TILBURG UNIVERSITY

CEO overconfidence and firm performance

Bachelor thesis finance

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Abstract

This paper investigates the influence of CEO overconfidence on firm performance over the 2005 – 2010 period. Using an options-based measure for CEO overconfidence (Malmendier and Tate, 2005), I find that overconfidence has a positive influence on firm performance, measured by Tobin's Q and ROA. By investigating the relationship during the crisis, I find that the effect of overconfidence on Tobin's Q is positive, but decreases compared to the years before the crisis. The influence of low overconfidence on firm performance is negative, while the effect of high overconfidence is positive.

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1. Introduction

The last decades have shown a considerable increase of interest in behavioral finance. Ricciardi and Simon (2000) describe the behavioral finance theory as a field that attempts to explain how the emotions and mental mistakes of investors influence their decision making process. Essentially, behavioral finance studies the effect of psychological and sociological factors on the financial actions and performance of "practitioners" (all types of investors) and the subsequent effect on markets (Shefrin, 2000).

Traditional finance is based on three concepts; rational behavior, the capital asset pricing model (CAPM), and the efficient market hypothesis. However, these assumptions cannot stand in the 'real world' because of market frictions and other imperfections. Psychological and sociological forces interfere with all three components of the traditional paradigm (Shefrin, 2001). This paper focuses on the idea of behavioral finance that the behavior of investors and managers is not fully rational. Research in behavioral finance on this topic takes two approaches. The first approach emphasizes that investors are less than fully rational, the second emphasizes that managers are less than fully rational. The latter approach, the irrational manager model, studies the influence of nonstandard preferences and judgmental biases - unreasoned judgments or prejudices - on CEO decisions (Baker, Ruback, and Wurgler, 2007). Two particular biases that managers may be prone to are overconfidence and optimism. Most papers uses overconfidence optimism and interchangeably. Ben-David, Graham and Harvey (2007) define overconfidence as a general miscalibration in beliefs. CEOs overestimate their own judgmental precision and underestimate the variance of random processes. However, Gervais, Heaton and Odean (2002) distinguish overconfidence from optimism. Gervais et al. define optimism as the belief that favorable future events are more likely than they actually are, and define overconfidence as the belief that the precision of one's information is greater than it actually is. Also Hackbarth (2008) makes a distinction between overconfidence and optimism by introducing the 'risk perception bias' and the 'growth perception bias'. Overconfident managers underestimate the riskiness of earnings (risk perception bias), while optimistic managers overestimate the growth rate of earnings (growth perception bias).

This paper focuses on CEOs who are overconfident by following the definition of Malmendier and Tate (2005). Malmendier and Tate define CEOs as overconfident when they

overestimate the expected returns of their corporate policy.[1] Hence, overconfidence and optimism are used interchangeably in this study.

In the last few years many researchers have identified important effects of CEO overconfidence; particularly the influence of overconfidence on dividends, investments and on mergers and acquisitions. For the effect of overconfidence on dividends Deshmukh, Goel and Howe (2012) find that the level of dividend payout is lower in firms managed by overconfident CEOs. The influence of overconfidence on investments is first studied by Malmendier and Tate. Malmendier and Tate (2005) find that, between 1980 and 1994, investment of overconfident CEOs is significantly more responsive to cash flow, particularly in equity-dependent firms. Hirshleifer, Teoh and Low (2010) find that, from 1993 to 2003, firms with overconfident CEOs have greater return volatility, invest more in innovation, obtain more patents and patent citations, and achieve greater innovative success for given research and development expenditures. For the relationship between overconfidence and mergers and acquisitions Malmendier and Tate (2008) find that, using a sample of firms from 1980 to 1994, overconfident CEO's are more likely to undertake diversifying mergers, which are unlikely to create value on average, than rational managers. However, there has been little empirical analysis of the relationship between overconfident CEOs and the general performance of the firm. Fairchild (2005) suggests that future research could develop further the analysis of this relationship. In this study I want to examine whether CEO overconfidence influences firm performance. This leads to the following question:

What is the relationship between CEO overconfidence and firm performance?

