overconfidence, and Moderate Overconfidence based on the option exercise behavior of the CEOs.

The results of the study indicate that high overconfident CEOs increase firm value while low and moderate overconfident CEOs shrink it. Furthermore, the results indicate that highly overconfident CEOs increase firm value by increasing investment closer to the optimal levels and simultaneously maintaining lower research and development expenses and leverage on the firms. Moreover, the results indicate that overconfident CEOs significantly increase firm value, thus moderate levels of overconfidence might not be optimal for firms.

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1. Introduction

Behavioral finance is a topic of the literature that has been researched extensively in the last years. The specific field of study examines the idea that managers and investors do not behave rationally as traditional finance predicts (Shefrin, 2001). The concept of behavioral finance is based on phenomena like moral hazard and adverse selection that intervene with the basic pillars of the traditional theory and are used as explanations of critical patterns that cannot be explained by traditional theory.

Two approaches of behavioral finance literature examine the behaviour of managers and agents. The first approach aims at cases where the manager incorrectly believes he maximizes firm value but he actually diverges from his goal. Overconfidence is the main bias, broadly examined in behavioral literature that explains this behaviour. Under the overconfidence umbrella many different functions of this bias are been found like optimism. Optimism is part of the overconfidence presented both by managers and agents; however, optimistic managers present slightly different behaviour than overconfident managers.

These biases relate managers' behavior with the consequences deriving from their behavior. More concretely, behavioral corporate literature suggests that overconfident and optimistic managers overvalue their skills and they believe that the market undervalues their company, thus they are reluctant to use external financing. As a result, they underinvest when they have to address external financing to fund their projects. Furthermore, overconfident managers undervalue the financial distress costs and the risks deriving from operational processes resulting in overinvestment when internal funds are available. Existing literature suggests that overconfident managers prefer internal funds over external funds to finance their projects and when external financing is inevitable they prefer to issue debt over equity (Ben-David, et al., 2007).

Behavioral corporate finance literature still remains under development and many questions need to be fully addressed. The main concerns regarding the losses deriving from managerial biases need to be addressed since losses impact at a great level the firm value. As a consequence, the direct impact of biased managers on firm value remains unclear and needs to be empirically examined. I try to examine the specific relationship by focusing my study on the following research question:

What is the relationship between overconfident CEOs and firm value?

Academic papers have tried to shed light in the relationship between biased managers and firm value. Gervais and Goldstein (2004) and Fairchild (2009) suggest that managerial overconfidence increases the productivity of the firms resulting from better operational processes. On the other hand, there are influential papers in the existing literature that argue irrational managers choose to undertake more risky projects by increasing the leverage of the firm above the optimal level that results in higher financial distress costs (Hackbarth, 2009).

The increase in the firm's leverage drives irrational managers to be more sensitive to cash flows. This sensitivity to cash flows sometimes is taken into consideration from the board of directors when they try to monitor and moderate the overconfident managers and their decision making. However, various authors (Gervais, Heaton & Odean, 2003, Goel & Thakor, 2008) support that the bias of overconfidence may assist to alleviate underinvestment from risk-averse managers to more optimal investment levels that increase the firm value. Moreover, academic papers examine the relationship between overconfident CEOs and investment levels on R&D.

Existing researches argues that overconfident CEOs tend to invest more at research and development and achieve greater innovation levels and are characterized as better innovators compared to rational CEOs (Hirshleifer, 2012). Through this process, overconfident CEOs manage to capture greater market share and eventually increase firm value. Many different theories aim to the impact of CEO overconfidence and firm value.

For the purpose of this study, I use a panel data of 1816 US firms and 12,528 firm years from 2006 to 2019. The measures used to capture the overconfidence bias of CEOs are developed based on the influential papers of Hirshleifer, Low, and Teoh (2012) and also, of Campbell, Gallmeyer, Johnson, Rutherford, and Stanley (2011). The proxies used to capture the overconfidence levels of CEOs are based on the option exercise behavior of CEOs. More concretely, four overconfidence proxies, which are dummy variables, are employed to capture the overconfidence levels of CEOs, Holder67, High Overconfidence, Moderate Overconfidence, and Low Overconfidence namely.

The Holder 67 proxy dummy variable is based on the line of thinking of Malmendier and Tate (2005) and the dummy variable takes the value of one if the CEO holds vested options that are at least 67% in the money or higher. Moreover, High Overconfidence takes the value of one if the CEO holds her exercisable stock options that are 100% or more in the money while Low Overconfidence dummy takes the value of one if the CEO exercises her options that are less than 30% in the money. Lastly, the Moderate Overconfidence dummy takes the value of one if the CEO is characterized neither as High Overconfident nor as Low

Overconfident. All four (4) overconfidence measures are tested separately on Tobin's Q, to examine the relationship with firm value, leverage, investment, and R and D to derive conclusions regarding corporate policies.

The results of the study indicate that high overconfident CEOs maintain higher levels of investment compared to moderate and low overconfident CEOs. The increased levels of investment could be explained by the negative relationship of dividends and investment. A biased CEO might prefer to invest more within the firm instead of providing dividends at the firm's shareholders. In addition overconfident CEOs seem to increase firm value measured by Tobin's Q and leverage while moderate and low overconfident CEOs maintain a negative relationship with it. On the other hand, high overconfident managers negatively impact on research and development expenses of the firm.

This study contributes to behavioral corporate finance literature in different ways. Firstly, the relationship between CEO overconfidence and firm value is tested in one enveloping framework. Secondly, this study empirically tests the relationship of overconfident CEOs with other corporate policies like leverage, investment, and R&D in the efforts to broaden the literature of the effects of biased CEOs with corporate policies.

This study is organized as follows:

Section 2: Begins with an extensive review of the literature background on the research question.

Section 3: Describes the research design employed for the purpose of this study.

Section 4: Describes the methodology used.

Section 5: Describes the empirical results generated from the model, and

Section 6: Concludes and describes the limitations and avenues for further research of this study.

2. Theoretical Background

2.1. Overconfidence

Overconfidence is a cognitive bias that is known for centuries and affects the behavior of humans in many different aspects, especially decision making. Overconfidence alters the decision making and sometimes leads to positive outcomes but other times it has detrimental consequences. The literature of behavioral finance seeks to shed light on the impact of overconfidence by examining the consequence of overconfidence on managers and investors. The main biases examined already from researchers are overconfidence and optimism (Ben-David et al., 2013). Both biases focus on the characteristics of individuals whose actions have

a distinct impact on firms and corporations (Hackbarth, 2008). Overconfidence incorporates many different aspects of psychology literature and thus makes it interesting to explore its consequences into finance and corporations.

But what exactly is overconfidence?

Overconfidence is defined as a behavioral bias that tends to make people overestimate the accuracy of their information as well as their ability to estimate future outputs over a reference group. An extreme example of overconfidence is the case of Royal Dutch-Shell in the 1970s which caused huge costs at the company deriving from its geologists. Back in the 1970s, the company had hired some young and talented geologists with impeccable credentials to make research and choose locations where the company could extract oil from. However, the overconfident geologists were producing inaccurate predictions about the sites causing enormous expenses to the company. Overconfidence prompts people to overestimate the information they already possess and their ability to forecast potential outcomes while simultaneously lead them to underestimate risks incorporated into their actions (Ben-David et al., 2013).

Calvet, Campbell, and Sodini (2009) conduct research using data under Sweden households and surprisingly they found that entrepreneurs are associated with more mistakes on creating financial wealth mainly due to overconfidence. Similarly, research conducted by Landier and Thesmar (2009) revealed that only 6% of French entrepreneurs in their sample anticipate complications in the year after they created their operations. Behavioral finance literature mainly focuses on executives that are extensively optimistic over their abilities and as a result they are keener to overestimate their skills to fulfill their main goals. Moreover, self-attribution bias describes the tendency of individuals to attribute positive outcomes to their own skill, while accusing actions of other or bad luck in the case of negative outcomes or underperformance (Ben-David et al., 2013).

Langer and Roth (1975) researched the predictions of coin tossing where probabilities are equally distributed between the two potential outcomes and observed that people with successful early guesses acknowledged themselves skilled in the forecast of tosses. Moreover, existing literature reveals that overconfidence is highly related to gender discrimination, especially in excessive trading. Barber and Odean (2001) conclude that men trade more excessively than women after conducting their research and controlling for genders.

Overconfidence can be related to many different biases and thus this creates a disadvantage while there is not clear unanimous terminology or correlated biases regarding overconfidence. Nevertheless, the growing behavioral finance literature associates two main biases to

overconfidence, overoptimism, and miscalibration or overprecision namely (Campbell et al., 2011). Within existing literature overconfidence is cited as overoptimism. Overoptimism describes the tendency of individuals to be more optimistic about future outcomes relying on the overestimation of their own skills (Clayson, 2005). More concretely, optimism is defined as the view that positive future events are more likely to take place than in reality happen (Hackbarth, 2008).

A relevant example is presented by Heaton (2002) in his paper, where he finds that actual cash flows of organizations with optimistic executives are different than the cash flows executives were forecasting. The actual cash flows are less compared to the forecast cash flows which is an indication that optimistic executives favor probabilities for positive outcomes while disregarding possibilities for a bad outcome. Economic literature perceives overconfident executives as individuals who consistently overestimate the mean returns of their investments (Malmendier and Tate, 2005). Concretely, the overestimation related to executives can lead to investment distortion and thus decrease in firm value (Heaton, 2002). An individual's overestimation of his own skills leads to another well-reported bias; the better than the average effect (Alicke, 1985). Svenson (1981) presents that individuals believe that they maintain better driving skills than the average while Moore and Cain, (2007) present that people believe that they have better-memorizing skills than the average.

Executive overconfidence is based on the better than the average effect while the executive regularly overestimates the return of his investment projects and as a result the value of the firm. This overestimation is obtained by the fact that executives or CEOs are more prompt to overvalue their abilities and skills compared to the average (Larwood and Whittaker, 1977). Very interesting research conducted by Graham (1999) reveals the magnitude of the specific effect and the implications it might have on firms by examining research on CFOs' beliefs about the stock valuation of their firms. Almost two-thirds of the sample of CFOs viewed the stock of their firm to be undervalued. Similarly in the technology sector, approximately half of the sample of CFOs viewed their company's stock undervalued which is a remarkable observation while the survey was conducted during the dotcom bubble and shortly before the crash of the technology sector.

The second well-documented bias in the literature related to overconfidence is miscalibration. Miscalibrated executives are more prone to overestimate the precision of their forecasts while they underestimate the volatility of random processes and the range of potential outcomes (Ben-David et al., 2013). More concretely, Ben-David, Graham, and Harvey (2013) after surveying CFOs of S&P 500 firms asking them to forecast the expected

annual S&P 500 return after one year, remarkably they observe that only 36% of S&P500 realizations fall within predicted eighty per cent of the confidence interval. The authors conclude that CFOs are critically miscalibrated and this effect has a strict impact on corporate decision-making.

