The impact of CEO overconfidence in M&A: A study in the European Market

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Dissertation
Master in Finance

Supervised by
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2021

Acknowledgments

Finalizing one of the most important stages of my academic career, I wish to leave a sign of appreciation to the ones that help me through this journey. Firstly, I would like to thank my supervisor, Professor Júlio Lobão, for all his constructive recommendations, availability and dedication throughout the elaboration of this dissertation. Additionally, I would like to thank my parents and my brother for all the words of encouragement in this process, giving me all the strength to go forward.

Abstract

Mergers and Acquisitions transactions are considered one of the most important decisions for a company, where its potential has been the subject of considerable research for many years. In the generality of empirical studies, mergers and acquisitions either do not create value or even reduce the value for acquiring shareholders (Andrade *et al.,* 2001). Managerial overconfidence is the hypothesis presented by several authors to justify the outcomes of financial operations that harm their own shareholders (Doukas and Petmezas, 2007; Malmendier and Tate, 2008; Ferris *et al.,* 2013). Using data from 2002 to 2020 with a sample of 522 completed M&A transactions conducted by 182 European listed companies, the dissertation analyzes the impact of CEOs overconfidence, one of the most studied bias on the literature, on the value created in European mergers and acquisitions. Since most research is applied to the US reality, this European study aims to understand if indeed overconfident managers are more likely to engage in acquisitions, especially diversifying ones, use cash as a financing method and realize worse performance than non-overconfident managers (Malmendier and Tate, 2008).

Based on a group of public acquisitions carried out by European companies, the results show that overconfident CEOs have a higher tendency to pursue acquisitions, especially diversifying ones, when compared to non-overconfident CEOs. Furthermore, this research provides empirical evidence that acquisitions conducted by overconfident CEOs use more often cash as a form of financing and lead to a negative market reaction, destructing the shareholders' wealth in the short-term, being these results in line with prior literature.

Keywords: Behavioral finance, CEO, Overconfidence, Mergers and Acquisitions, value destruction, corporate governance

JEL Codes: G32; G34; G41

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1. Introduction

Mergers and acquisitions are among the most important decisions for a company and have a significant impact on the firm's operations. Throughout the years, for companies to grow faster and enter new markets, M&A have been a frequent choice to survive the constant competition. Furthermore, there is a need to expand the company's business, increasing market power, economies of scale, tax advantages and creating synergies between the acquirer and the target (Renneboog and Vansteenkiste, 2019). However, the potential associated with M&A has been the subject of considerable research for many years, resulting in a rich literature that points out to the possibility of no value added after the transaction or even a reduction of value especially for the acquirer firm' shareholders, leading to a possible destruction of value. Moreover, it is extremely important to carefully evaluate such decision (Andrade *et al.,* 2001; Moeller *et al.,* 2004), being relevant to understand why companies continue to pursue such operations even with negative results.

Most individuals are influenced by emotions and personal characteristics that are inherent and when making decisions, they are affected by behavioral characteristics. The same happens in decisions made inside each company, where managers may be affected by overconfidence bias that can significantly impact several corporate decisions, such as M&A (Malmendier and Tate, 2008; Billett and Qian, 2008). As M&A operations reflect managers' individual decisions and because individuals are affected by factors of a behavioral nature in the decision process, it is important to analyze the impact that specific behavioral characteristics, as overconfidence, have on the outcome of M&A. Several authors introduced how overconfidence bias can impact on M&A activity (Ferris *et al.,* 2013).

Malmendier and Tate (2008) provided important results regarding the effect of CEO overconfidence on mergers and acquisitions, being pioneers with the overconfidence measure adopted. They provided indirect quantitative methods for measuring overconfidence based on the time of exercise of CEO stock options and found that overconfident CEOs are indeed more likely to undertake acquisitions, in which diversifying transactions mainly contribute to this effect, due to the overestimation of their own skills. Their empirical analysis show that overconfident CEOs tend to perceive the firm as undervalued and will use cash more often to finance such transactions as opposed to equity. Furthermore, there is empirical evidence of a negative market reaction towards the acquiring firm when the CEO is classified as overconfident since the market believes that the acquisitions would create a lower value to the company. Following this, and even with

the adoption of different measures of overconfidence, similar results were obtained in many studies (Doukas and Petmezas, 2007; Ferris *et al.,* 2013; Kolasinski and Li, 2013).

The impact of managerial overconfidence on M&A is a widely documented topic in the current literature, however most studies only focus on acquisitions carried out by US companies and few include UK companies. In addition, Ferris *et al.* (2013) conducted a study examining whether the results of Malmendier and Tate (2008) also hold when investigating international M&A, focusing on countries all over the world. As such, this dissertation will focus on the influence of CEO overconfidence on M&A transactions exclusively conducted by European companies, which to the best of my knowledge has never been done before. Hence, this dissertation aims to diminish the existing gap by investigating managerial overconfidence on M&A transactions conducted by European acquirers in an updated timeframe compared to earlier studies, contributing to the existing literature in the area of managerial overconfidence and M&A, focusing on the level of acquisitiveness, diversifying characteristics, method of financing, market response and the corporate governance measures that can attenuate managerial overconfidence.

Based on a sample of 522 M&A transactions conducted by European firms between 2002 and 2020, this research provides statistically significant evidence that overconfident CEOs pursue more often M&A, being 2.645 times more likely to be involved in a deal than non-overconfident CEOs. Such transactions are more often described as diversifying and associated with a poorer quality. In addition, overconfident CEOs use more often cash as a method of payment. Finally, M&A transactions associated with overconfident CEOs resulted in significantly negative announcement returns, in which such results remained significant after the inclusion of control variables, being in accordance with prior studies.