This paper focuses on firms in the United States using a sample from 2005 to 2010. First, the influence of CEO overconfidence on firm performance is tested. Within the time frame the relationship between CEO overconfidence and firm performance during the crisis is also investigated. Furthermore, the relationship is tested for high versus low overconfidence. Firm performance is measured with Tobin's Q and return on assets (ROA). Financial data that is needed for calculating these measures is retrieved from the Compustat database. The measure for CEO overconfidence is Holder67 (Malmendier and Tate, 2005). Holder67 indentifies CEO

[1] Malmendier and Tate classify a CEO as overconfident if the answer to one of the following questions is 'yes':
• Does the CEO hold his options beyond a theoretically calibrated benchmark for exercise?
• Does the CEO hold his options even until the last year before expiration?
• Does the CEO habitually buy stock of his company during the first five sample years?

overconfidence based upon the timing of the CEO's option exercise behavior. CEOs are classified as overconfident when they do not exercise stock options in their own firms that are more than 67% in-the-money. These in-the-money options are worth being exercised, but the overconfident CEOs overestimate the expected returns of their corporate policy. Hence, the CEOs are overconfident in their ability to keep the stock price of their company rising. The data that is needed for calculating the overconfidence measures is collected from the ExecuComp database.

This study contributes to the extant literature on CEO overconfidence and firm performance. Slothouber (2010) tests the relationship between overconfidence and firm value for the period from 2006 to 2009. Hirshleifer et al. (2010) find that there is a positive relationship between overconfidence – using an option-based overconfidence measure – and firm performance from 1993 to 2003. However, this paper examines the relationship for the years 2005 to 2010 and investigates the relationship during the crisis. Hirshleifer et al. do not relate their results to the crisis (e.g. the Internet bubble 2001 – 2003), neither does Slothouber. Consequently, this paper provides much unique and recent information. Furthermore, understanding how CEO overconfidence can affect firm performance can provide valuable insights that may help predict the extent to which firms might hire certain overconfident CEOs.

The rest of this paper is organized in the following way. In section 2 the literature on the research question is reviewed. In the 3rd section the model, variables and data used are described. In section 4 the empirical results are presented. The 5th section concludes.

2. Literature review

Malmendier and Tate (2005) identify three different measures of overconfidence, Holder67, Longholder, and Net buyer. Holder67 identifies managers as overconfident when they do hold options beyond a theoretically calibrated benchmark for exercise. Longholder defines managers as overconfident when they do hold options even until the last year before expiration. Net buyer classifies managers as overconfident when they do habitually buy stock of their company during the five first years sample years. This paper only focuses on managers who hold options beyond a theoretically calibrated benchmark (Holder67). Malmendier and Tate take 67% as the benchmark, this choice comes from calibrating Hall and Murphy's (2002) model using a detailed dataset on executive stock option holdings and exercises. This model recognizes that risk-averse executives typically hold undiversified portfolios and should exercise options early if they are rational expected utility maximizers (Campbell, Gallmeyer, Johnson, Rutherford, and Stanley, 2011). Following Malmendier and Tate, this paper takes 67% as benchmark. If a CEO persistently exercises options later than suggested by this benchmark, the CEO overestimates his ability to keep the company's stock price rising and wants to benefit from the increase in the stock price.

The last decade has shown different explanations of CEO overconfidence. The better-than-average effect has an important link to CEO overconfidence (Alicke, Klotz, Breitenbecher, Yurak and Vredenburg, 1995). People maintain unrealistically positive images of themselves relative to others. In this respect, the better-than-average effect can be viewed as a type of self-serving bias in which people evaluate their behaviors, opinions, characteristics, and prospects more favorably than those of others. Furthermore, Weinstein (1980) shows that individuals tend to be more optimistic about outcomes to which they are highly committed. Gilson (1989) finds that managers are highly committed to the performance of the firm because their personal wealth, reputation, and employability are highly depending on it. These explanations provide foundations of the impact of CEO overconfidence on corporate decisions.

Research during the last decade has established that CEO overconfidence affects firm performance by influencing corporate policies and decisions. (Slothouber, 2010). Fairchild (2005) shows that CEO overconfidence leads to higher leverage, which causes higher

financial distress costs and leads to discounts on risky debt and equity. This indicates a negative relationship between overconfidence and firm performance. However, Fairchild demonstrates that CEO overconfidence is not necessarily bad for shareholders. Higher leverage leads to high effort levels, thereby increasing firm performance. Goel and Thakor (2008) find that the effect of CEO overconfidence on firm performance is positive because overconfidence leads risk averse managers to move investment to the optimal level. Gervais et al. (2002) find that overconfidence aligns the decisions of managers with the interests of shareholders, and motivates managers to expend more effort. Gervais et al. conclude that overconfidence may affect manager's behavior, in addition to influencing capital budgeting decisions and effort, in other ways that benefit the firm. Shareholders may be better off hiring moderately overconfident CEOs than paying rational managers additional incentives to change their decisions patterns. Shareholders may even prefer overconfident managers to rational managers who have more ability. Hirshleifer et al. (2010) study the effect of CEO overconfidence on firm performance. Hirshleifer et al. show that overconfident managers improve innovation, which may suggest that overconfidence CEOs do not necessarily harm firm value or profitability. Therefore, Hirshleifer et al. examine the effect of overconfidence on future Q, ROA and log(sales). Using the option-based overconfidence measure Holder67, Hirshleifer et al. find that, over the 1993 – 2003 period, there is a positive relationship between overconfidence and firm value.