Moreover, authors mention that overconfident CFOs retain larger miscalibration in forecasting own-project returns, based on the results of the survey where they required from CFOs to forecast internal rate of return. Also, the authors reveal that miscalibrated CFOs are associated with higher corporate investment and leverage. More specifically long-term miscalibration is correlated with more corporate investment while short-term miscalibration with more increase in leverage.

2.2. CEO Overconfidence and Firm Value

Behavioral finance is a rather new area of study still under development and the impact of CEO overconfidence on firm value remains blurred yet. It is hard to explain the impact of managerial overconfidence on firm value while there is no consensus behavior deriving from overconfidence that affects firm value in one direction. There are studies conducted by Fairchild (2005b, 2009) he finds that managerial overconfidence has a negative impact on firm value while it leads to an increase of leverage and thus higher expected financial distress costs. In his research, Fairchild includes asymmetric information and observes the negative relationship between managerial overconfidence and firm value. However, when he includes moral hazard in his model he observes that the impact of managerial overconfidence might be both positive and negative in firm value. An overconfident CEO can lead a firm to undertake more projects and thus create value. He states that the impact on firm value depends on which effect deriving from managerial overconfidence is larger. Lastly, Fairchild concludes that there are optimal levels of managerial overconfidence that can create value for the firm.

Different studies are reaching similar conclusions. Moderate levels of overconfidence drive managers to overcome the underinvestment effect and avoid high financial distress costs (Gervais et al., 2003). Similarly Hackbarth (2009); reports that CEO overconfidence results in a twofold effect. Firstly, he discusses the reluctance of overconfident CEOs to use external financing especially issue equity since they believe the market undervalues their company. As a consequence, they underinvest and miss opportunities to create value for the firm. On the contrary, the second effect refers to the overinvestment on future projects by overconfident CEOs while they underestimate the risk and volatility of random processes. Moreover,

overconfident CEOs are willing to engage in more mergers and acquisitions which can lead to value distortion.

Goel and Thakor (2008) also indicate the existence of an optimal level of overconfidence. High or low level of overconfidence, lead managers to undertake many projects with low (in the case of miscalibrated manager negative) net present value and thus decrease firm value. However, moderate levels of managerial overconfidence alleviate the problems of risk-averse managers and thus mitigate underinvestment and enhancing firm value.

The existing literature of behavioral finance has not extensively examined empirically the impact of managerial overconfidence on firm value. Ye and Yan (2008) present one of the few papers that examined this relationship when empirically tested it in Chinese firms. They try to examine the specific relationship by examining the impact on firm value through investment. More concretely, they assume that firm value, CEO overconfidence, and investment are endogenous variables in their equation model. They documented that at the beginning the relationship between overconfident CEOs and firm value is positive, however, it gets negative after a certain point. The authors suggest that there is an optimal level of overconfident that can create value for the firm. Their findings are in line with previous studies that suggest the existed relationship is a U-shaped relationship.

Based on the existing literature, we can conclude that a theoretical relation between CEO overconfidence and firm value occurs. Existing studies recommend that both positive and negative ramifications might affect firm value. Due to the nature of the firm value, the process of examining the variables that affect firm value and is hard to provide accurate empirical evidence. There are different variables that impact on firm value in different ways. Following the existing literature I try to summarize the impact of overconfident CEOs on corporate policies and the effect on firm value.

Firstly, CEO overconfidence seems to drive an increase in debt levels and a higher financial cost of distress. CEOs view external financing as too costly thus they are reluctant to issue debt or equity and harm firm value. Secondly, managerial overconfidence leads to high investment cash-flow sensitivity. This sensitivity can lead to either overinvestment or underinvestment depending on existing available funds. More precisely, overinvestment regarding mergers and acquisitions or undertake many projects with low or negative net present value can decrease firm value. However, whenever internal funds are unavailable this might lead to underinvestment. The impact of underinvestment on firm value remains blurred. Lastly, overconfident CEOs tend to present a risk-loving profile and willing to undertake riskier projects and are characterized as greater innovators in innovative industries. Marchi

(2012), states in her paper that overconfident CEOs are more likely to be greater green innovators (Galende, 2006) compared to non-overconfident CEOs.

Summarizing the true impact of managerial overconfidence in firm value remains questionable. Overconfidence has a positive impact on some policies while negative to some others. Some studies state that too high or too low levels of overconfidence harm firm value while moderate levels increase it. Some studies reveal that there might be an optimal level of overconfidence which enlarges firm value. Taking into consideration the existing findings from the literature I will test the following hypotheses:

Hypothesis 1: Firm value is increasing when the CEO is overconfident.

Hypothesis 1a: Moderate levels of CEO overconfidence have a positive force on firm value and Low and High CEO overconfidence has a negative response to firm value.

2.3. The Effect of Overconfident CEO on Corporate Policies

2.3.1. Leverage

An excessive discussion has been raised in the past decades among researchers related to the optimal capital structure of firms. The discussion concerns the optimal debt and equity levels that should be applied in organizations to operate efficiently and create profits for the firm and its shareholders. However, the greatest question arising is how organizations decide which is the optimal level for debt and equity to create value for the firm. Many research papers have been conducted and theories have been deployed to shed light on the specific topic.

The most traditional theory presented by Modigliani and Miller (1958) argues that the value of the firm remains the same no matter what the capital structure of the firm is. Modigliani and Miller though set strong assumptions for the theory to hold. Following the two authors regarding the exploration of a firm's optimal capital structure, Myers introduced the static trade-off theory. Myers (1984) stated that equity is more costly compared to debt and managers to reach the optimal capital structure and increase firm value should consider the trade-off between tax shields and the cost of financial distress. Static trade-off theory is not enough to explain managerial behavior regarding capital structure and simultaneously with the development of static trade-off theory another theory was introduced to facilitate the explanation of capital structure, the pecking order theory.

The pecking order theory was firstly induced by Donaldson (1961) and further developed by Myers and Majluf (1984). The main aim of pecking order theory is to induce a hierarchy of firm's financing based mainly on the transaction costs of increasing capital and the debt capacity of firms by taking into consideration information asymmetry between internal and external stakeholders. According to pecking order theory managers prefer initially to use internally available funds over external funds and issue debt instead of equity (Shyam-Sunder and Myers, 1999). Both theories have been applied over the years into researches receiving mixed empirical results though.

Many recent studies have revealed that various reasons can explain the effects in leverage with overconfidence being one of the potential reasons explaining the specific anomaly (Lemmon et al., 2008). The general approach that has been deployed in literature is that managerial overconfidence increases firm leverage (Hirshleifer et al., 2012). Overconfident CEOs underestimate the possibility of default and the costs of financial distress and thus they prefer to issue more debt and increase firm leverage (Shefrin, 2001). More precisely overconfident CEOs increase by almost 33 cents over a dollar more debt compared to non-overconfident CEOs (Malmendier and Tate, 2005).

Ben-David et al. (2007) reveal that managerial overconfidence induces executives to underestimate the volatility of a firm's cash flow and discount rate; as a result, they underestimate the possibility of bankruptcy and costs of financial distress. As a consequence investors view firms as too risky under overconfident executives and thus they undervalue the projects undertaken by the firm leading to mispricing of the firm's equity. This phenomenon makes managers unwilling to issue equity, thus it increases the leverage in the firm. The more overconfident managers in the company are, the more they believe equity is undervalued which results in increasing debt to finance the firm's projects and operations. Moreover, when CEOs feel that the firm's equity is undervalued they proceed with the buyback technique by purchasing the company's stocks from other investors (Peyer, 2008).

Another point of view for the reluctance of CEOs to issue equity is based on the underestimation of the discount rate. Overconfident CEOs value future cash flows with very low discount rates which make them believe that the firm is undervalued by external investors and the market and thus the issuance of equity will be too costly for the firm (Malmendier, Tate and Yan, 2010). Internal funds available are preferred over external funds, while when external funding is inevitable CEOs prefer to issue debt instead of equity which is in line with pecking order theory.

The preference of CEOs for internal funding compared to external, and specifically the issuance of equity, contradicts existing studies that reveal overconfidence drives CEOs to increase the leverage of the firm. The overconfidence bias can potentially explain the empirical puzzle of debt conservatism. This puzzle reveals that in general firms do not issue enough debt and move away from their optimal capital structure and potentially leave money on the table. Malmendier et al., (2005) support this argument by revealing a positive relationship between overconfidence and debt conservatism.

Behavioral finance literature though presents some main differences in the behavior between overconfident and miscalibrated CEOs. Hackbarth (2008) in his paper presents that in contrast with overconfident CEOs, miscalibrated CEOs undervalue debt instead of equity while they believe that the future profits based on the projects they undertake funded by debt are safer compared to the market. As a result, miscalibrated CEOs are more likely to issue equity instead of debt resulting in a reverse form of pecking order theory. Moreover, Hackbarth (2009), reveals that overconfident managers are keener to issue debt when they expect lower financial distress costs which is in line with theory. Moreover, Fairchild (2005) finds that overconfident managers are willing to issue more debt not only because managers perceive equity issuance more costly but because managers overestimate their skills and their ability to deliver the requirements and preferences of shareholders.

Managerial overconfidence has been extensively studied through the years taking into consideration different aspects and has been administrated into different models. Many discussions have been risen based on the specific managerial bias and its impact on firms' capital structure and most of them present the same conclusion; managerial overconfidence increase firm leverage. Two main manifestations are based on specific biases. Firstly, overconfidence makes CEOs more eager to issue debt while they underestimate financial distress costs. Secondly, overconfident CEOs believe that the market undervalues the fair value of the company thus make them more reluctant to issue equity. All these effects move firms away from the optimal capital structure and sometimes destroy firm value. Thus I will test the following hypothesis to examine the effect of leverage on firm value:

Hypothesis 2: Leverage is lower when the CEO is overconfident.

Hypothesis 2a: Leverage is lower when the CEO is moderately overconfident.

2.3.2. Investment

2.3.2.1. Overinvestment

There are different explanations of the impact overconfidence has on the overinvestment behavior of managers. As long as overconfident managers have available internal funds they tend to overinvest while they overestimate the future cash flows generated from the projects they invest. Optimistic managers are willing to invest in more projects, even undertake projects with a low or negative net present value which harms firm value in the long run (Heaton, 2002). This relationship has been examined empirically from Fairchild (2009) who finds that overconfident managers are related to free cash flow errors. Also, overconfident managers tend to overestimate future profits as a result they tend to overinvest for all levels of investment (Malmendier and Tate, 2005a).

The managerial overconfidence though is hard to be defined as a unanimous measurement and its impact on investment depends on the overconfident measurement used. Baker et al. (2007) for example examine the managerial optimism on the company's assets and its impact on investment. More concretely the authors find that optimism managers who overvalue assets in place adopt lower discount rates which eventually lead to overinvestment. Ben-David et al. (2013) models overconfidence regarding miscalibration and derive similar conclusions. According to the authors, the overconfident manager underestimates the volatility of the company's cash flow and the possibility of random processes that lead her to use lower discount rates and thus higher investment levels.