The research is structured as follows: chapter 2 contains the respective relevant literature review regarding the impact of overconfidence on M&A activity and characteristics. Chapter 3 presents the developed hypotheses used to conduct the study based on the existing literature. Furthermore, chapter 4 describes the sample selection, referring the type of overconfidence measure and variables used, as well as the methodology adopted in the research. Chapter 5 provides the main empirical findings and a discussion regarding the relationship between CEO overconfidence and M&A characteristics and the cumulative abnormal returns of the acquiring firm. Finally, chapter 6 demonstrates the conclusions that can be drawn following several empirical studies, comparing to prior literature and including limitations and suggestions for further study.

2. Literature Review

2.1. Mergers and Acquisitions

2.1.1. Characteristics, motivations and performance

Mergers and acquisitions are considered transactions in which the ownership or part of the company are transferred or combined with another company. In the literature, there are several reasons that seek to justify why companies engage in M&A activity. Among other reasons, M&A activity is typically motivated by the gains related to synergies, operating efficiencies, market power conditions, the desire to improve companies' competition through a larger market share, access to new products and markets, maximization of strengths, attaining economies of scale and even tax benefits (Renneboog and Vansteenkiste, 2019).

Empirical research of M&A documented over the years suggest that not all mergers and acquisitions are successful (Jensen and Ruback, 1983; Lubatkin, 1983; Agrawal *et al.,* 1992; Lougran and Vijh, 1997), in which some suggest a significant improvement in the operating performance following M&A (Healy *et al.*, 1992; Switzer, 1996; Heron and Lie, 2002), while others might result in value destruction for the acquiring firm (Asquith, 1983; Clark and Ofek, 1994; Loughran and Vijh, 1997).

The complexity associated with M&A decisions can present various challenges. Despite the frequent merger activity across various industries throughout the world, limited evidence of the success of corporate mergers has been verified, especially the ones conducted by overconfident CEOs. Excessive confident managers persist in undertaking M&A deals even though decades of research show a low probability of success and a possible destruction of value, especially for the acquiring firm (Malmendier and Tate, 2008).

2.2. Behavioral Finance

For several years, traditional financial theory neglected behavioral assumptions in models of managerial decision-making, referring to investors and managers as rational, in which their actions and decisions are viewed to maximize the firm and shareholders value. However, because there are market imperfections and people do not act completely rational, such theory does not align with reality (Shefrin, 2001). With the introduction of behavioral corporate finance, it was possible to include a more realistic approach about the decision-making process and assume individuals as non-rational since they can have

irrationalities that may influence their decisions (Baker *et al.,* 2007; Malmendier and Tate, 2008; Aktas *et al.*, 2016).

Empirical studies discuss the presence of behavioral biases among individuals and their impact in the decision-making process (Shefrin, 2001). In many circumstances, people tend to make decisions based on emotion, where behavior bias play an important role in shaping the type of decisions they make, being overconfidence considered a robust empirical evidence among many managerial biases (De Bondt and Thaler, 1995). Overconfidence affects the decision-making process and how individuals process and interpret information, especially in M&A transactions (Chen *et al.,* 2015).

2.2.1. Overconfidence Bias

In the past years, several behavioral explanations have emerged to provide a theoretical foundation to M&A activity, being one of them the overconfidence bias. Overconfidence is a strong and consistent psychological bias, considered *"perhaps the most robust finding in the psychology of judgement"* (De Bondt and Thaler, 1995, p.389) that can significantly impact the decision-making process of individuals, influencing corporate investments (Hayward and Hambrick, 1997; Malmendier and Tate, 2005, 2008; Doukas and Petmezas, 2007; Billett and Qian, 2008; Ferris *et al.,* 2013; Kind and Twardawski, 2016).

After several years of continuous investigation, researchers achieved a consensus that individuals, especially managers, tend to show signals of overconfidence. Firstly, overconfidence is related to overplacement, in which managers tend to perceive themselves as above average, regarding their own skills, having overly positive self-assessments (Fischhoff *et al.,* 1977; Weinstein, 1980; Taylor e Brown, 1988). Overconfidence is considered a common bias in which people overestimate the precision of their knowledge and capabilities as well as the likelihood of success (Moore and Healy, 2008), believing they possess superior decision-making abilities resulting in overly optimistic expectations. Indeed, overconfident people tend to believe they know more than others, having expectations of their own capabilities that exceed their actual performance, underestimating the probability of failure and risks, mainly in situations of considerable ambiguity and complexity (Langer, 1975; Moore and Healy, 2008). In fact, they tend to have strong beliefs in their ability to predict the future, attributing the success to their own decision-making skills while assigning the responsibility to other factors in case of underperformance or even failure (Billett and Qian, 2008).

2.3. CEO overconfidence in M&A

CEO overconfidence can have a huge impact on the decision-making process of any company. As an explanation for unsuccessful M&A, the literature suggests CEO overconfidence and links this bias to value-destroying acquisitions due to the overestimation of the ability to create value and the possible synergies associated with the transaction. Managers with overconfidence have an inflated perception of their own capabilities, resulting in an overbidding and overpayment for the target (Roll, 1986).

Roll (1986) was the first to investigate the effects of managerial overconfidence and acknowledge the impact of such behavioral characteristics in explaining the various puzzles of M&A, introducing the overconfidence approach to corporate finance, mainly with the managerial *hubris hypothesis*.

Overconfident managers have unrealistic beliefs that they can manage the target firm more efficiently than its current CEO, demonstrating excessive certainty in the accuracy of their own judgements, believing that *"the market does not reflect the full economic value of the combined firm"* (Roll, 1986, p.199). This theory explains the observed negative stock performance within acquirers since CEOs overestimate their own competence as well as merger synergies. Overconfident managers systematically face unrealistic expectations and despite the considerable risks associated, they tend to be excessively willing to overestimate the return of their investment projects (Malmendier and Tate, 2005; Doukas and Petmezas, 2007) and acquire companies that do not maximize firm value (Hayward and Hambrick, 1997; Banerjee *et al.,* 2015; Malmendier and Tate, 2015).