There are clear signs that CEO overconfidence has more advantages than disadvantages for the firm. The hypothesis to test these inferences is as follows:
Hypothesis 1: Firm performance is positively influenced by CEO overconfidence.

The relationship between CEO overconfidence and firm performance during the crisis from 2008 to 2009 is not examined in current literature. However, Kaniel, Massey and Robinson (2010) show that dispositional optimism dropped as a result of the financial crisis of 2008. Kaniel et al. conclude that dispositional optimism may largely be a fixed personality trait, but is still subject to situational influence. Malmendier and Nagel (2011) investigate whether individual experiences of macroeconomic shocks affect financial risk taking. Malmendier and Nagel find evidence that individuals who have experienced low stock market returns throughout their lives so far are more pessimistic about future stock returns. Furthermore, past economic shocks have a long-lasting effect on individual risk aversion and deter risky financial investment decisions such as stock-market participation. Mueller (n.d.) empirically

tests whether companies under overconfidence CEOs show a more pronounced business cycle-sensitivity of investment than rational CEOs. Mueller finds a significant and positive relationship between CEO overconfidence and investment in the early expansion phase of the business cycle, but no effects in later downturn phases. The results in the expansion phase indicate higher and earlier investment under overconfident management along the path of economic development. This investment could thereby increasing firm performance.

There are signs that CEO overconfidence increases firm performance in the expansion phase of the business cycle and that CEO overconfidence drops as a result of the financial crisis. The hypothesis to test these inferences is as follows:
Hypothesis 2: Compared to 2006 and 2007, firm performance is negatively influenced by CEO overconfidence during the crisis.

Ye and Yuan (2008) provide evidence on the interrelationships among firm value, investments, and CEO confidence in Chinese firms. Ye and Yuan show that there may be an optimal level of CEO confidence. When this optimal level is not reached yet, CEO self-confidence brings more benefits. However, beyond this optimal level, overconfidence cause inefficient investments and may harm firm value. Hackbarth (2008) find that mildly biased managers can enhance firm value for two reasons. First, because higher debt levels restrain managers from diverting discretionary funds, mildly biased managers unknowingly mitigate manager-shareholder conflicts over payout policy, leading to better firm performance. Second, though higher debt levels generally delay irreversible investments, mildly biased managers' investment decisions can reduce this bondholder-shareholder conflict over investment policy, permitting better firm performance. However, Hackbarth find that extreme CEO biases are detrimental to the firm. Campbell et al. (2011) show that a moderate level of CEO optimism can lead the CEO to choose a first-best investment level. Optimism below the optimum level leads the risk-averse CEO to underinvest, while optimism above the optimum level leads the CEO to overinvest. Goel and Thakor (2008) study theoretically the effects of three levels of CEO confidence – excessive diffidence (low confidence), moderate overconfidence, and excessive overconfidence – on investment policy and firm value. Goel and Thakor conclude that moderate levels of overconfidence increase firm value, because these levels of overconfidence cause the decision making of risk-averse CEOs to approach that of a risk neutral CEO. Excessively overconfident CEOs reduce firm value because they overestimate the precision of their information, underinvest in information acquisition and

therefore overinvest in projects. Excessively diffident CEOs also reduce firm value because they reject profitable projects that would have increased shareholder wealth. This implies that there would be an optimal amount of overconfidence for CEO's, and that both low and high CEO overconfidence have a negative influence on firm value.

There are clear signs that both high and low CEO overconfidence have more negative than positive influence on firm performance. To examine the inferences discussed the following hypothesis is tested:
Hypothesis 3: Firm performance is negatively influenced by high and low CEO overconfidence

The three hypotheses stated in this section lead to answering the research question of this paper: *What is the relationship between CEO overconfidence and firm performance?*

3. Methodology

3.1. Model

Figure 1 represents the model used in this paper. The independent variable of this study is CEO overconfidence, measured by Holder67, and by high overconfidence and low overconfidence. The dependent variable is firm performance, measured by Tobin's Q and ROA. The control variables used in this study are firm size, CEO ownership and CEO compensation.