Managerial overconfidence increases the levels of investment regarding mergers and acquisitions as well. Roll (1986) was the first one who discussed the potential implications of managerial overconfidence on merger activity. He describes the tendency of overconfident managers to overvalue future returns of potential mergers or acquisitions and the synergies created. Moreover, he introduced the winner's curse, which is the fact that winners in auctions overpay to gain the auction and the same phenomenon applies in real life with mergers and acquisitions. Overconfident managers are willing to overpay to acquire another company while they overestimate the potential gains from this investment which might harm their firm value. Malmendier and Tate (2005) find that overconfident CEOs are more likely by 65% to undertake acquisitions compared to rational CEOs. Overconfident managers increase merge activity as a consequence they increase the possibilities to undertake projects with negative net present value and distort firm value. Further, it is revealed that increased merger activity leads to negative market responses.

On the other hand, managerial overconfidence has its bright side as well. Overconfident managers are keener to take risky projects and balance out managerial characteristics like risk-averse which are not desired by shareholders. Moreover, overconfident CEOs are more inclined to undertake projects with less information, which would be rejected by rational CEOs, and thus alleviate agency problems. According to Hirshleifer et al., (2012), overconfidence is related to more investment innovation and more innovation output per unit of investment, and thus overconfident CEOs are characterized as better innovators. Based on the authors' findings though, greater productivity is accomplished in innovative industries.

2.3.2.2. Underinvestment

As it is described above overconfident CEOs underestimate risks associated with projects and random processes while simultaneously they overvalue future cash flows. As a result, biased CEOs perceive that their firm is undervalued, which drives them to a misconception of costs related to external financing. Biased CEOs wrongly believe that creditors request higher interest rates, than they should, for supplying debt while shareholders expect too high returns and compensation to provide equity (Malmendier, Tate, Yan, 2010). As a consequence, overconfident CEOs consider external financing as too expensive and therefore are reluctant to issue either equity or debt. However, when external financing is inevitable, biased CEOs prefer to issue debt over equity since they view equity as more overvalued compared to debt.

Due to their bias, overconfident CEOs are financially constrained due to misinterpretation of the actual value of their firm and they are reluctant to use external financing. As a consequence, if internal funds are not available, they will not invest in projects with a positive net present value which leads to the phenomenon of underinvestment (Heaton, 2002). Overconfident CEOs will only accept to address external financing if the estimated returns are greater than the expected financing costs (Malmendier et al., 2010). Based on the financial constraint theory, the disinclination of biased CEOs to use external financing contributes to underinvestment and could potentially destroy firm value (Fazzari et al., 1988). Lastly, a research conducted by Ye and Yuan (2008) validate the specific theory and state that overconfident CEOs are more likely to conduct underinvestment even for projects with positive net present value and thus destroy firm value.

Behavioral literature documents that overconfident CEOs maintain a great impact on firm investment decisions. As it is described below, biased CEOs experience intensive cash flow sensitivity that could explain the distortions on investment decisions. Both forms presented, namely over- and under-investment, are outcomes of the specific heightened cash flow

sensitivity. As empirical findings reveal overinvestment, especially in the form of mergers, may dismantle firm value. In the contrast, CEO overconfidence may alleviate concerns based on the investment that rational CEOs have and move investments closer to optimal levels. On the other hand, underinvestment might lessen some of the concerns related to overinvestment but still might harm firm value.

2.3.2.3. Investment Cash- flow Sensitivity

Most of the behavioral literature relates managerial overconfidence to the sensitivity of cash flows. More precisely, overconfident managers are keener to undertake more projects when internal funds are available in contrast when there are restrictions to internal available funds (Heaton, 2002). Overconfident CEOs overestimate the future returns from the projects in which they invested and undervalue the costs related to financial distress. As a result, overconfident managers are investing more when internal funds are available however, they underinvest when funds are not available while they believe the market undervalues their company. As a result, overconfident managers view external financing as more costly thus they underinvest.

Many papers in the behavioral literature state a positive correlation between overconfident CEOs and cash flows sensitivity. A study examined by Malmendier and Tate (2005) provide evidence of the specific relationship, while the authors find that the investments undertaken by overconfident CEOs are more prone to cash sensitivity than rational CEOs. Moreover, their study confirms that CEOs are more reluctant to undertake new projects when funds are not available and they have to issue debt or equity. This consequence lessens the overinvestment phenomenon while the CEO will not undertake projects which might harm the company's value in the long run. This phenomenon might protect managers from conducting value-destroying investments; however, it leads to underinvestment and managerial risk averseness which is unfavorable from shareholders' perspective.

Overconfident managers are particularly interested in cash flows especially when internal funds are not available. Malmendier and Tate (2005) find that overconfident managers are reluctant to issue debt or equity to finance their projects so they increase their sensitivity to cash flows while they view it as the only way to fund their investments. Empirically they confirm that there is a higher overconfident CEO's sensitivity to cash flows when internal funds are scarce especially for equity-dependent firms.

Moreover, Hovakimian and Hovakimian (2009), point out the importance of cash flow sensitivity from overconfident CEOs while they observe that overconfident CEOs invest

excessively when cash flows are high while underinvest when cash flows are low. The general impact of CEO overconfidence on investment decisions remains enigmatic and more research has to be conducted.

Therefore, I test the following hypothesis due to my efforts to understand how CEO overconfidence affects investment:

Hypothesis 3: Investment is higher when the CEO is overconfident.

Hypothesis 3a: Investment is higher when the CEO is moderately overconfident.

2.3.3. Research and Development

The bias of overconfidence on CEOs level impacts on the decision making process in multiple dimensions. One of these dimensions can be viewed as the decision of CEOs regarding the R&D investment of the firm. Existing literature supports that the CEOs' decisions regarding R&D investments can be interpreted as the motivation of CEOs to be greater innovators or not within the industry. CEOs who want to achieve higher levels of innovation increase the R&D investment of their firm to achieve their goal.

Hirshleifer et al. (2012), try to explore the connection between CEO overconfidence and innovation. They measure innovation as by the number of patent applications and citations of firms. Researchers find that overconfident CEOs increase the investment in research and development compared to non-overconfident CEOs. Overconfident CEOs are characterized as better innovators and they stimulate a firm's growth. However, within the existing literature, it is also stated that the increase of R&D expenses can be beneficial mostly for firms that operate in innovative markets and the increased competition demands higher R&D expenses to achieve greater market share (Galasso, 2011).

A very interesting question arises within existing behavioral finance literature regarding the increase of R&D expenses and firm value. Chen et al. (2014) explore the specific relationship by examining the effect of CEO overconfidence and the unexpected increases on R&D costs as long as the long-term abnormal stock return and operating performance after an increase in R&D costs. The main conclusions the authors derive are that actually market reacts positively when firms increase their research and development expenses, while investors gain positive abnormal stock returns. However, these positive abnormal returns are observed for companies that maintain non-overconfident CEO. Overconfident CEOs do invest

more in R&D, but this investment doesn't increase significantly long term abnormal returns for stockholders.

According to Simon (2003), investors negatively react to decisions of overconfident CEOs regarding future projects. The market assumes that overconfident CEOs overestimate the outcome of the projects invested and underestimate the risks associated with the investments, so markets are keener when investments are made by non-overconfident CEOs rather than overconfident.

Taking into consideration the existing findings from the literature I will test the following hypotheses to explore the relationship between overconfident CEOs and R&D expenditures:

Hypothesis 4: R&D expenses are higher when the CEO is overconfident.

Hypothesis 4a: R&D expenses are higher when the CEO is moderately overconfident.

2.3.4. CEO Overconfidence Measures

As it is excessively stated in the literature the construction of a proxy measuring CEO overconfidence is one of the greatest challenges regarding the analysis of managerial behavior. It has been widely described that managerial overconfidence is a bias that cannot be easily observed and thus is hard to be measured. Many authors try to overcome the specific obstacle by administering surveys which are used as a proxy to measure managerial overconfidence.

Ben-David et al. (2013) use surveys including questionnaires to measure CFO miscalibration; the questionnaire includes questions that ask CFOs to predict the expected annual returns of S&P500 for the following year. If CFOs' predictions do not fall within 80% confidence interval realizations then CFOs are characterized as miscalibrated. Other studies use Consumer Sentiment Index to estimate a proxy for overconfidence (Oliver, 2005). Another study conducted by Grinblatt and Keloharju (2009), use a different survey-based measure for overconfidence. The authors use a sample from Finland, and they measure the overconfidence based on psychological and aptitude tests before men went to the military. The overconfidence measure is created based on the self-reported confidence level minus how confident men should feel based on their test performance.

Different studies use firm characteristics to assemble a proxy for managerial overconfidence. Barros et al. (2007) employ a measure of overconfidence regarding leverage in the firm. The higher leverage levels a company has the higher the overconfidence levels of the managers. Moreover, other studies use the density on mergers and acquisitions a firm is involved as a proxy for managerial overconfidence. It is noted in the literature that

overconfident CEOs are more involved in mergers and acquisitions compared to non-overconfident CEOs (Doukas and Petmezas, 2007). Additionally, a study organized by Barros and Silveira (2007) adopt the managerial status of their sample. A manager's status that is an entrepreneur is characterized as overconfident since it is stated in the literature that entrepreneurs are more sensitive in the specific bias.

In the existing literature studies organized by Malmendier and Tate have brought the revolution regarding the construction of overconfidence measurement and are broadly used. The authors use three different measures for overconfidence regarding the shareholders' status of managers. They try to measure overconfidence by the choice of managers to expose themselves to idiosyncratic risk. The compensation packages offered to top managers involve besides cash, company shares and company options. The options are not allowed to be traded before they vest and also executives are not allowed to trade their stock and short sell. Through this way, shareholders try to expand the incentives for managers to increase firm value and align managerial incentives with theirs. Through this process, top managers' personal portfolio is under diversified and exposed to idiosyncratic risk. In order to diversify, rational managers should desire to exercise their options once they are in the money and minimize their exposure in the firm.

Overconfident managers though truly believe in their estimations and the actions they undertake and thus believe that firm value will increase and as a result company's stock price will rise too. Based on this assumption overconfident manager is willing to postpone the exercise of their options and even more they are willing to increase their exposure by acquiring more company stocks.

Malmendier and Tate (2005) take into consideration the specific phenomenon and construct three main measurements for overconfidence. Initially, they built the 'Holder 67' and 'Long holder' which are proxies based on option exercise and allocate CEO as overconfident if she exercises her option later than optimal or hold her options until expiration, respectively. The third measure introduced by the authors is named 'Net Buyer' and allocates CEO as overconfident if she purchases company stocks. Malmendier and Tate use a very detailed sample regarding the measurement of overconfidence and thus it makes it hard to construct the specific measurements identically.

3. Research Design

3.1. Proxies and Overconfidence Measures

For the purpose of this study I will follow Campbell et al., (2011) and Hirshleifer et al., (2012) who use identical measures to ‘Holder 67’ and derive data from Compustat and Execucomp. Additionally similarly to ‘Holder 67’ they create two proxies that differentiate low and high overconfidence and will be applied in my analysis as well. Lastly, I will formulate the modest overconfidence proxy which captures the differences between high and low overconfident CEOs.