An excessively confident CEO considers themselves as "*above average*" compared to other CEOs (Taylor and Brown, 1988; Wrońska-Bukalska, 2018), resulting in the so called "*better than average effect"* (Larwood and Whittaker, 1977; Alicke *et al.*, 1995). Such behavior may be justified by the idea that top managers usually are inserted in an environment that enhances the illusion of power and overconfidence. Overconfident CEOs may exhibit an excessively optimistic view regarding future merger outcomes that they believe are under their control because they fail to perceive some of the intrinsic risks, especially within projects they are highly committed to (Langer, 1975; Weinstein, 1980).

Overconfidence is often associated to the self-attribution bias, which consists of individuals overstating their role when it comes to successful results, attributing an exaggerated part of their success to intrinsic factors, such as merit, knowledge, or their forecasting skills (Hirshleifer, 2001). At the same time, people tend to underestimate their

responsibility in the case of poor performance as well as the risk associated with the implementation of a certain strategy, attributing it to external and random factors (Langer and Roth, 1975; Miller and Ross, 1975). Following this perspective, managers tend to become even more overconfident after associating past successes to their own abilities, which will result in an overestimation of the chances of future successes (Gervais and Odean, 2001).

An excessively optimistic and confident CEO tends to overestimate their own abilities to create value (Roll, 1986), believing that the stock price poorly portrays the value of the firm and that the target's current performance is below what is possible to achieve. Due to this optimistic view, managers tend to overestimate the possible synergy gains resulting from M&A, while underestimating the expected costs, which leads to a higher valuation of the target company, and subsequently higher premiums, a phenomenon designated *winner's curse* (Roll, 1986).

Moreover, overconfident CEOs find themselves in bidding wars more often than non-overconfident CEOs do (Malmendier and Tate, 2015), resulting in high acquisition premiums that damage the operating performance following M&A and result in notorious negative consequences for the wealth of the acquiring company's shareholders (Hayward and Hambrick, 1997; Malmendier and Tate, 2008; Croci *et al.*, 2010).

2.3.1. Acquisitiveness

Excessive optimism combined with a level of overconfidence leads to an overestimation of knowledge and a simultaneous underestimation of possible risks, which result in overconfident CEOs being more acquisitive due to an overvaluation of a potential target (Malmendier and Tate, 2008).

Overconfident managers tend to be more optimistic towards their own skills to generate returns and more prone to engage in multiple acquisitions when compared to non-overconfident managers, believing that such investment decisions are in the best interest of shareholders and that they will benefit from potential synergies even though the net present value of the transactions might be negative (Roll, 1986; Doukas and Petmezas, 2007; Billett and Qian, 2008; Malmendier and Tate, 2008; Ferris *et al.*, 2013).

Malmendier and Tate (2008) links managerial overconfidence to M&A activity by examining the impact of overconfidence on acquisitiveness, concluding that the odd of pursuing an acquisition is 1.65 higher for overconfident CEO. Furthermore, several studies also found that overconfident CEOs tend to engage in more acquisitions than non-

overconfident CEOs due to their higher likelihood of undertaking risky projects, overestimating the benefits while underestimating the costs and risks associated with such project (Gervais and Odean, 2011; Ferris *et al.,* 2013).

2.3.2. Diversifying M&A

Malmendier and Tate (2008) find that the overconfidence bias encourages CEOs to engage in highly complex deals classified as diversifying acquisitions, characterized as risky and uncertain since the company enters an unknown industry. Diversifying acquisitions are defined as riskier for managers since they may have less knowledge and information about the target firm industry, being outside their area of expertise (Croci and Petmezas, 2015).

Managers with excessive confidence tend to underestimate the risks associated with such transactions and are indeed more likely to pursue acquisitions beyond their company's core business (Malmendier and Tate, 2008; Ferris *et al.,* 2013). Even though such diversification is expected to result in an increase in economic value, the reality is that in most cases they lack synergies and might destroy value and acquiring company's shareholders tend to gain less from diversifying acquisitions than from non-diversifying acquisitions (Morck *et al.,* 1990; Malmendier and Tate, 2005).

2.3.3. Method of payment in M&A

Before undertaking any M&A deal it also matters which type of financing will be used in the transaction. Overall, the payment method adopted in each operation, whether the acquiring firm chooses to pay the target firm with either shares, cash, or a combination of both, it may signal valuable information to the market regarding the acquirer's expectations and at the same time influence and originate very different results (Travlos, 1987). Empirical evidence suggests that the form of payment matters for both the acquirer's and the target's shareholders, and at the same time it is an important determinant of the post-acquisition performance (Malmendier and Tate, 2005, 2008).

Normally, overconfident managers rely on internal financing for M&A transactions over external financing to make investments, perceiving external financing as costly, which results in an overinvestment when there are sufficient internal resources available. Overconfidence can affect the capital structure, since in the need of external funds, managers favor the issue of debt over equity which results in an increase in leverage on the long term, which can induce higher financial distress costs (Myers and Majluf, 1984; Heaton, 2002; Malmendier and Tate, 2005; Hackbarth, 2009).

Overconfident CEOs overestimate the value of their own company and their capabilities to create value in acquisitions, believing that the market undervalues the company, therefore making them reluctant to raise external capital to finance an acquisition because they see such transaction as costly (Heaton, 2002; Malmendier and Tate, 2005; Ferris *et al.,* 2013). Thus, managers tend to restrict their investments if they do not have sufficient internal funds, being reluctant to pursue some deals even in the presence of value-creating merger opportunities (Malmendier and Tate, 2005). As such, overconfident CEOs are more likely to conduct mergers if they have sufficient internal capital, preferring cash when acquiring a target, being more confident about the merger results, leading to a higher premium paid.