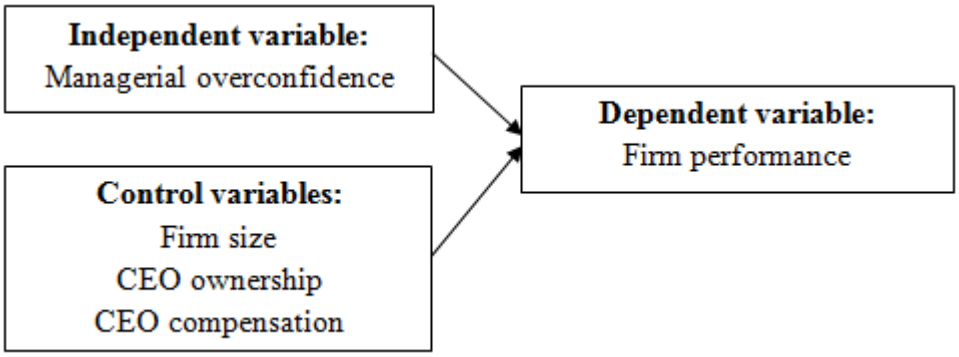

Figure 1: Model

This model cannot stand in the 'real world', because CEO overconfidence affects firm size, CEO ownership and CEO compensation as well. However, these imperfections are not taken into account in this study, but can influence the results.

3.2. Variables

Measuring firm value

Tobin's Q and ROA are the primary performance measures for this paper. Tobin's Q is the generally accepted measure for firm value in finance literature (Chung and Pruitt, 1994), ROA is a measure of profitability. Lei and Song (2011) calculate Tobin's Q as the market value of total assets divided by the book value of total assets. The market value of total assets is defined as the market value of common stock plus the preferred stock plus debt. The market value of common stock is defined as the number of common shares outstanding times the stock price at fiscal year end. Debt is defined as long term debt plus inventories plus current liabilities minus current assets.

$$Tobin's\ Q = \frac{market\ value\ of\ common\ stocks + preferred\ stocks + LT\ debt + inventories + current\ liabilities - current\ assets}{book\ value\ of\ total\ assets}$$

For this paper, ROA is calculated as the earnings before interest, tax, depreciation, and amortization (EBITDA) divided by the book value of total assets.

$$ROA = \frac{EBITDA}{book\ value\ of\ total\ assets}$$

Measuring CEO overconfidence

For *Hypothesis 1* and *Hypothesis 2* the measure of CEO overconfidence, Holder67, is defined by following Malmendier and Tate (2005). Malmendier and Tate uses proprietary data, hence it is not possible to construct the exact same measure using data gathered from the ExecuComp database that is used in this study. The construction of Malmendier and Tate using stock option data in ExecuComp is validated by Campbell et al. (2011) validate the construction of Malmendier and Tate. Campbell et al. calculate the average moneyness of the options as follows.

$$average\ moneyness\ of\ the\ options = \frac{stock\ price\ at\ fiscal\ year\ end}{stock\ price\ at\ fiscal\ year\ end - \left(\frac{total\ realizable\ value\ of\ unexercised\ excercisable\ options}{number\ of\ unexercised\ excercisable\ options}\right)} - 1$$

First, the average realizable value per option is calculated by dividing the total realizable value of in-the-money unexercised exercisable options by the number of unexercised exercisable options. Second, the exercise price is calculated as the stock price at fiscal year end minus the average realizable value per option. Third, the average moneyness of the options is calculated by dividing the stock price at fiscal year end by the estimated exercise price minus one. The result is the percentage by which the options of the CEO are in-the-money. If the average moneyness of the options exceeds 0,67; the CEO can be defined as overconfident. The dummy variable Holder67 takes the value one if the CEO can be classified as overconfident, and zero otherwise. According to *Hypothesis 1*, Holder67 is expected to have a positive influence on firm performance. According to *Hypothesis 2*, Holder67 is expected to have a negative influence on firm performance for the years 2008 to 2010 (during the crisis) compared to 2006 and 2007.