3.1.1. Holder 67

The first measurement of overconfidence is ‘Holder 67’ and it is based on the exercise behavior of CEOs regarding options (Hirshleifer et al., 2012). The authors apply the methodology used by Hall and Murphy (2002) who state that a rational CEO will exercise her options if options are adequately in the money while she tries to increase her under diversification and minimize her exposure to idiosyncratic risk. Hall and Murphy use the 67% or more in the money as an indication for overconfident CEOs and the belief that the specific bias is constant and does not change over time. Hirshleifer et al., (2012) categorize a CEO as overconfident if she holds vested options which are at least 67% in the money.

In order to determine the overconfidence of CEOs regarding the specific measure, I calculate the average option moneyness first. The average option moneyness is the result of realizable value per option over the average exercise price. The average realizable value per option is calculated by dividing the total realizable value of the exercisable options over the number of exercisable options.

As already mentioned the CEO is classified as overconfident if the average moneyness of options held by CEOs is at least 67% or higher. Therefore I will construct a dummy variable that takes the value 1 if it is above the threshold and zero otherwise and these values remain the same for the entire time frame. Negative and values of zero are excluded from the analysis just like CEOs who never hold options with a positive value.

3.1.2. Low, High and Modest Overconfidence Measures

Moving on to the following measurements of overconfidence, a second option-based measure is applied following Campbell et al., (2011) who created two dummy variables for low and high overconfidence. A CEO is characterized as high overconfident if she holds her

options that are more than 100% in the money thus the dummy variable CEO High takes the value 1 and zero otherwise. On the other hand, a CEO is characterized as low overconfident if exercises her options that are less than 30% in the money and if she doesn't hold any exercisable options that are more than 30% in the money. The dummy variable CEO Low takes the value one if the value of exercised stocks the CEO hold is 30% or less in the money and she doesn't hold any options with average moneyness of 30%, and zero otherwise.

The condition used for moneyness is the same applied for the measurement 'Holder 67' above. In order to estimate the average option moneyness from exercising I divide the per option value realized from exercising over the estimated average exercise price of the exercised options. The option value realized from exercising equals the total value realized from exercising stock options normalized by the number of options that are exercised.

Consequently, the estimated average exercise price derives from the difference in stock price at fiscal year-end minus the option value realized from exercising. Lastly, the CEO Modest proxy is a dummy variable that captures the CEOs who are not characterized either High or Low overconfident. The modest overconfidence proxy is a dummy variable which equals one minus the CEO Low minus CEO High. If the CEO doesn't belong in both CEO High and CEO Low proxies then she is characterized as modest overconfidence CEO.

3.2. Measurement of Firm Value

For the measurement of firm value, this study uses the proxy of Tobin's Q. Existing literature uses extensively the specific proxy as a consensus measurement of firm value (Fang, Noe, & Tice, 2009; Mackay & Moeller, 2007). Tobin's Q is excessively accepted as a measurement of firm value in the finance literature and it is defined as the market value of assets over replacement costs of assets (Brainard and Tobin, 1968). The computation of the proxy based on the specific data many times seems harsh based on the availability of data to calculate it. Therefore many studies use a simplified version of the proxy and alter replacement costs of assets with book value assets (Kaplan & Zingales, 1997).

For the purpose of this study I will use Tobin's Q following Malmendier et al., (2005) who calculate Tobin's Q as the market value of assets over the book value of assets. The authors compute the market value of assets as the sum of Total Assets plus Market Equity Value minus Book Equity value. Market equity value is calculated as the product of the number of common shares outstanding times' stock price at the end of the fiscal year. While book equity value is the sum of total shareholders' equity plus deferred taxes and investment tax credit

(Balance Sheet) minus preferred stock at liquidating value. Moreover, the market value of assets is calculated as total assets. Lastly, all the variables used in to produce Tobin's Q are logged.

For robustness purposes, I use an alternative proxy following Chung and Pruitt (1994). They define Tobin's Q as the market value of assets divided by total assets. In order to calculate the market value of assets the authors calculate the market value of equity (as calculated by Malmendier and Tate) plus preferred stock at liquidating value plus debt. Debt is the result of the sum up of total debt in current liabilities plus total inventories minus total long-term debt minus total current assets. All the variables used to produce the alternative measure of Tobin's Q are logged just like the normal proxy of Tobin's Q.

3.3. Control Variables

This chapter aims, subsequently, to examine and to analyze briefly the most important 'Control Variables' related to various companies, which affect the firm value and also, have been extensively incorporated in existing academic researches. Some of these Control Variables are: the Firm Size, Profitability, Liquidity, Leverage, Market to Book Ratio, CEO Ownership, etc.

a) Firm Size

Numerous papers examining the firm value take into consideration firm size as it influences accounting profitability and as a result firm value (Allayannis and Weston, 2001). Most studies in existing literature use firm size as a control variable, thus the same methodology is employed in this study as well. Following the paper that use firm size as a control variable, firm size is calculated as the log of Total assets. An alternative proxy is used too and it equals the log of Net Sales.

b) Profitability

It has been observed in previous studies that profitability has a positive impact in firm value (Yermack, 1995). Thus it is commonly used as a proxy to control for firm value. Malmendier, Tate and Yan (2005) calculate the proxy of profitability as ROA which equals the operating income before depreciation over the book value of assets. This study follows a slightly different approach and instead of book value of assets I use the logarithm of Total Assets. An alternative variable regarding profitability is also calculated by dividing Net Income over Total Assets.

c) Leverage

Existing literature suggests that firms seek to reach an optimal leverage ratio that maximizes firm value. Static trade-off theory recommends that firms' optimal ratio of debt to equity should be at the level where it maximizes the trade-off between tax shields benefits against financial distress costs (Myers, 1984). The influence of leverage on firm value is still not clear while it depends on many other variables like industry and others. For the purpose of this study the leverage variable equals the debt-to-equity ratio. In order to construct the debt-to-equity ratio, the sum of Total Long Term Debt and Total Debt in Current Liabilities is divided by Total Stockholder's Equity. Moreover, the leverage variable is used as an independent variable in Hypothesis 2 and sub-hypothesis 2a to examine the relationship of overconfident CEO with leverage. An additional proxy is also employed to measure for leverage and its equal to Total Long Term Debt divided by Stockholder's Equity.

d) Dividends

The option of firms to maintain cash available influences decision making in great level. Available internal funds can lead to overinvestment and thus firm value distortion while scarce internal funds might lead managers to neglect projects with positive net present value and as a result to harm firm value as well (Allayannis and Weston, 2001). Based on the very important influence of cash available in decision making this study includes a dummy variable controlling for cash availability. Following Roll et al., (2009), the created dummy takes the value of one if the company pays cash dividends and zero otherwise.

e) CEO Ownership

Many papers investigating into the overconfidence effects on firms control for CEO ownership (Malmendier et al., 2010). Literature suggests that the more company shares a CEO maintain the more skin on the game she has and she is has greater incentives to perform better. The incentives of a CEO with many company's shares align with those of shareholders' which are in simple lines to increase firm value. Thus, following the paper of Hirshleifer et al (2012), a measurement of CEO ownership is constructed and includes the percentage of company stock that is owned by the CEO excluding options. According to Chung and Pruitt (1994), they find that CEO ownership has a positive effect on firm value.

f) Liquidity

Existing literature has revealed that liquidity of the assets of the firm is a variable that affects the company's leverage. Overall firms require less external financing when they possess more liquid assets and can be used instead of debt. According to De Jong et al (2008) the liquidity control variable is described as the total current assets over the total current liabilities.

g) Market to Book Ratio

Market to Book ratio is a ratio that describes the valuation of the firm. For example a company with low Market to Book ratio means that the market value of the company is less compared to its book value of assets and thus this company is undervalued. While a company with high Market to Book ratio is described as overvalued and its market value exceeds its book value of assets. Many research papers used the specific ratio as control variable when investigate firms regarding leverage analysis. Frank and Goyal (2009) define the specific ratio as a ratio of the market value of the assets over the book total assets of the firm. A more detailed definition is provided by Malmendier and Tate (2005) while they state that the specific ratio can be derived from market value of equity plus the long term debt plus the preferred liquidation value of stocks minus the deferred taxes divided all by the total assets. This study follows the specific approach.

h) CEO Compensation

In many well established papers written like the researched conducted by Malmendier and Tate (2005); Hirshleifer et al. (2012), researchers control for CEO compensation in their analysis. As a result a CEO compensation proxy is also used in this study. The CEO compensation proxy is computed as the logarithm of Total compensation including option grants. Chung and Pruitt (1966) in their study find a positive relationship between remuneration and firm value.

i) Investment

The exact correlation of investment and firm value remains uncertain within existing literature. Ye and Yuan (2008) document that there are evidence for positive relationship between firm value and investment but they don't find any evidence for the other way around. In order to construct a proxy for investment I follow Malmendier et al (2010) study. The authors use a formula to measure investment by computing the Capital Expenditures plus Increase in Investments plus Acquisitions minus Sale of Property minus Sale of Investments and then normalize it by investment with beginning of the year capital. Moreover, the

investment variable is used as an independent variable in Hypothesis 3 and sub-hypothesis 3a to examine the relationship of overconfident CEO with investment. This thesis uses a simplified proxy for investment and normalizes investment by Total Assets. Moreover, Malmendier and Tate (2008) use an alternative proxy for investment by dividing Capital Expenditures over Total Assets. The same proxy is used in this study as an alternative control variable.

j) Research and Development

There is generally evidence in existing literature that suggests CEO overconfidence impact on innovation through Research and Development investment. For the purpose of this study I construct the RD proxy based on the variable provided by Compustat, RD expenses. Moreover in order to create alternative proxy for the specific variable I follow Hirshleifer et al., (2012) who constructed the specific proxy by dividing Research and Development Expense by Book Assets. To simplify the proxy, I construct the alternative RD variable by dividing Research and Development Expense by Total Assets instead of Book Assets. These variables will be used as independent variable to test Hypothesis 4 and sub-hypothesis 4a.

3.4. Data Source and Sample

For the construction of the panel data, Compustat and ExecuComp both available at Wharton Research Data Services were used. Not all firms within the sample maintain an equal amount of observations which makes the dataset unbalanced. The financial data for the dependent and control variables are extracted from Compustat while the data needed for the compensation of CEOs are extracted from ExecuComp. The sample ranges from 2006 to 2019 and includes only North American firms.

Furthermore since this study takes into consideration overconfidence of CEOs, only CEOs are included within the sample. The specific study aims to magnify the number of observations and not immediately drop observations with missing data. Only for the construction of overconfidence measures missing observations are deleted since they are critical for the analysis.