There is a clear preference for cash as a method of payment for M&A transactions when compared to issuing new equity (Malmendier and Tate, 2005, 2008). Prior research suggests that transactions paid with cash obtain higher positive abnormal returns around the announcement compared to stock-financed M&A that tend to be more detrimental to the company (Travlos, 1987). In this case, overconfident CEOs will only finance an M&A by issuing shares when the financial transaction is understood as exceptionally advantageous.

2.3.4. Market reaction to CEO overconfidence

In the short-term, only few acquisitions add value, suggesting the impact of managers' overconfidence in the wealth of the acquiring company's shareholders (Malmendier and Tate, 2008; Croci *et al.*, 2010). Indeed, manager's psychological profile has a significant impact on M&A's consequences for shareholders.

Mergers and acquisitions are considered disruptive activities that often do not create value for the shareholders of the acquiring firm (Andrade *et al.,* 2001). There is a consensus in prior research indicating that the presence of such behavioral bias among managers are at best value neutral but result in most cases in negative abnormal returns for the acquiring firm's shareholders around the announcement of an acquisition (Doukas and Petmezas, 2007; Malmendier and Tate, 2008).

The stock market reaction is an important indicator to understand if a transaction creates shareholder value or not. Several studies conclude the existence of negative acquirer returns for M&A deals conducted by overconfident CEOs, suggesting that such transactions are not in the interest of acquirer shareholders since they do not create shareholder value (Malmendier and Tate, 2008; Kolasinski and Li, 2013).

Indeed, overconfident bidders realize lower announcement returns when compared to non-overconfident bidders and exhibit significant wealth losses (Doukas and Petmezas, 2007). Negative returns on the shares of acquiring companies suggest that managers often pay excessively for targets, which results in a transfer of wealth from the acquiring company's shareholders to the target company's shareholders, the clear winners, at least in the short term (Doukas and Petmezas, 2007).

There is consensus among empirical studies that poor acquisitions decisions, aligned with the phenomenon of overpayment and the difficulty of realizing the expected synergies, overconfident CEOs destroy a significant amount of shareholder value (Malmendier and Tate, 2008; Billett and Qian, 2008), being this decisional bias often persistent among company managers and simultaneously difficult to overcome (Malmendier and Tate, 2005; Billett and Qian, 2008).

2.3.5. Corporate Governance

A decision to acquire a company usually is subject to the board involvement and requires the approval of a company's board of directors, however, boards rely heavily on guidance from top management (Hayward and Hambrick, 1997). The CEO is focal in approving transactions, especially in large acquisitions and in many cases, there is information asymmetry in favor of the CEO, which creates an unchallenged level of power for the CEO over the board, decreasing the opposition faced (Hayward and Hambrick, 1997; Brown and Sarma, 2007; Croci *et al.,* 2010; Kolasinski and Li, 2013).

Corporate boards exist to represent the shareholder's interests, mitigate agency problems, select and help managers make better strategic decisions that are value maximizing (Denis and McConnell, 2003). As such, the board of directors plays a critical role of monitoring and controlling acquisitions with the purpose of minimizing the agency costs between the shareholder and the management (Faleye *et al.,* 2011). Because CEO overconfidence might be the product of corporate governance, it is important to consider the composition of corporate boards to avoid excessive power and bad decisions that are unfavorable for the shareholders (Baldenius *et al.,* 2014).

An effective and vigilant board of directors is a crucial control mechanism to help minimize the risk of managerial overconfidence bias. Strong and well-developed corporate governance measures can neutralize the influence of CEO overconfidence and simultaneously mitigate the destructive effects originated by such decisional bias (Helland and Sykuta, 2004; Coles *et al.,* 2008; Baldenius *et al.,* 2014). When the board of directors

fails the surveillance functions, then the effects of overconfidence bias become particularly intense (Hayward and Hambrick, 1997; Brown and Sarma, 2007).

To mitigate overinvestment based on overconfidence it is important to introduce an effective corporate governance mechanism, in which the board of directors should monitor the firm's management and advise it on key decisions (Baldenius *et al.,* 2014). However, the effectiveness of boards in performing such tasks is continuously questioned. Moreover, the structure of the board, regarding the size of the board, the presence of independent directors and board gender diversity may influence the effectiveness of corporate decisions.

2.3.5.1. Board Size

Board size can highly impact the decisions made, being correlated with M&A performance. A large board may lead to inefficiencies related with the decision process and monitoring of CEOs due to increasing agency problems and coordination costs, lack of consensus, poorer communication, resulting in an inferior corporate governance quality (Coles *et al.,* 2008). Smaller boards are perceived as more productive and effective in the management supervision, being associated with a better M&A performance (Carline *et al.,* 2009). A board that includes between 4 and 12 directors is considered an efficient board with a higher propensity to control the psychological biases of CEOs and its effects on corporate decisions (Malmendier and Tate, 2008).

2.3.5.2. Independent Board

Literature suggests that outside directors tend to monitor overconfident managers better than inside directors. When a board is dominated by independent directors, the effects of managerial overconfidence may be mitigated (Kolasinski and Li, 2013; Banerjee *et al.,* 2015). A greater proportion of inside directors can have an advantage regarding firm specific knowledge, however it can also induce CEO power and result in negative effects in M&A performance, being fundamental to closely monitor managerial decisions and limit its power (Linck *et al.,* 2008; Faleye *et al.,* 2011). Having strong and independent boards can attenuate the destructive effects of overconfidence, avoiding actions that may harm shareholders, since independent outside directors have a more objective view of M&A transactions (Malmendier and Tate, 2008; Kolasinski and Li, 2013; Banerjee *et al.,* 2015).

It is expected that a board composed with a higher proportion of outside directors may challenge CEO decision, however the findings in the literature are rather ambiguous.