For the third hypothesis there is made a distinction between high and low overconfidence. Campbell et al. (2011) define a high and a low overconfidence measure. Excessively overconfident CEOs hold options too long, e.g. they let options go 100%, or deeper, in-the-

money. The proxy for high overconfidence (HO) is calculated in the exact manner as for the Holder67 measure. If the average moneyness of the options exceeds 1; the CEO can be defined as high overconfident. The dummy variable takes the value one if the CEO can be classified as high overconfident, and zero otherwise. According to *Hypothesis 3*, HO is expected to have a negative influence on firm performance. Excessively diffident CEOs exercise stock options that are less than 30% in-the-money. Following Campbell et al., the proxy for low overconfidence (LO) is calculated as follows.

$$average\ moneyness\ of\ the\ options = \frac{value\ realized\ on\ exercised\ options\ /\ number\ of\ acquired\ shares\ on\ exercised\ options}{stock\ price\ at\ fiscal\ year\ end - \left(\frac{total\ realized\ value\ from\ exercising\ options}{number\ of\ excercised\ options}\right)}$$

First, the value realized from exercising options is divided by the number of exercised options. This per option realized value is divided by the exercise price (the stock price at fiscal year end minus the average realizable value per option). If the result drops below 0,3; the CEO can be defined as low overconfident. The dummy variable takes the value one if the CEO can be classified as low overconfident, and zero otherwise. According to *Hypothesis 3*, LO is expected to have a negative influence on firm performance.

The measures of CEO overconfidence and firm performance both depend on stock price, so the expectation is that there is some correlation between those variables. To construct a model without this correlation all the independent variables are lagged by one period with respect to the dependent variables by following Hirshleifer et al. (2010).

Control variables

Following Hirshleifer et al. (2010) firm size, CEO shares ownership and CEO compensation are included as control variables. Firm size is measured using the logarithm of sales. Hirshleifer shows that similar results are obtained if book value of total assets or number of employees are used as alternative size controls. CEO shares ownership is defined as the number of shares held divided by the total shares outstanding. CEO compensation is defined as the total compensation of the CEO including option grants. Year and industry dummies are included for every year in the sample in order to control for possible time and industry effects.

3.3. Sample

The sample of this paper consists of North American companies included in the ExecuComp and Compustat database for the years 2005 until 2010. Financial firms (SIC 6000-6999) are excluded from the sample due to their specific nature. The ExecuComp database is used to gather information for the independent and control variables. The Compustat database is used to gather information for the dependent and control variables.

4. Empirical analysis

4.1. Descriptive statistics

The descriptive statistics for this study are reported in table 1. The reported numbers concern the full sample from 2005 to 2010.

Variable	Number of observations	Mean	Standard deviation	Minimum value	Maximum value
Dependent variables					
Tobin's Q	8399	1,368	0,972	-0,363	9,732
ROA	8399	0,131	0,104	-1,017	0,949
Independent variables					
H67	8399	0,404	0,491	0	1
HIGH	6595	0,285	0,451	0	1
LOW	6595	0,118	0,323	0	1
Control variables					
Firm size	8394	7,185	1,579	0,726	12,948
CEO ownership	8399	1,968	5,071	0	79,7
CEO compensation	8399	2627,72	3968,98	0	84598,70

Table 1: Descriptive statistics

The table is organized in three sections. The first section presents the summary statistics for the firm performance measures, Tobin's Q and ROA. The mean of Tobin's Q is 1,368, ROA has a mean of 13,1%. The second section presents the summary statistics of the overconfidence measures. Because each confidence level indicator is a zero-one dummy variable, its mean represents the proportion of the CEOs that is classified as overconfident. H67 defines 40,4% of the CEOs as overconfident. HO and LO classify 28,5% and 11,8% of the CEOs as high and low overconfident respectively. The standard deviation of H67 and HO are 0,491 and 0,461 respectively, where the standard deviation of LO is 0,323. The mean of CEO ownership is 1,968, this indicates that the number of shares held by CEOs divided by the total number of shares is approximately 2%. The highest percentage of shares owned by CEOs is 79,1%. The mean of CEO compensation $ 2627,72. It shows that the standard deviation of CEO compensation is very large. A possible reason for these differences is that there are used both small and large firms in this study.

4.2. Correlations

Table 2 provides an overview of the correlations between the dependent and independent variables.

	Tobin's Q	*ROA*	*H67*	*HO*	*LO*
Tobin's Q	1,000				
ROA	0,4298 *(0,000)*	1,000			
H67	0,3551 *(0,000)*	0,1522 *(0,000)*	1,000		
HO	0,3388 *(0,000)*	0,1249 *(0,000)*	0,7559 *(0,000)*	1,000	
LO	-0,1332 *(0,000)*	-0,0873 *(0,000)*	-0,2698 *(0,000)*	-0,2082 *(0,000)*	1,000

Table 2: Correlations

The levels of significance are reported in parentheses.