Moreover, CEOs who never hold valuable options are excluded since if they were included it would lead to biased conclusions. Lastly, following previous literature, financing firms with SIC codes 4900-4999 and regulated utilities with SIC codes 6000-6999 are excluded. After all the alterations made the final sample of panel data consists of 1.816 firms and 12.528 firm years

4. Methodology

4.1. Regression Analysis

This study following Malmendier and Tate (2005b) and Hirshleifer et al. (2012), uses OLS regression to estimate the parameters of the model. The measures of CEO overconfidence are dummy variables that are assumed to remain stable for CEOs over time. Through the whole time range of the study, CEOs are characterized as overconfident for all firm years in the sample or for none. This study employs four different hypotheses and four sub-hypotheses respectively. The first regression used to test hypothesis 1 and 1a is the following:

$$\begin{aligned} \text{Tobin's } Q_{i,t} = & a0 + a1 (\text{Overconfidence}_{i,t}) + a2 (\text{Firm Size}_{i,t}) + a3 (\text{Profitability}_{i,t}) + a4 \\ & (\text{Leverage}_{i,t}) + a5 (\text{Dividend}_{i,t}) + a6 (\text{CEO Ownership}_{i,t}) + a7 (\text{CEO Compensation}_{i,t}) + a8 \\ & (\text{Investment}_{i,t}) + \varepsilon_{i,t} \quad (1) \end{aligned}$$

Where a_0 is the intercept, a_1 measures the coefficients for the different overconfidence measures, while other control variables like firm size, profitability, leverage, dividends, CEO ownership, CEO compensation, and investment are used in order to alleviate endogeneity errors regarding the firm value and ensure the robustness of the results. The overconfidence measure will be replaced with all the other overconfidence measures mentioned above and regressions are tested separately. After all four overconfidence measures are tested separately; another regression which includes both High overconfidence and Modest overconfidence is tested. The aim of this additional regression is to examine in greater depth the interaction of highly and moderately overconfident CEOs on firm value and the other corporate policies.

Regression (1) will test hypotheses 1 and 1a by measuring the coefficient a_1 . Moderate levels of overconfidence are expected to have a positive impact on firm value while high and low overconfidence measures are expected to have a negative response to firm value.

The following regression is used in order to test the relationship between CEO overconfidence and firm leverage. Hypothesis 2 and 2a state the negative relationship between overconfident CEOs and leverage levels of firms. Regression (2) examines the relationship stated by hypotheses 2 and 2a by measuring the coefficient a_1 . According to the hypotheses, the relationship is expected to be negative as a result the coefficients a_1 are expected to be negative for all four overconfidence measures.

$$\begin{aligned} \text{Leverage}_{i,t} = & a0 + a1 (\text{Overconfidence}_{i,t}) + a2 (\text{Tobin's } Q_{i,t}) + a3 (\text{Dividend}_{i,t}) + a4 \\ & (\text{Liquidity}_{i,t}) + a5 (\text{MB Ratio}_{i,t}) + a6 (\text{Firm Size}_{i,t}) + \varepsilon_{i,t} \quad (2) \end{aligned}$$

The last two hypotheses with their sub-hypotheses state the positive impact of CEO overconfidence on investment levels and R&D expenses respectively. Regression (3) is used to test hypotheses 3 and 3a while regression (4) is used to examine hypotheses 4 and 4a. In both cases, the coefficient of interest is a1 and is expected to be positive. As in the previous regressions, these regressions are tested with all four different measures of overconfidence and lastly they are tested with both measures of highly and moderately overconfident CEOs, to consider the effects of different levels of overconfidence on investment and R&D expenses.

$$\text{Investment}_{i,t} = a0 + a1 (\text{Overconfidence}_{i,t}) + a2 (\text{Tobin's } Q_{i,t}) + a3 (\text{Dividend}_{i,t}) + a4 (\text{CEO Ownership}_{i,t}) + a5 (\text{Firm Size}_{i,t}) + \varepsilon_{i,t} \quad (3)$$

And

$$R\&D_{i,t} = a0 + a1 (\text{Overconfidence}_{i,t}) + a2 (\text{Tobin's } Q_{i,t}) + a3 (\text{Dividend}_{i,t}) + a4 (\text{CEO Ownership}_{i,t}) + a5 (\text{Firm Size}_{i,t}) + \varepsilon_{i,t} \quad (4)$$

4.2. Robustness Tests

After running the regressions mentioned above, this study performs different robustness tests to evaluate the accuracy of the results. Firstly, as already mentioned above this study uses four different measures of overconfidence. In addition, alternative proxies for the measures of Tobin's Q, Firm size, Profitability, Leverage, R&D, and Investment are used. The main concerns regarding the usage of alternative proxies are to control if the regressions produce similar results and if the relationships created in the first model survive the robustness tests as well. The outcome of the robustness tests will be discussed only if the substitution by the alternative proxies used in the model produces qualitatively different results.

Furthermore, the aim of this study is not to delete observations rather consider missing data from control variables as non-material and therefore estimate missing values as zero (Hirshleifer et al., 2012). Moreover, both models with normal measures and alternative proxies are tested by including Fixed Effects. This study applies industry and year fixed effects to control for time and industry effects. For the industry fixed effects, I follow Yermack (1995) and transform two-digit SIC codes while in the sample the SIC codes consisted of four-digit codes. Lastly, errors are clustered at firm level.

5. Results

5.1. Descriptive Statistics

Table 2 provides the descriptive statistics of the independent, dependent, and control variables. The averages of the variables are similar to previous studies regarding CEO overconfidence with some slight alterations on some variables. The first overconfidence measure employed in the specific study is Holder67 which is the measure that has the biggest difference compared to previous studies. As it is shown in table 2, Holder67 classifies 41.3% of the sample as overconfident. This estimation is lower compared to Malmendier and Tate (2005b) who estimate the specific measure as 51.3%. The additional overconfidence measures classify a CEO as high, low, and modest overconfident with means of 28.9%, 3.7%, and 67.4% respectively. These overconfidence measures slightly differ to previous studies in the existing literature.

More precisely, the mean of low overconfident CEO is lower compared to Campbell et al., (2011) who estimate a mean of 8.9% while the mean of modest measurement of overconfidence maintains a greater value of 67.4% compared to 57% the authors estimate in their study. This difference in descriptive statistics can be explained by the different approaches used in Malmendier and Tate (2005) and in the paper of Campbell (2011). In previous studies, the overconfident dummy of either low or high becomes one the first moment a CEO reveals an overconfident behavior and remains like that for the rest of the years¹. So, this study estimates CEO as overconfident, if she satisfies the requirements of measures, for all their CEO years.

5.2. Regression Results

5.2.1. CEO Overconfidence and Firm Value

The outcome of the OLS regressions can be found in Table 3; the results shown in the table include fixed year and industry effects while errors are cluster at firm level. The results of these OLS regressions will be used to test Hypothesis1: Firm value is increasing when the CEO is overconfident and sub-hypothesis 1a: Moderate levels of CEO overconfidence has a

¹ Initially Malmendier and Tate (2005) construct the Holder 67 dummy based on the assumption that the CEO holds options that are at least 67% in the money twice. However, Hirshleifer et al., (2012) apply robustness tests and find that the output remains unchanged if CEOs hold 67% or more in the money options just once in the sample. This thesis follows the specific approach.

positive force on firm value and Low and High CEO overconfidence have a negative response to firm value.

As the results on the table depict, the coefficients of the overconfidence measures do not display statistical significance regarding the firm value. The signs of the coefficients are in line with the hypotheses since Holder 67 and High OC maintain positive values while Low OC and Modest OC maintain negative signs. However, when both highly and moderately overconfident measures are included in the regressions the signs are positive for both overconfident proxies. As it can be seen from the table, since the coefficients are not statistically significant at any level of confidence accurate conclusions regarding the first hypotheses cannot be derived.

The control measures used in the model maintain the predicted signs, and more specifically, only Firm Size, Profitability and Leverage display significance results. The firm size measure demonstrates a negative impact on Tobin's Q which is also statistically significant at 1% level for all measures of overconfidence used. On the other hand, the control variables of profitability and leverage have a positive relationship with firm value as it is expected. More precisely, profitability and leverage, maintain positive statistically significant at 1% level. This relationship, which survives for all the overconfidence measures used, indicates that Profitability and Leverage have a statistically significant impact on Firm Value.

Table 4 depicts the output of the regressions after I use the alternatives proxies. Compared to the previous table, the key differences are presented for the Low overconfidence measure when tested separately and for the high and modest overconfidence when both overconfident measures are included. The low overconfidence measure displays a negative statistical significant relationship with firm value at 5% level. Column (5) presents the results when both high and moderate overconfidence measures are used. As it can be seen in the table both high and modest overconfidence coefficients are positive and statistically significant at 10% and 5% level respectively.

Another alteration on the results compared to the previous table is presented by the proxy of Net Income/Total Assets. The specific alternative measure displays reveals a negative statistical significant relationship with firm value at 10%. The specific relationship survives for all the overconfidence measures used in the regressions. Additionally the Compensation of CEOs measure leads to a negative and statistical significant relationship at 1% level with the alternative measure of Tobin's Q. This negative relationship survives for all the overconfidence measures used in the model.

5.2.2. CEO Overconfidence and Leverage

Table 5 presents the results of the regressions between CEO overconfidence measures, leverage within firms and the control variables. The results do not reveal any statistical significance between the overconfidence measures and leverage of the firms. The signs of the coefficients reveal a positive relationship for the high overconfidence measures and leverage of the firms while low and modest overconfidence measures maintain negative signs. However, the results are not statistically significant thus, accurate conclusions for the Hypothesis 2: Leverage is lower when the CEO is overconfident and sub-hypothesis 2a: Leverage is lower when the CEO is moderately overconfident, cannot be derived.

The specific results are partially in alignment with expected predictions while existing literature documents that highly overconfident CEOs undervalue the financial distress costs. They underestimate the costs related to bankruptcy while simultaneously they want to profit from the tax shields by increasing the leverage of the firm. Behavioral literature assumes that overconfident CEOs overestimate their skills and projections about the future outcome, thus they overestimate the investment returns of their decisions. However, empirical studies try not only to predict which financial instrument is better but also the difference between internal and external funding. The negative impact can be attributed to debt conservatism. Debt conservatism indicates that CEOs are reluctant to issue debt to finance their projects. Malmendier et al (2011) document that there is a variation on behavioral traits by CEOs that derives from past experiences. These past experiences might alter the beliefs and preferences of CEOs.

Out of all the control variables used in the regressions three present statistical significance. More concretely, Market to Book ratio and Firm Size maintain positive and statistical significance at 1% level for all the overconfidence measures used. These two control variables can be translated as the bigger the firm is the more leverage CEOs choose to take on. This observation can be based on the fact that banks and debt investors are more likely to loan at big firms which most probably have more assets and greater cash flows to put as collaterals, thus it is easier for firms to increase their leverage compared to smaller firms and start-ups. Also Market to Book ratio is an indicator of how much the company is valued by the market over its actual value. The bigger the specific ratio the better evaluation the company maintain the easier it could be to increase the leverage within the firm.

Contrarily, liquidity, demonstrates negative and statistically significant relationship at 1% for all overconfidence measures. The negative sign of the liquidity control variable is in line with Pecking Order Theory, since empirically tested, firms prefer internal over external funds to finance their projects.

The model with the alternative proxies incorporated is not discussed within this thesis. The reason is that the output of the regressions produce similar results regarding the signs of the coefficients but all the results is statistically insignificant. Therefore it is not explained in more detail.