2.3.5.3. Board Gender Diversity

There are significant differences between men and women regarding risk preferences and decision-making process (Barber and Odean, 2001). Overconfidence tends to be more pronounced in males, since they are characterized as less-risk averse and tend to overestimate more often their own abilities. In this case, firms with more male managers conduct more M&A transactions, that are more often value-destroying, compared to female managers that tend to reflect less overconfidence by pursuing less M&A deals and paying lower premiums (Levi *et al.,* 2014).

Greater female board representation in the board is linked to better monitoring and lower levels of acquisitiveness, possibly having a moderating effect on managerial overconfidence and a positive M&A performance, enhancing the quality of the decision-making process (Adams and Ferreira, 2009; Dowling and Aribi, 2013; Huang and Kisgen, 2013; Levi *et al.,* 2014; Banerjee *et al.,* 2015; Chen *et al.,* 2016). Hence, the importance of having women on boards to impact the propensity for conducting M&A transactions and the acquisition premiums paid (Barber and Odean, 2001; Eckel and Grossman, 2008; Levi *et al.,* 2010, 2014).

2.3.5.4. CEO duality

In the case when the CEO is also the chairman, the board vigilance and the effectiveness of governance corporate governances may be weakened, resulting in a lack of monitoring which promotes the increase of CEO power and entrenchment, negatively impacting the corporate performance (Hayward and Hambrick, 1997). It is important to separate both positions to reduce the power associated to the CEO and possible heuristic errors (Schepker and Oh 2013).

3. Research Hypotheses

This research aims to study the impact that managerial overconfidence has on the type of M&A deal conducted and their characteristics as well as to analyze the influence that CEO overconfidence has on the announcement returns of a M&A transaction, in order to understand the market reaction and if in fact, overconfident CEOs tend to destroy value more often than they create, in comparison to non-overconfident CEOs.

3.1 Overconfidence and acquisitiveness

CEOs that are qualified as being overconfident tend to overestimate their own capabilities as well as the returns that are expected to be generated both in the acquirer and the target firm. Such behavior relates to an increased likelihood of undertaking an acquisition when compared to non-overconfident CEOs. Indeed, overconfident CEOs are more likely to pursue a M&A than non-overconfident CEOs since they frequently undertake riskier projects, overestimating the benefits and underestimating the costs and risks associated with the transactions (Malmendier and Tate, 2008; Gervais and Odean, 2011). Following this, the first hypothesis focuses on the role of overconfidence in the level of acquisitiveness to observe if CEOs that are classified as overconfident are more likely to complete deals than non-overconfident CEOs.

H_1 - The presence of overconfident CEOs in the acquiring firm increases the likelihood of conducting multiple M&A.

3.2 Overconfidence and diversification

Companies have to make difficult decisions on whether to focus on the core skills of the firm or to diversify into distinct portfolio of activities. Prior research has revealed that overconfident CEOs are more likely to conduct a diversifying acquisition when compared to CEOs classified as non-overconfident (Malmendier and Tate, 2008). Such transactions are considered by the literature as value-destroying since there is a diversification discount associated. To test such theory, a second hypothesis is conducted focusing on the impact that managerial overconfidence has on the likelihood of occurring a diversifying M&A.

H_2 – Overconfident CEOs are more likely to pursue diversifying acquisitions.

3.3 Overconfidence and the method of financing

Managerial overconfidence tends to increase the CEO's preference for internal over external financing when raising funds to make investments (Malmendier and Tate, 2005, 2008). Moreover, past research has shown a positive relationship between managerial overconfidence and cash as the method of payment adopted in M&A transactions.

Overconfident CEOs tend to overestimate their own skills to generate positive results as well as the firm's future cash flows, believing that the market undervalues the company, which makes them reluctant to issue equity since they perceive external finance as costly. In the need of external financing, they prefer debt over equity. Furthermore, a third hypothesis is conducted focusing on the impact that managerial overconfidence has on the method of financing adopted in M&A.

H_3 – CEO overconfidence is positively related with the probability of a M&A transaction being financed by cash.

3.4 Market reaction to CEO overconfidence

According to several empirical research, more often there is a negative response from the market to the announcement of M&A transactions that are conducted by overconfident CEOs. Overconfident CEOs tend to overestimate their capability to generate value with the transaction and such behavior leads them to pay a higher premium which is negatively viewed by the market (Malmendier and Tate, 2008). Several studies have found that overconfident CEOs tend to make value-reducing or suboptimal decisions due to their behavioral bias (Roll, 1986), leading to a negative market response.

Additionally, to confirm this, a fourth hypothesis is tested, relating the managerial overconfidence with the market reaction, measured by the cumulative abnormal returns.

H_4 – CEO overconfidence negatively affects the cumulative abnormal returns of the acquirer's stock surrounding an M&A announcement.

4. Data and Methodology

This section presents the type of overconfidence measure chosen to distinguish overconfident CEOs from non-overconfident CEOs, as well as the description of all dependent and control variables that are included in the research. Further, it also includes the data referred to the methodology that the study will follow. Table 8 in the appendix presents all the variables used in this dissertation and past studies in which they were adopted.

4.1 Measure of CEO Overconfidence: Net Buyer

Even though managerial overconfidence has been a widely topic of research over the years, finding a direct measure for CEO overconfidence is very complex, hence the lack of consensus and difficulty in assessing a proxy that will precisely measure such subjective and abstract concept. In past empirical literature, several different proxies were constructed to capture this phenomenon, in which, Malmendier and Tate (2005, 2008) introduced three commonly used overconfidence measures that focus on the personal portfolio decisions of CEOs and their exposure to firm-specific risk: Holder 67 and Longholder that are related to the timing of option exercises, in which overconfident CEOs tend to hold in-the money equity options. Such measures are commonly used in research conducted in the US, however for the European market such option holding data is not available since stock option programs are not as common, thus a comparable measure cannot be adopted. Furthermore, the Net buyer proxy was also introduced by Malmendier and Tate (2005) being associated with the net purchase of company stock.