The correlation between the two dependent variables, Tobin's Q and ROA is 0,4298, indicating that the two variables are positively related to each other. The correlation between H67 and HO is 0,7559, and the correlation between LO and both H67 and HO is negative. Furthermore, table 2 could provide an indication of the influence of the overconfidence measures on firm performance. The correlation between H67 and both performance measures indicates a positive relationship between these variables. This corresponds with *Hypothesis 1*. The correlation between LO and both Tobin's Q or ROA indicates a negative relationship between these variables, this correspond with *Hypothesis 3*. However, the correlation between HO and the performance measures indicates a positive relationship, this does not correspond with *Hypothesis 3*.

4.3. Regression results

Table 3 provides the results to test *Hypothesis 1* relating on the influence of CEO overconfidence on firm performance. The table consists of four regressions. For both Tobin's Q and ROA there is done one test excluding and one test including control variables. The models excluding control variables explain 37,81% and 27,48% of total variation in Tobin's Q and ROA respectively, the models including control variables explain 37,85% and 33,06%. Hence, the adjusted R^2 increases by adding the controls. This indicates that the fraction of variance explained by the model is increased by including controls.

	Tobin's Q		*ROA*	
H67	0,685 *** (27,55)	0,682 *** (27,39)	0,040 *** (13,96)	0,043 *** (15,51)
Firm size		-0,022 ** (-2,44)		0,023 *** (23,13)
CEO ownership		0,001 (0,63)		0,001 ** (4,67)
CEO compensation		9,50e-06 *** (3,60)		-1,67e-06 *** (-5,66)
Constant	1,311 *** (3,39)	1,423 *** (3,61)	0,098 ** (2,18)	-0,089 ** (-2,03)
Number of observations	6473	6466	6466	6459
Adjusted R^2	37,81%	37,85%	27,48%	33,06%
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes

Table 3: Regressions Hypothesis 1

The associated t-statistics are reported in parentheses, where; *, **, and *** state the 10%, 5%, and 1% significance level respectively.

There is a positive and significant coefficient on variable H67 for both Tobin's Q and ROA, which indicates that CEO overconfidence positively influences firm performance. The coefficient of H67 indicates the average increase in firm performance, 0,682 for Tobin's Q and 0,043% for ROA, for overconfident CEOs relative to non-overconfident CEOs, ceteris paribus. These results provide evidence in favor of accepting *Hypothesis 1*. For Tobin's Q, the coefficient of firm size is negative and the coefficient of CEO compensation is zero, but they are significant at a 0,05 and 0,01 level respectively. The coefficient of CEO ownership is approximately equal to zero and not significant. For ROA, the coefficient of firm size is slightly positive and significant at a 0,01 level. CEO ownership and CEO compensation are approximately equal to zero, but significant at a 0,05 level and 0,01 level respectively. The three control variables barely influence firm performance. Altogether, the empirical results provide evidence to support *Hypothesis 1*, CEO overconfidence positively influences firm performance.

Tables 4 and 5 show the results of the regression analysis for each year. The overconfidence measure H67 is lagged with one year with respect to the performance measures Tobin's Q and

ROA. In table 4 the results to test *Hypothesis 2* relating on the influence of CEO overconfidence on Tobin's Q are presented.

	Tobin's Q 2006	*Tobin's Q 2007*	*Tobin's Q 2008*	*Tobin's Q 2009*	*Tobin's Q 2010*
H67 (lagged with one year)	0,827 *** (5,00)	0,550 *** (5,35)	0,082 (0,43)	0,304 * (1,91)	0,583 *** (15,74)
Firm size	-0,159 ** (-2,32)	0,000 (0,01)	-0,571 *** (-7,68)	-0,299 *** (-7,18)	-0,026 ** (-2,25)
CEO ownership	0,024 ** (2,48)	0,011 ** (2,10)	-0,001 (-0,21)	-0,015 (-1,03)	-0,000 (-0,15)
CEO compensation	6,31e-06 (0,50)	1,96e06 (-0,26)	0,000 ** (2,47)	0,000 *** (3,17)	9,39e-06 ** (2,54)
Constant	1,888 (1,19)	0,618 (0,47)	0,542 ** (2,05)	2,635 (1,05)	
Number of observations	735	1095	1310	3093	3306
Adjusted R^2	23,03%	25,07%	18,85%	8,77%	38,00%
Industry fixed effects	Yes	Yes	Yes	Yes	Yes

Table 4: Regressions of Hypothesis 2

The associated t-statistics are reported in parentheses, where; *, **, and *** state the 10%, 5%, and 1% significance level respectively.