5.2.3. CEO Overconfidence and Investment

Table 6 displays the results of the regressions between overconfidence measures of CEOs, investment levels, and the control variables. The results presented in the table are used to test the hypothesis 3: Investment is higher when the CEO is overconfident and sub-hypothesis 3a: Investment is higher when the CEO is moderately overconfident.

As can be seen at the table high overconfident CEOs maintain a greater level of investment for their firms. More specifically, the measures of Holder67 and High OC maintain a positive and statistically significant coefficient with investment at 1%; 0.0192 and 0.0207 respectively. Moreover, the positive and statistically significant at 1% level relationship for high overconfident CEOs and investment level survives when both high and moderate overconfidence proxies are included within the regression and the output is presented in column (5). The positive coefficients of High OC and Moderate OC are in line with the existing literature. Overconfident CEOs underestimate financial distress costs and overvalue their own skills and projections. As a result, if firms maintain available internal funds, overconfident CEOs are more prone to overinvest.

On the other hand, Modest OC displays a negative statistically significant relationship at 1% with investment levels. The statistical negative coefficient of Modest OC, -0.0178, reveals that CEOs with a moderate level of overconfidence are not so prone to overinvestment. Based on the outcome of the specific table, hypothesis 3: Investment is higher when the CEO is overconfident is accepted. On the other hand, sub-hypothesis 3a: Investment is higher when the CEO is moderately overconfident is rejected.

The control variables used in the specific model present the expected signs according to existing literature. Firm size maintains a positive and statistically significant relationship at 1% with investment levels, which can be translated that the bigger a firm is the more prone its managers are to conduct overinvestment. CEO ownership regarding the percentage of shares

she possesses seems not to affect the investment decision since Ownership coefficients are positive but insignificant for all four overconfidence measures. In the contrast, dividend's coefficient has a negative impact on investment which is statistically significant at 1% as it was expected. Firms that pay dividends, distribute part of their profits to their shareholders that could be used for investment into new projects.

After using the alternative proxies in the model I observe some small alterations on the results, which are presented in Table 7. The coefficients of the overconfidence measures maintain the same signs and significance levels with the normal models; except when both high and moderate overconfidence measures are included where the output is still positive but statistically insignificant.

The control variables present some different results. More precisely, the log(Net Sales) has negative and statistically significant coefficients at 10%, for all overconfidence measures. Based on the normal model Firm Size maintains a positive statistically significant relationship with investment levels. However, after using the alternative proxies, this relationship becomes negative and statistically significant at 10% level of confidence. The explanation for this alteration lays in the nature of the specified proxy. The normal proxy used incorporated the logarithm of Total Assets, while the alternative proxy uses the logarithm of Net Sales. The logarithm of Total Assets presents the positive coefficients since large firms that maintain a lot of assets undertake more investment opportunities. On the other hand, the alternative proxy refers to the sales of each company achieves and there are chances of investment projects undertaken by CEOs not to create value for the company.

In addition, the measure of Ownership now maintains a positive and statistical significant relationship at 10% level compared to the insignificant coefficients of the normal proxy of Ownership. The coefficients of ownership reveal that the more skin on the firm the CEO maintains the more she wants to invest to create value for the company.

5.2.4. CEO Overconfidence and Research and Development

Table 8 shows the output of the regressions used to examine hypothesis 4: R&D expenses are higher when the CEO is overconfident and sub-hypothesis 4a: R&D is higher when the CEO is moderately overconfident.

The coefficients of interest do not reveal significance in their results. All the results produced from the regressions maintain statistical insignificant coefficients for the

overconfidence measures used within the models. The only exception is presented by the modest overconfidence measure that is used in the model which incorporates the alternative proxies, which is presented in Table 9. The specific measure maintains a positive and statistical significant relationship with the Research and Development expenses at 10% level. As a result accurate conclusions about the hypothesis cannot be derived and accept or reject the hypotheses.

The control variables used in regressions that test the hypothesis 4 and sub-hypothesis 4a reveal statistically significant coefficients in both models with normal and alternative proxies included. The firm value measured as of Tobin's Q, CEO ownership, and firm size demonstrate a positive statistically significant relationship with R&D expenses. Tobin's Q and Firm Size maintain positive and statistical significant relationship at 1% level for all the overconfidence measures used while CEO Ownership maintains the positive relationship at 5% level of significance. In the contrast, the availability of dividends, measured as the dummy variable, exhibits a negative relationship which is statistically significant at 5% level. The coefficients of the Dividend and Firm Size proxies display similar cases with investment results. Since Research and Development expense is included in investment opportunities as a different type of project it only seems logical to display similar results and signs. The statistically negative relationship remains significant for all different overconfidence measures of CEOs.

Table 9 presents the output after I investigate the specific relationship using the alternative proxies. The alternative proxies employed in the model do not display any significant alteration for the overconfidence measures used in the model that are the main coefficients of interest. However, I do observe some alterations on the control variables. More concretely, CEO Ownership now displays a negative relationship with R&D expenses which is statistically significant at 10% level compared to the positive relationship presented above. Moreover, log(Net Sales) presents a negative and statistical relationship which is also significant at 10% level too. Besides those two alterations on the coefficients of CEO Ownership and log(Net Sales), the only other change is presented by the Modest Overconfidence measure which is discussed above.

6. Conclusion

This study aims to shed light on the impact of CEO overconfidence on firm value, and intends to achieve that by examining the following research question:

What is the relationship between overconfident CEOs and firm value?

The research question is complemented with three additional hypotheses and sub-hypotheses that serve as further clarifications of the main research question. Behavioral literature reports how overconfident CEOs affect different corporate policies. The aim of the supplementary hypotheses therefore is to test the sovereign effects of CEO overconfidence on Leverage, Investment and R&D respectively and combine those effects into one framework to conclude the overall effect on firm value.

The direction of this study is on U.S firms; panel data is extracted from ExecuComp and Compustat and consists of 1.816 firms and 12.528 firm years for the period of 2006 to 2019. For the purpose of the specific study the CEO overconfidence is defined as an overestimation of the mean returns to investment projects and an underestimation of the risks associated.

The first hypotheses among with its sub hypothesis examine the relationship of overconfident CEOs and firm value. Accurate conclusions cannot be derived since the significance of the results does not allow it. Based on the results can be observed that Firm Size and Profitability seems to affect the most firm value.

Hypotheses 2 to 4 among with their sub-hypotheses are tested to shed light on the impact of CEO overconfidence on corporate policies. The second hypothesis in accordance with its sub-hypothesis examines the impact of CEO overconfidence on leverage levels of the firms. However, statistically significant results are not produce regarding overconfident CEOs. Based on the output generated Market to Book ration and Firm Size have a positive impact on leverage while Liquidity maintains a negative impact on firm's leverage.

Hypothesis 3 and 3a try to shed light in the relation between overconfident CEOs and investment. Results indicate that high overconfident CEOs maintain higher levels of investment. Moreover the bigger the firm is the more investments its managers conduct while the existence of dividends negatively affects investment.

Lastly, hypothesis 4 and 4a analyse the impact of overconfident CEOs on Research and Development expenses. In accordance with the results it can be stated that moderately overconfident CEOs increase R&D expenses. Moreover firm value maintains a positive relationship with R&D while the existence of dividends negatively affects R&D expenses.

This study concludes by answering the main research question:

What is the relationship between overconfident CEOs and firm value?

The results presented above are not significant, thus accurate conclusions cannot be derived. However, based on the signs of the results it can be speculated that high overconfident CEOs increase firm value while moderate and low overconfident CEOs harm firm value. Moreover highly overconfident CEOs are reluctant to increase the leverage levels of the firm; however, they manage to increase investment levels of their firms resulting to an increase of firm value. Lastly, the output regarding R&D development presents the opposite signs that were expected for the highly overconfident CEOs.

There might be two possible explanations for the specific fact. Firstly, the nature of the firms that consists the specific sample might have affected results. Many of the firms that are included in the sample are not characterized as innovative or technological companies thus it's logical not to maintain high levels of Research and Development expenses. Secondly, many of the firms that consist the sample do not report Research and Development expenses thus the data gathered were limited regarding the specific variable.

The results might be useful either for contracting and hiring incentives from the board of directors or to create incentives for further research on the specific area since existing literature is still under development. Furthermore the outputs of the regressions tested indicate that highly overconfident CEOs contribute to increase firm value through different policies and behaviors. Moreover, the board of directors might take into consideration conclusions deriving from that kind of researches when they make hiring decisions. Firms might be more inclined to aim their attention into hiring efforts to attract more overconfident managers. Lastly, many studies have been conducted to bring closer the incentives of managers and shareholders through different compensation packages like option-based compensation to mitigate unwanted behaviors of overconfident CEOs on corporate policies.

6.1. Limitations

The assumption of Malmendier and Tate (2005) that CEO beliefs can be based on their exercising behavior is important for this study. The authors document CEOs as overconfident if they hold vested options above a specific threshold, while economics laws forecast that they should diversify their options since they are exposed to idiosyncratic risk. However, this exercise behavior of CEOs can be altered by different motives that are not exclusively based on idiosyncratic risk. Since that kind of alternative motive is crucial for this study, I briefly discuss some cases that are strong enough to influence CEOs' motives either to hold or exercise early their options. Briefly, existing literature on CEOs' incentives documents that

the main benefits of exercising early are tax advantages and lower exposure to idiosyncratic risk. Malmendier and Tate (2005) support that rational CEOs' main incentive to exercise their options early is to decrease their exposure to idiosyncratic risk. However, disadvantages related to early exercise like loss of underlying value of the options through exercising the option and sell the stock should not be ignored.

Other explanations of the early exercise of the options by CEOs can be institutional constraints (Klein, 2011). Some examples of the specific phenomenon are blackout and vesting periods. Restrictions imposed on trading can significantly lessen the trading activity while the expiration of the vesting period can increase the exercise rates. Additional cases are the payment of dividends or employment termination. Another example of early exercise is a behavioral explanation that is related to anchoring. Literature empirically documents that the fluctuations of stock prices significantly affect CEO exercise behavior (Heath, 1999). The 52-week maximum and minimum stock price influence CEOs' decisions for exercising since their beliefs are anchored on the specific indicators. If the company's stock price is above the 52-week maximum CEO is more likely to exercise his options while he is less likely to exercise if the stock is trading below the 52-week minimum. The line of thinking imposed by Malmendier and Tate suggests that CEOs are classified as overconfident if they hold their options, however, their incentives might not be related to overconfidence. CEOs who exercise early can still be overconfident.

The second concern regarding the exercise behavior of CEOs that Malmendier and Tate (2005) present is the inside information. The authors argue in their paper that inside information is not an alternative explanation for the exercise behavior since CEOs who hold options in the money do not gain any abnormal returns. However, the authors do not account for negative inside information. If CEOs possess negative inside information, meaning they perceive stock price will fall, then their incentives are altered and they are more likely to sell their options even if the CEO is overconfident. As a result, an overconfident CEO with negative inside information is documented as non-overconfident. On the other hand, Bartov and Mohanram (2004) argue the other way around. The authors present evidence that CEOs with positive inside information hold their options in the money since they expect the stock price of the firm to rise even more. As a result CEOs with access to positive inside information are documented as overconfident even if they are not so.