Following Malmendier and Tate (2005), this research will focus on the net buyer proxy to distinguish overconfident CEOs from non-overconfident CEOs through their purchase of additional company stock. This measure exploits the tendency of CEOs to purchase additional company stock despite the under-diversified and highly exposed to firm-specific risk portfolio (Malmendier and Tate, 2005). This research appoints CEOs as overconfident if the CEO bought stock on net in more years than he sold on net during their tenure, and zero otherwise, taking into account the fact that there were more periods with shares bought than periods with shares sold, as was adopted by Malmendier and Tate (2005).

To assess this measure, data regarding shares owned by the CEO excluding options is retrieved from Thomson Reuters Eikon and only CEOs with more than five years of tenure are considered in the sample. So, a dummy variable is constructed, attributing a value of one if the CEO bought stock on net in more years than he sold on net during

those years, and zero otherwise. Moreover, it is important to refer that the information to construct this proxy was hand-collected which limits the availability of data, diminishing the possible number of European companies and M&A transactions that can be included in the sample.

4.2 Dependent Variables

Overconfident CEOs are characterized as optimistic and frequent acquirers, being more prone to engage in multiple transactions when compared to non-overconfident CEOs, accordingly to the literature (Roll, 1986; Doukas and Petmezas, 2007; Malmendier and Tate, 2008; Billett and Qian, 2008; Ferris *et al.,* 2013). To test the first hypothesis, a binary variable *acquisitiveness* is created equaling one if the firm conducts at least one successful M&A transaction in a given year, and zero otherwise.

Past literature has shown that excessively confident CEOs tend to engage more often on diversifying M&A transactions that are characterized as risky and uncertain. Companies that conduct diversifying deals underperform acquirers that participate in transactions in a related sector, concluding that diversifying M&A may be value-destroying since acquirer's abnormal announcement returns tend to be lower (Morck *et al.,* 1990; Moeller *et al.,* 2005; Malmendier and Tate, 2005). When the acquiring firm focus on deals that promote their own core business and enter a familiar segment, often there is a higher probability of success due to the increasing knowledge towards the target industry. Such related transactions can result in greater synergies due to economies of scale, generating greater abnormal announcement returns.

Furthermore, past empirical research suggests that the relatedness of business in M&A deals affects market returns for the acquiring firm (Brown and Sarma, 2007; Malmendier and Tate, 2008; Hornstein and Nguyen, 2014). Therefore, regarding the formation of the second hypothesis, a dummy variable *diversification* was created, in which a M&A transaction is defined as a diversifying one if the target operates actively in a different industry than the acquiring firm, according to the Standard Industrial Classification (SIC). Subsequently, a binary variable is constructed, which equals one if the two-digit SIC code of the acquirer and the target differ, operating in different industries, and zero otherwise.

The payment method chosen in M&A deal signals a valuable information to the market (Myers and Majluf, 1984). Previous empirical research reveals that overconfident CEOs prefer to use cash more often as a method of payment when performing M&A transactions (Malmendier and Tate, 2008). Such biased behavior has to do with CEOs believing that the

market undervalues the company's equity, making them reluctant to raise equity. Moreover, the payment method chosen to finance a M&A deal, being all-cash bids or a combination of cash and stock or all-stock bids, can have a great influence on the stock returns. All-cash financed M&A acquisitions tend to generate higher bidder returns compared to all-stock financed acquisitions (Andrade *et al.,* 2001; Moeller and Schlingemann, 2004; Savor and Lu, 2009). In order to test the third hypothesis, following Malmendier and Tate (2008), it was included a dummy variable *cash payment* that captures the method of payment used in the transaction, assuming a value of one if the transaction is financed exclusively with cash and, zero otherwise.

Lastly, prior research assumes that the cumulative abnormal returns are a good indicator for the performance of a specific M&A deal (Hayward and Hambrick, 1997), in which there is a consensus indicating that the presence of overconfidence bias among managers are at best value neutral but result in most cases in negative abnormal returns for the acquiring firm's shareholders around the announcement of an acquisition (Doukas and Petmezas, 2007; Malmendier and Tate, 2008). Indeed, bidder overconfidence and announcement abnormal returns are negatively related, indicating that managerial overconfident can destroy a significant amount of shareholder value (Malmendier and Tate, 2008; Billett and Qian, 2008). The fourth hypothesis aims to understand the market response around the announcement date of a given M&A transaction, being necessary to conduct an event study by calculating the acquirer's cumulative abnormal returns during the event period.

4.3 Control Variables

To complement the data, a set of control variables is used to isolate and to properly examine the effect of CEO overconfidence and to eliminate the influence of other factors on the regression results, with the purpose of increasing the accuracy of those regressions. Empirical literature has shown that there are distinct variables that can affect the acquisition characteristics and performance (Alexandridis *et al.,* 2017). Therefore, firm-specific control variables, deal-specific variables, CEO and board characteristics are included as factors that may impact the M&A decision process.

4.3.1 Deal characteristics

Some variables that aim to control for deal characteristics are included in the dataset from deals announced between the period of 2002 to 2020, being variables commonly used

in the literature when analyzing the impact that managerial overconfidence has on the characteristics and the acquirer's abnormal announcement returns of a M&A transaction.

Empirical research shows that excessively confident CEOs may conduct larger M&A deals due to their behavioral bias (Aktas *et al.,* 2016), which may be associated with positive abnormal announcement returns (Fuller *et al.,* 2002). Consequently, the *deal size* is included in the sample as the value that was paid for the target firm in the transaction, in which the natural logarithm of the transaction value is taken.

In addition, the binary variables *diversification* and *cash payment*, previously described, will also be applied as control variables when measuring the effect of managerial overconfidence on the acquirer's cumulative abnormal returns.