The adjusted R^2 decreases from 23,03% in 2006 to 8,77% in 2009, but then increases to 38,00% in 2010. The independent variable H67 is positive for all years of the sample and significant at a 0,01 level for 2006, 2007 and 2010. In 2008, the first "crisis year", the coefficient drops from 0,550 to 0,082 and is insignificant, in 2009 it increases to 0,304 and is significant at a 0,10 level. This coefficient indicates, ceteris paribus, the average increase in Tobin's for overconfident CEOs relative to non-overconfident CEOs. Hence, for 2007 Tobin's Q increases with 0,550 for overconfident CEOs relative to non-overconfident CEOs, while for 2008 Tobin's Q increases with 0,082. These results indicate that CEO overconfidence during the crisis negatively influence Tobin's Q compared to the effect before the crisis, and thereby provide evidence to accept *Hypothesis 2*. Nevertheless, the relationship remains positive. This implies that overconfidence even during the crisis do not necessarily harm firm value. The control variable firm size is negative or zero in all sample years. The coefficient in 2008 is outstanding, it decreases from 0,000 in 2007 to -0,551 in 2008. A

possible reason for the decrease in 2008 can be the crisis. CEO ownership and CEO compensation are approximately equal to zero and not significant for all years of the sample. These two control variables barely influence firm performance. Altogether, the decrease in H67 and firm size in 2008 could support the idea that the crisis is influencing firm performance negatively compared to the years before the crisis. Hence, even though the coefficient of H67 in 2008 was insignificant, the results of the regression provide evidence to accept *Hypothesis 2* relating to Tobin's Q.

Table 5 presents the results to test *Hypothesis 2* relating on the influence of CEO overconfidence on ROA.

	ROA 2006	*ROA 2007*	*ROA 2008*	*ROA 2009*	*ROA 2010*
H67 (lagged with one year)	0,052 *** (3,38)	0,060 *** (6,28)	0,083 *** (4,73)	0,066 *** (6,97)	0,027 *** (6,88)
Firm size	0,044 *** (6,87)	0,053 *** (14,89)	0,092 *** (13,52)	0,036 *** (14,41)	0,019 *** (15,14)
CEO ownership	0,001 (1,60)	0,000 (1,01)	0,000 (0,22)	0,002 ** (1,84)	0,002 *** (3,66)
CEO compensation	-1,96e-06 * (-1,74)	-2,25e06 *** (-3,12)	-4,14e-06 *** (-2,96)	-4,12e-06 *** (-4,05)	-1,60e-06 *** (-4,04)
Constant	-0,321 ** (-2,12)	-0,400 *** (-3,16)	-0,686 *** (-2,79)	-0,181 (-1,18)	-0,083 ** (-2,28)
Number of observations	765	1161	1357	3207	3446
Adjusted R^2	33,72%	34,73%	17,47%	21,10%	36,18%
Industry fixed effects	Yes	Yes	Yes	Yes	Yes

Table 5: Regressions of Hypothesis 2

The associated t-statistics are reported in parentheses, where; *, **, and *** state the 10%, 5%, and 1% significance level respectively.

The adjusted R^2 decreases from 34,73% in 2007 to 17,47% in 2008, and then increases to 36,18% in 2010. The independent variable H67 is positive and significant at a 0,01 level for each year in the sample. The coefficient increases in 2008 with 38%, so cannot provide evidence to accept *Hypothesis 2*. The three control variables barely influence firm performance. For each year of the sample, the coefficient of firm size is slightly positive and the coefficient of CEO compensation is approximately equal to zero, both are significant at a

0,01 level. The coefficient of CEO ownership is approximately equal to zero for each year and only significant in 2009 and 2010 at a 0,05 and 0,01 level respectively. Altogether, the results of ROA do not provide evidence to support *Hypothesis 2*.

All in all, combining the conclusions discussed above, the empirical results cannot provide enough evidence to accept *Hypothesis 2*. The results of Tobin's Q provide evidence in favor of accepting the hypothesis, but the results of ROA do not. Hence, the relationship between overconfidence and firm performance during the crisis remains ambiguous. However, the empirical results show that Tobin's Q, the accepted measure of firm value, is negatively influenced by CEO overconfidence during the crisis compared to the years before the crisis.

Table 6 shows the results to test *Hypothesis 3* relating on the relationship between high and low overconfidence, and firm performance.