Signaling is another explanation for the CEO's exercise behavior that Malmendier and Tate (2005) do not consider in their paper. The market takes into account the exercise behavior of the insiders of each company. If early exercise takes place then usually it is interpreted as

negative news. Empirical evidence suggests that after early exercise from insiders there is a decrease at stock price. This phenomenon can be related to the inside information discussed above. If the value of the option that is lost through the exercise is considered as great then the signal to the market that the CEO possesses negative information is analogous and the impact on the stock price is also negative. As a result, CEOs might be motivated to hold their options to avoid a negative signal to the market and a decrease in the company's stock price. Therefore, CEOs who act in that way might not be overconfident but on the contrary, might be under confident. Under confident and insecure CEOs in their efforts to protect the company's stock price are more likely to hold their options. Under confidence can explain the reluctance of CEOs to use external financing and conduct underinvestment due to their risk-averse profile. More research has to be conducted to shed light on the alternative motives of CEOs to hold or exercise their options.

Another limitation of this study is the endogeneity as reported by Malmendier and Tate (2005) and Hirshleifer et al., (2012). Firms might base their hiring decisions on overconfidence criteria and overconfident CEOs might apply at companies with higher value; as a result, CEO overconfidence is not an exogenous variable. Some of the control variables used in the models alleviate partially the endogeneity concerns.

7. Appendix

Table 1: Overview of the Variables

Table 1: Overview of the Variables	
Control Variables	Description
Firm size	$\text{Log}(\text{Total Assets})$
Profitability	$\frac{\text{Operating Income Before Depreciation}}{\text{Book Value Of Assets}}$
Leverage	$\frac{\text{Total Long Term Debt} + \text{Total Debt in Current Liabilities}}{\text{Total Assets}}$
Dividend	Dummy variable if company pays dividends, then Dividends Dummy=1
CEO Ownership	Percentage of Total Shares Owned by the CEO
Liquidity	$\frac{\text{Total Current Assets}}{\text{Total Current Liabilities}}$
Market to Book Ratio	$\frac{(\text{Market Value of Equity} + \text{Long Term Debt} + \text{Preferred Liquidation Value of Equity} - \text{Deferred Taxes})}{\text{Total Assets}}$
CEO Compensation	$\text{Log}(\text{Total compensation including option grants})$
Investment	$\frac{(\text{Capital Expenditures} + \text{Increase in Investments} + \text{Acquisitions} - \text{Sale of Property} - \text{Sale of Investments})}{\text{Total Assets}}$
R&D	R&D Expenditures
Tobin's Q	$\frac{\text{Market Value Of Assets}}{\text{Book Value of Assets}}$
Market Value of Assets	$\text{Log}(\text{Total Assets} + \text{Market Value of Equity} - \text{Book Value of Equity})$
Market Value of Equity	$\text{Log}(\text{Number of Common Shares Outstanding} * \text{Stock Price at Fiscal Year End})$
Book Value of Equity	$\text{Log}(\text{Stockholder's Equity} - \text{Preferred stock at liquidating value} + \text{B/S deferred taxes and investment tax credit})$
Book Value of Assets	$\text{Log}(\text{Total Assets})$
Tobin's Q Alt	$\frac{\text{Market Value of Assets}}{\text{Total Assets}}$
Market Value of Assets	$\text{Log}(\text{Market Value of Equity} + \text{Preferred Stock at Liquidating Value} + \text{Debt})$
Debt	$\text{Log}(\text{Total Debt in Current Liabilities} + \text{Total Inventories} + \text{Total Long - Term Debt} - \text{Total Current Assets})$
Firm Size Alt	$\text{Log}(\text{Net Sales})$
Profitability Alt	$\frac{\text{Net Income}}{\text{Total Assets}}$
Leverage Alt	$\frac{\text{Total Long Term Debt}}{\text{Stockholder's Equity}}$
Investment Alt	$\frac{\text{Capital Expenditures}}{\text{Total Assets}}$
R&D Alt	$\frac{\text{R\&D Expenditures}}{\text{Total Assets}}$

Table 2: Descriptive Statistics

Table 2 depicts the number of observations, means, standard deviations, and minimum and maximum values of the dependent, independent, and control variables of this study. A variable name followed with the abbreviation Alt indicates an alternative proxy of that variable.

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
Holder 67	12528	.413	.492	0	1
High OC	12528	.289	.453	0	1
Low OC	12528	.037	.189	0	1
Modest OC	12528	.674	.469	0	1
Tobin's Q	11341	1	.002	.98	1.174
<i>$\frac{\text{Market Value of Assets}}{\text{Total Assets}}$</i>	4597	.002	.004	0	.108
Liquidity	12240	2.55	2.221	.105	68.592
MB	11636	.191	.215	-.245	3.863
Firm Size	12528	7.631	1.662	1.575	13.587
Log(Net Sales)	12494	7.481	1.71	-3.5413	.089
Profitability	12506	121.185	303.838	-306.194	6376.502
<i>$\frac{\text{Net Income}}{\text{Total Assets}}$</i>	12508	.054	.109	-2.556	.902
Leverage	12194	.423	.242	.014	4.271
<i>$\frac{\text{Total Long Term Debt}}{\text{Stockholder's Equity}}$</i>	12473	.58	17.169	-776.587	867.25
Dividend	12441	.51	.5	0	1
Ownership	11112	1.798	4.844	0	79.47
Compensation	12524	8.297	1.031	-6.908	11.809
Investment	8207	.081	.108	-.863	3.514
<i>$\frac{\text{Capital Expenditures}}{\text{Total Assets}}$</i>	12496	.047	.052	0	.715
RD	8636	263.9	884.437	0	12740
<i>$\frac{\text{R\&D Expenditures}}{\text{Total Assets}}$</i>	8636	.054	.077	0	.958

Table 3: CEO Overconfidence and Firm Value

Table 3 depicts the OLS regression results for four regressions where the dependent variable is Tobin's Q, and the independent variables are the four overconfidence measures; Holder 67, High OC, Low OC, and Modest OC. All four overconfident measures are dummy variables. Across all models industry fixed and year fixed effects have been implemented. Standard errors are clustered at firm level. Columns 1-4 report results of the regressions that produced after the four different overconfidence measures are included. Column 5 reports the results after both Modest and High OC are included. The coefficients are reported with *, **, and *** which stand for the significance levels of 10%, 5%, and 1% respectively. The corresponding t-statistics are displayed in parentheses below the reported coefficient.

	(1)	(2)	(3)	(4)	(5)
Variables	Tobin's Q	Tobin's Q	Tobin's Q	Tobin's Q	Tobin's Q
Holder 67	0.000130 (9.56e-05)				
High OC		6.75e-05 (0.000100)			0.000163 (0.000111)
Modest OC				-4.19e-05 (9.29e-05)	0.000101 (8.62e-05)
Low OC			-0.000117 (8.18e-05)		
Firm Size	-0.000967*** (0.000211)	-0.000970*** (0.000212)	-0.000971*** (0.000210)	-0.000971*** (0.000212)	-0.000969*** (0.00021)
Profitability	3.21e-06*** (8.15e-07)	3.22e-06*** (8.18e-07)	3.22e-06*** (8.13e-07)	3.22e-06*** (8.19e-07)	3.22e-06*** (8.18e-07)
Leverage	0.00248*** (0.000728)	0.00247*** (0.000724)	0.00246*** (0.000730)	0.00246*** (0.000724)	0.00247*** (0.000724)
Dividend	0.000123 (7.94e-05)	0.000120 (7.66e-05)	0.000114 (8.15e-05)	0.000118 (7.68e-05)	0.000120 (7.64e-05)
Ownership	5.81e-06 (1.35e-05)	6.20e-06 (1.35e-05)	6.59e-06 (1.31e-05)	6.42e-06 (1.34e-05)	6.16e-06 (1.35e-05)
Compensation	1.91e-05 (9.99e-05)	2.43e-05 (9.97e-05)	2.68e-05 (9.96e-05)	2.57e-05 (9.96e-05)	2.41e-05 (9.99e-05)
Investment	0.000476 (0.000892)	0.000503 (0.000892)	0.000526 (0.000865)	0.000514 (0.000887)	0.000503 (0.000892)
Constant	1.006*** (0.00228)	1.007*** (0.00229)	1.007*** (0.00227)	1.007*** (0.00224)	1.007*** (0.00229)
Observations	6,507	6,507	6,507	6,507	6,507
R-squared	0.127	0.127	0.127	0.127	0.127
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Table 4: CEO Overconfidence and Firm Value Alternative Proxies

Table 4 depicts the OLS regression results for four regressions where the dependent variable is Tobin's Q , and the independent variables are the four overconfidence measures; Holder 67, High OC, Low OC, and Modest OC. All four overconfident measures are dummy variables. Across all models industry fixed and year fixed effects have been implemented. Standard errors are clustered at firm level. Columns 1-4 report results of the regressions that produced after the four different overconfidence measures are included. Column 5 reports the results after both Modest OC and High OC are included. The coefficients are reported with *, **, and *** which stand for the significance levels of 10%, 5%, and 1% respectively. The corresponding t -statistics are displayed in parentheses below the reported coefficient.

	(1)	(2)	(3)	(4)	(5)
Variables	$\frac{\text{Market Value of Assets}}{\text{Total Assets}}$	$\frac{\text{Market Value of Assets}}{\text{Total Assets}}$	$\frac{\text{Market Value of Assets}}{\text{Total Assets}}$	$\frac{\text{Market Value of Assets}}{\text{Total Assets}}$	$\frac{\text{Market Value of Assets}}{\text{Total Assets}}$
Holder 67	0.000120 (0.000162)				
High OC		0.000207 (0.000178)			0.000495* (0.000265)
Modest OC				-0.000124 (0.000145)	0.000304** (0.000146)
Low OC			-0.000352** (0.000167)		
Log(Net Sales)	-0.00102*** (0.000103)	-0.00102*** (0.000103)	-0.00102*** (0.000103)	-0.00102*** (0.000103)	-0.00102*** (0.000103)
$\frac{\text{Net Income}}{\text{Total Assets}}$	-0.00893* (0.00537)	-0.00897* (0.00536)	-0.00885* (0.00527)	-0.00890* (0.00533)	-0.00898* (0.00536)
$\frac{\text{Total Long Term Debt}}{\text{Stockholder's Equity}}$	-1.00e-06 (6.61e-07)	-9.97e-07 (6.55e-07)	-9.86e-07 (6.58e-07)	-1.01e-06 (6.67e-07)	-9.74e-07 (6.47e-07)
Dividend	0.000201 (0.000180)	0.000206 (0.000181)	0.000193 (0.000175)	0.000201 (0.000180)	0.000205 (0.000181)
Ownership	1.65e-05 (2.90e-05)	1.59e-05 (2.92e-05)	1.69e-05 (2.88e-05)	1.63e-05 (2.91e-05)	1.59e-05 (2.92e-05)
Compensation	-0.000479*** (0.000119)	-0.000480*** (0.000118)	-0.000474*** (0.000115)	-0.000477*** (0.000117)	-0.000481*** (0.000119)
$\frac{\text{Capital Expenditures}}{\text{Total Assets}}$	0.000193 (0.00226)	0.000145 (0.00226)	0.000253 (0.00231)	0.000204 (0.00228)	0.000137 (0.00226)
Constant	0.0134*** (0.00107)	0.0134*** (0.00107)	0.0135*** (0.00110)	0.0135*** (0.00114)	0.0131*** (0.00102)
Observations	4,011	4,011	4,011	4,011	4,011
R-squared	0.346	0.346	0.346	0.346	0.346
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Table 5: CEO Overconfidence and Leverage

Table 5 depicts the OLS regression results for four regressions where the dependent variable is Leverage, and the independent variables are the four overconfidence measures; Holder 67, High OC, Low OC, and Modest OC. All four overconfident measures are dummy variables. Across all models industry fixed and year fixed effects have been implemented. Standard errors are clustered at firm level. Columns 1-4 report results of the regressions that produced after the four different overconfidence measures are included. Column 5 reports the results after both Modest and High OC are included. The coefficients are reported with *, **, and *** which stand for the significance levels of 10%, 5%, and 1% respectively. The corresponding t-statistics are displayed in parentheses below the reported coefficient.