4.3.2 Firm characteristics

Further, we include some firm-specific control variables that are related to the financial attributes of the acquiring firm. Normally, larger firms have access to larger resources than smaller companies (Chatterjee and Hambrick, 2011), in which the size of the acquirer company can have impact on CEO overconfidence and in the acquisitiveness of firms (McCarthy and Dolfsma, 2012).

CEOs of larger firms tend to exhibit a more overconfident behavior, being more likely to participate in M&A deals that are value-destroying when compared to smaller companies that usually tend to conduct more value-enhancing transactions (McCarthy and Dolfsma, 2012). Larger acquiring companies tend to be more acquisitive due to the fewer obstacles in obtaining financial resources, and experience lower abnormal announcement returns when compared to small acquirers (Moeller *et al.*, 2004). Following previous research developed by Malmendier and Tate (2008), we controlled for *firm size* using the natural logarithm of total assets at the beginning of the year in which the merger or acquisition is announced.

A significant positive relationship between the sensitivity of investment to cash flow and CEO overconfidence is expressed in the literature (Malmendier and Tate, 2005). Moreover, the more internal funds available, the lower the financial constraints, so higher levels of profitability will lead to higher acquisitiveness (Harford *et al.,* 2008). In companies with a higher availability of cash, CEOs tend to conduct more value destroying investment opportunities (Jensen, 1986). To control for internal level of resources and consequent company's profitability, the variable *cash flow* is included being measured as earnings before extraordinary items plus depreciations, normalized by beginning-of-the-year capital that

consists of property, plants and equipment. According to the literature, a higher level of profitability is associated with a higher level of acquisitiveness.

Some empirical research found that firms with lower Tobin's Q tend to acquire more (Malmendier and Tate, 2008), whereas others state that higher levels of Tobin's Q capture growth opportunities and are associated with companies, engaging more in M&A being more acquisitive (Hirschleifer *et al.,* 2012) and earning higher abnormal stock returns (Lang *et al.,* 1989, 1991). On the other hand, prior research shows that the Tobin's Q is negatively related with cumulative abnormal returns (Moeller *et al.,* 2004). Commonly used in the M&A literature as a control variable, *Tobin's Q* at the beginning-of-the-year, controlling for investment opportunities, is calculated by the ratio of market value of assets to the book value of assets and it is used to control for investment opportunities. Following Malmendier and Tate (2008), the market value of assets is denoted as total assets plus market value of equity, subtracted by the book value of equity, and the book value of assets is defined by total assets.

A company's leverage ratio can be a proxy for the level of financial distress, and it is expected to affect M&A transactions (Sen and Tumarkin, 2015). Moreover, a high leverage ratio will pressure and negatively affect the availability of cash, as well as the level of acquisitiveness (Modigliani and Miller, 1958; Jensen and Meckling, 1976; Myers and Majluf, 1984; Billett and Qian, 2008). A higher leveraged company has limited availability of cash, decreasing the percentage of cash paid in an M&A deal, resulting in a lower premium paid, which would lead to a less negative market reaction (Hu and Yang, 2016). In the research, the *leverage ratio* of the acquiring firm is calculated as total liabilities over total assets.

4.3.3 CEO characteristics

At the individual CEO level, several control variables are included such as *age,* having substantial explanatory power regarding corporate finance decisions in which overconfidence is inserted (Malmendier *et al.,* 2011). Younger CEOs tend to be more aggressive in making decisions (Li and Tang, 2010; Serfling, 2014) and more willing to engage in M&A activity (Barber and Odean, 2001; Yim, 2013), while older CEOs tend to be more cautious and demonstrate a lower tolerance for risk, reducing the level of risk taking as age increases (Levi *et al.,* 2010; Ferris *et al.,* 2013). In contrast, additional research suggested that overconfidence can increase with the level of experience, which is associated usually with an increased age (Malmendier and Nagel, 2011).

Tenure has been widely used as a control variable in several empirical research, while some literature suggests that with the increase of CEO's tenure, and consequent experience and knowledge, it may decrease the risk associated, while others, associate a longer tenure to a higher level of overconfidence (Taylor and Brown, 1988). Following Ferris *et al.* (2013) and Malmendier and Tate (2005), CEO *tenure* is included in the sample to control for the number of years that the CEO remains in his position on the company, and it is defined as the number of years that the CEO is employed at the company at the time of the observation.

A CEO that simultaneously is the chairman of the board tends to result in a more powerful behavior that could give the opportunity to the CEO to pursue their own personal interests, leading to more value-destroying acquisitions (Masulis *et al.,* 2007). Furthermore, this can result in a negative impact on the M&A deal performance due to the lack of monitoring. *CEO chairman* is incorporated in the data, being a dummy variable that equals one if the CEO is also the president and chairman of the board of the company in addition to being CEO, and zero otherwise.

CEO *compensation* might impact managerial overconfidence and will also be included as a control variable as the ratio between fixed remuneration, defined as salary, and the total compensation, including bonus and options. The smaller the proportion of fixed compensation compared to total compensation, the higher the likelihood of a manager being considered overconfident due to a higher level of entrenchment (Berger *et al.,* 1997). Prior research indicates that CEO overconfidence is associated with a higher proportion of fixed compensation because there is a lower dependence on his own efforts (Schrand and Zechman, 2012).

4.3.4 Board characteristics

The following set of control variables are related to the corporate governance part of the companies. When conducting M&A transactions, it is important to have effective corporate governance measures and to monitor such decisions, hence the importance of including corporate governance related variables, such as the board size, the proportion of independent board members and the proportion of females in the board.

Firstly, the board composition may affect the type of M&A conducted and the effectiveness of the decision monitoring. Board size is seen as a significant variable (Liu and Wang, 2013; Swanstrom, 2006), however there is a mixed thought regarding board size and its influence on M&A performance. Some point out that smaller boards seem to be

more effective in monitoring tasks which may result in a better M&A performance, while others refer that a larger board size may help to control the actions of managers, being and efficient board size between four and twelve members (Malmendier and Tate, 2008). However, an excessive amount of board members does not necessarily mean that it will correspond to an increase governance of the firm, and indeed could result in the opposite effect and may be ineffective in controlling the actions of CEO (Jensen 1993). In this research, we also considered the *board size* as a control variable that is assessed by the total number of board members at the end of the fiscal year.