	Tobin's Q		*ROA*	
HO	0,378 *** (8,58)	0,370 *** (8,38)	0,026 *** (6,54)	0,030 *** (7,65)
LO	-0,198 *** (-3,15)	-0,185 *** (-2,96)	-0,006 (-1,06)	-0,008 (-1,44)
Firm size		-0,058 *** (-2,99)		0,015 *** (8,60)
CEO ownership		-0,017 *** (-3,46)		-0,001 (-1,32)
CEO compensation		0,000 *** (2,80)		-1,58e-06 *** (-3,17)
Constant	1,511 *** (4,15)	1,871 *** (4,86)	0,144 *** (4,18)	0,047 (1,30)
Number of observations	2319	2319	2441	2441
Adjusted R^2	41,56%	42,06%	32,83%	35,19%
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes

Table 6: Regressions of Hypothesis 3

The associated t-statistics are reported in parentheses, where; * , **, and *** state the 10%, 5%, and 1% significance level respectively.

Table 6 consists of four regressions. For the performance measures, Tobin's Q and ROA, there is done one test excluding and one test including control variables. The models excluding control variables explain 41,56% and 32,83% of total variation in Tobin's Q and

ROA respectively, the models including control variables explain 42,06% and 35,19% respectively. Hence, adding control variables increases the adjusted R^2. There is a positive and significant coefficient on variable HO (high overconfidence) for both Tobin's Q and ROA. These results provide evidence in favor of rejecting *Hypothesis 3*. The coefficient of HO indicates the average increase in firm performance, 0,370 for Tobin's Q and 0,030% for ROA, for overconfident CEOs relative to non-overconfident CEOs, ceteris paribus. The results show a negative coefficient on variable LO (low overconfidence). This result is significant at a 0,01 level for Tobin's Q, but insignificant for ROA. Low overconfident CEOs decrease Tobin's Q on average with 0,185 relative to non low overconfident CEOs. For both performance measures, the three control variables are approximately equal to zero, but significant at 0,01 level (only CEO ownership is insignificant). These results provide evidence in favor of accepting *Hypothesis* 3. These variables barely influence firm performance.

Hypothesis 3 is divided into two parts to draw some conclusions. The first part consists of the influence of high overconfidence on firm performance. It seems that high overconfidence positively influences Tobin's Q and ROA. Hence, this result provide evidence in favor of rejecting the first part of *Hypothesis 3*. The second part consists of the influence of low CEO overconfidence on firm performance. The results of Tobin's Q are negative and significant, but negative and insignificant for ROA. Even though not all results are significant, the results provide evidence in favor of accepting the second part of *Hypothesis 3*.

5. Conclusion

This study focuses on the question whether CEO overconfidence has influence on firm performance. Understanding how CEO overconfidence can affect firm performance can provide valuable insights that may help predict the extent to which firms might hire certain overconfident CEOs. The empirical section of this study leads to the following conclusions.

The effect of CEO overconfidence on firm performance is positive and significant. Furthermore, high CEO overconfidence has a positive and significant on firm performance. This implies that firms could increase their value and profitability by hiring overconfident CEOs. Campbell et al. (2011) show that there is an interior optimum level that maximizes firm value. Hence, it could be that the optimal level of overconfidence was not reached in this paper. On the other hand, low overconfident CEOs could harm firm value and firm profitability. The influence of CEO overconfidence on Tobin's Q, the measure of firm value, decreases during the crisis. However, the relationship between CEO overconfidence and Tobin's Q remains positive. This implies that even during the crisis CEO overconfidence does not necessarily harm firm value and profitability.

There are some limitations of this study. First, the model used in this study cannot stand in reality. This model states that overconfidence and the control variables, firm size, CEO ownership, and CEO compensation, have an effect on firm performance. However, overconfidence affects the control variables as well. These imperfections are not taken into account in this study, but can influence the results. Furthermore, it is difficult to make a distinction between managers who are overconfident and managers who purely rational exercise their options later. This can also influence the results of this study.

Future research could develop further the analysis of the relationship between CEO overconfidence and firm performance. This relationship during the crisis from 2008 to 2009 is not examined in current literature. A recommendation is to study this in more detail. "What is the effect of overconfidence on different corporate policies and how do they affect firm performance?" Furthermore, the relationship could be tested in other regions of the world.

To conclude this study the research question ***'What is the relationship between CEO overconfidence and firm performance?'*** should be answered. This study shows that

overconfidence and has a positive influence on firm performance as measured by Tobin's Q and ROA. By investigating the relationship during the crisis, this study finds that the effect of overconfidence on Tobin's Q is positive, but decreases compared to the years before the crisis. The influence of low overconfidence on firm performance is negative, while the effect of high overconfidence is positive.

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