	(1)	(2)	(3)	(4)	(5)
Variables	Leverage	Leverage	Leverage	Leverage	Leverage
Holder 67	0.00245 (0.00263)				
High OC		0.00373 (0.00277)			0.00744 (0.00499)
Modest OC				-0.00259 (0.00248)	0.00390 (0.00420)
Low OC			-0.00478 (0.00425)		
Tobin's Q	-0.0832 (0.985)	-0.0815 (0.986)	-0.0754 (0.987)	-0.0787 (0.987)	-0.0821 (0.986)
Dividend	0.00400 (0.00427)	0.00414 (0.00427)	0.00384 (0.00429)	0.00402 (0.00427)	0.00414 (0.00427)
Liquidity	-0.0250*** (0.00291)	-0.0250*** (0.00291)	-0.0250*** (0.00291)	-0.0250*** (0.00291)	-0.0250*** (0.00291)
MB	0.833*** (0.0136)	0.833*** (0.0136)	0.833*** (0.0135)	0.833*** (0.0136)	0.833*** (0.0136)
Firm Size	0.00837*** (0.00174)	0.00841*** (0.00174)	0.00837*** (0.00174)	0.00837*** (0.00174)	0.00842*** (0.00174)
Constant	0.451 (1.010)	0.449 (1.011)	0.445 (1.011)	0.450 (1.011)	0.446 (1.011)
Observations	10,988	10,988	10,988	10,988	10,988
R-squared	0.778	0.778	0.778	0.778	0.778
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Table 6: CEO Overconfidence and Investment

Table 6 depicts the OLS regression results for four regressions where the dependent variable is Investment, and the independent variables are the four overconfidence measures; Holder 67, High OC, Low OC, and Modest OC. All four overconfident measures are dummy variables. Across all models industry fixed and year fixed effects have been implemented. Standard errors are clustered at firm level. Columns 1-4 report results of the regressions that produced after the four different overconfidence measures are included. Column 5 reports the results after both Modest OC and High OC are included. The coefficients are reported with *, **, and *** which stand for the significance levels of 10%, 5%, and 1% respectively. The corresponding t-statistics are displayed in parentheses below the reported coefficient.

	(1)	(2)	(3)	(4)	(5)
Variables	Investment	Investment	Investment	Investment	Investment
Holder 67	0.0192*** (0.00284)				
High OC		0.0207*** (0.00329)			0.0224*** (0.00580)
Modest OC				-0.0178*** (0.00312)	0.00181 (0.00540)
Low OC			-0.00743 (0.00530)		
Tobin's Q	0.559 (0.896)	0.588 (0.878)	0.624 (0.843)	0.601 (0.868)	0.587 (0.878)
Dividend	-0.0125*** (0.00314)	-0.0120*** (0.00317)	-0.0140*** (0.00320)	-0.0122*** (0.00318)	-0.0120*** (0.00317)
Ownership	0.000156 (0.000294)	0.000134 (0.000298)	0.000260 (0.000296)	0.000166 (0.000297)	0.000133 (0.000298)
Firm Size	0.00326*** (0.00119)	0.00338*** (0.00119)	0.00322*** (0.00120)	0.00324*** (0.00119)	0.00339*** (0.00119)
Constant	-0.578 (0.900)	-0.607 (0.882)	-0.632 (0.848)	-0.599 (0.873)	-0.608 (0.883)
Observations	6,689	6,689	6,689	6,689	6,689
R-squared	0.075	0.075	0.075	0.075	0.075
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Table 7: CEO Overconfidence and Investment Alternative Proxies

Table 7 depicts the OLS regression results for the four regressions where the dependent variable is Investment and the independent variables are the four overconfidence measures; Holder 67, High OC, Low OC, and the Modest OC. All four overconfident measures are dummy variables. Across all models industry fixed and year fixed effects have been implemented. Standard errors are clustered at firm level. Columns 1-4 report results of the regressions that produced after the four different overconfidence measures are included. Column 5 reports the results after both Modest OC and High OC are included. The coefficients are reported with *, **, and *** which stand for the significance levels of 10%, 5%, and 1% respectively. The corresponding t-statistics are displayed in parentheses below the reported coefficient.

	(1)	(2)	(3)	(4)	(5)
Variables	$\frac{\text{Capital Exp}}{\text{Total Assets}}$	$\frac{\text{Capital Exp}}{\text{Total Assets}}$	$\frac{\text{Capital Exp}}{\text{Total Assets}}$	$\frac{\text{Capital Exp}}{\text{Total Assets}}$	$\frac{\text{Capital Exp}}{\text{Total Assets}}$
Holder 67	0.00604*** (0.00203)				
High OC		0.00659*** (0.00245)			0.00382 (0.00268)
Modest OC				-0.00544** (0.00217)	0.00156 (0.00457)
Low OC			-0.00327 (0.00465)		
$\frac{\text{Market Value of Assets}}{\text{Total Assets}}$	-0.117 (0.380)	-0.133 (0.383)	-0.140 (0.387)	-0.128 (0.382)	-0.134 (0.383)
Dividend	-0.00298 (0.00284)	-0.00290 (0.00283)	-0.00320 (0.00285)	-0.00294 (0.00284)	-0.00291 (0.00284)
Ownership	0.000674* (0.000363)	0.000659* (0.000362)	0.000691* (0.000369)	0.000665* (0.000363)	0.000660* (0.000363)
Log(Net Sales)	-0.00241* (0.00132)	-0.00238* (0.00132)	-0.00246* (0.00133)	-0.00240* (0.00132)	-0.00237* (0.00132)
Constant	0.0293*** (0.0107)	0.0297*** (0.0108)	0.0332*** (0.0111)	0.0354*** (0.0111)	0.0283*** (0.0111)
Observations	4,011	4,011	4,011	4,011	4,011
R-squared	0.539	0.539	0.539	0.539	0.539
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Table 8: CEO Overconfidence and R & D

Table 8 depicts the OLS regression results for the four regressions where the dependent variable is R&D and the independent variables are the four overconfidence measures; Holder 67, High OC, Low OC, and the Modest OC. All four overconfident measures are dummy variables. Across all models industry fixed and year fixed effects have been implemented. Standard errors are clustered at firm level. Columns 1-4 report results of the regressions that produced after the four different overconfidence measures are included. Column 5 reports the results after both Modest OC and High OC are included. The coefficients are reported with *, **, and *** which stand for the significance levels of 10%, 5%, and 1% respectively. The corresponding t-statistics are displayed in parentheses below the reported coefficient.

	(1)	(2)	(3)	(4)	(5)
Variables	RD	RD	RD	RD	RD
Holder 67	-28.80 (28.83)				
High OC		-17.40 (29.28)			11.82 (37.81)
Modest OC				-3.318 (23.97)	-119.5 (82.68)
Low OC			122.5 (84.81)		
Tobin's Q	51,465*** (12,204)	51,368*** (12,226)	51,290*** (12,135)	51,246*** (12,167)	51,364*** (12,205)
Dividend	-64.38** (28.95)	-63.62** (28.81)	-62.58** (29.14)	-61.86** (28.76)	-63.63** (28.78)
Ownership	8.893** (3.814)	8.798** (3.822)	8.722** (3.741)	8.594** (3.795)	8.844** (3.830)
Firm Size	297.6*** (42.93)	297.5*** (42.79)	297.4*** (42.84)	297.7*** (42.92)	297.3*** (42.69)
Constant	-52,759*** (12,541)	-52,668*** (12,562)	-52,595*** (12,475)	-52,553*** (12,511)	-52,543*** (12,515)
Observations	6,862	6,862	6,862	6,862	6,862
R-squared	0.292	0.292	0.293	0.292	0.293
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Table 9: CEO Overconfidence and R&D Alternative Proxies

Table 9 depicts the OLS regression results for the four regressions where the dependent variable is R&D and the independent variables are the four overconfidence measures; Holder 67, High OC, Low OC, and the Modest OC. All four overconfident measures are dummy variables. Across all models industry fixed and year fixed effects have been implemented. Standard errors are clustered at firm level. Columns 1-4 report results of the regressions that produced after the four different overconfidence measures are included. Column 5 reports the results after both Modest OC and High OC are included. The coefficients are reported with *, **, and *** which stand for the significance levels of 10%, 5%, and 1% respectively. The corresponding t-statistics are displayed in parentheses below the reported coefficient.

	(1)	(2)	(3)	(4)	(5)
Variables	<i>RD Exp.</i>	<i>RD Exp.</i>	<i>RD Exp.</i>	<i>RD Exp.</i>	<i>RD Exp.</i>
	<i>Total Assets</i>	<i>Total Assets</i>	<i>Total Assets</i>	<i>Total Assets</i>	<i>Total Assets</i>
Holder 67	-0.00324 (0.00242)				
High OC		-0.00350 (0.00223)			-0.00197 (0.00327)
Modest OC				0.00354* (0.00201)	0.00297 (0.00291)
Low OC			-0.00218 (0.00288)		
Market Value of Assets <i>Total Assets</i>	1.803* (0.997)	1.816* (1.002)	1.814* (1.005)	1.813* (1.002)	1.814* (1.002)
Dividend	-0.0120*** (0.00307)	-0.0120*** (0.00309)	-0.0119*** (0.00308)	-0.0120*** (0.00309)	-0.0120*** (0.00309)
Ownership	-0.000481* (0.000254)	-0.000476* (0.000252)	-0.000493* (0.000253)	-0.000478* (0.000252)	-0.000477* (0.000253)
Log(Net Sales)	-0.00377* (0.00205)	-0.00378* (0.00206)	-0.00371* (0.00206)	-0.00377* (0.00206)	-0.00378* (0.00206)
Constant	0.0374** (0.0160)	0.0374** (0.0162)	0.0359** (0.0162)	0.0338** (0.0159)	0.0344** (0.0159)
Observations	2,427	2,427	2,427	2,427	2,427
R-squared	0.260	0.260	0.259	0.260	0.260
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

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