Outside independent directors appear to strengthen the corporate board by controlling and monitoring the CEO. According to previous literature, the findings related with board independence are rather ambiguous, some suggest that having more independent directors is consider an important factor for having a successful M&A (McDonald *et al.,* 2008) because they tend to be better monitors (Agrawal and Chadha, 2005) and may decrease the influence of overconfidence on firm outcomes (Kolasinski and Li, 2013). With the purpose of controlling for the advisory role of the board of directors and the influence of independent boards, the *independent board* variable is created, and it is defined as the percentage of independent board members as reported by the company at the end of the fiscal year, being these members not currently employed at the company.

Men and women tend to have different preferences regarding risk (Croson and Gneezy 2009). Females tend to be less overconfident when compared to men (Barber and Odean, 2001), being consider better monitors, reducing the probability of unreasonably risky decisions (Adams and Ferreira, 2009). The inclusion of more women on the board, expanding the board diversity, may ultimately affect the company's outcomes, but also may enhance knowledge and the quality of decision-making (Carter *et al.,* 2003). In this case, having a greater gender-diverse board can be correlated with higher levels of monitoring (Adams and Ferreira 2009). Hence, the importance of including the variable *board gender diversity* that is calculated using the percentage of female on the board, as the number of female directors divided by the overall number of the directors on the board. According to Levi *et al.* (2014), it is important to have board gender diversity when conducting M&A transactions, which can also positively influence post M&A performance (Bellinger and Hillman, 2000).

4.4 Abnormal Returns

An event study investigates the impact of company's economic projects, in this case mergers and acquisitions, on share price, examining abnormal returns in the period surrounding a given announcement of a M&A to perceive if the transaction resulted in value creation or value destruction. Such methodology is widely applied for examining the market's reaction to M&A deals (Thompson, 1985; McWilliams and Siegel, 1997).

Following several M&A empirical research, the standard short-term event study methodology, proposed by Brown and Warner (1985) will be used to examine the short-term stock market reaction and capture the effect of the M&A announcement on the stock return, by obtaining the short-term returns around the event date to measure the acquiring firm's cumulative abnormal returns (CARs) in the sample using the market model. Such methodology is considered well specified and relatively powerful (Brown and Warner, 1985; MacKinlay, 1997), being the most reliable form of measuring value creation, better capturing the effect of an acquisition on stock performance (Andrade *et al.,* 2001).

Firstly, it is defined the announcement date as the event day $(t = 0)$ and secondly, the event window that allows the examination of periods surrounding the event is identified as well as the estimation window, knowing that they cannot overlap (MacKinlay, 1997). Several models can be used to estimate the expected returns, however the market model will be the one adopted, relating the stock returns to the returns of the market portfolio or index (MacKinlay, 1997). The model assumes a stable linear relationship between the market return and the stock return of the firm, in which logarithmic returns will be used to have the results normally distributed and standard statistical tests could be applied. The following equation demonstrates the estimation of normal returns according to the market model, in which the OLS is applied to estimate the relationship between the stock return and market return:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \qquad (1)$$

Lastly, the abnormal returns are calculated by the difference between the actual return and the expected normal return of a certain day, estimated by the market model, using the following equation:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt}) \qquad (2)$$

Where, AR_{it} is the abnormal return for stock i at time t. R_{it} is the actual return of stock i at time t. The expected return of stock i is estimated using the market model, in which R_{mt} indicates the return on the market at time t, which we decided to use the stock market

index of each firm's country as a proxy for the market, and α_i and β_i are the market model parameter estimates for a 210-day estimation window (Malmendier and Tate, 2008).

By aggregating the daily abnormal returns over the event window, we obtain the cumulative abnormal returns (CARs) of the acquirer to measure the effect of the M&A announcements on the stock prices. When observing negative CARs, it indicates that shareholders believe that such transaction will destroy value, on the other hand, positive CARs are seen as a positive sign from shareholder's view. Cumulative abnormal return for company i for (t_1, t) event window is:

$$CAR_i(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{it} \qquad (3)$$

It is important to analyze the abnormal returns before the announcement date since it will capture possible information leakages prior to the official announcement (Malmendier and Tate, 2008; Martynova and Renneboog, 2008). Similarly, it is also necessary to include the post announcement period because it will capture the market reaction to an M&A announcement that was announced after trading hours.

In line with Malmendier and Tate (2008), a three-day event window [-1, +1] surrounding a M&A announcement will be used to examine the abnormal returns, since it is a commonly used event window. However, other event windows will be considered in the robustness check with the goal of reducing biases and better assess the impact that the M&A transaction has. The companies' abnormal returns are obtained for the 11 days surrounding the announcement date in order to construct cumulative abnormal returns (CARs) for a five-day event window [-2, +2], a seven-day event window [-3, +3] and an eleven-day event window [-5, +5], representing a short-term event window. For this research we assumed an estimation window to be equal to [-252, -42] in order to measure the market model parameters, α_i and β_i (Malmendier and Tate, 2008).

In this research, data on daily stock and market index returns for the acquiring company are extracted from Thomson Reuters Datastream. Further, not all targets in the sample are publicly listed, so only the cumulative abnormal returns of the acquirer firms are obtained. In addition, the indexes used as proxies for the market are FTSE all share (UK), CAC 40 (France), SMI (Switzerland), ISEQ (Ireland), DAX 30 (Germany), AEX (Netherlands), OMX 20 (Norway), IBEX 35 (Spain), OMX Stockholm 30 (Sweden), OMX Copenhagen (Denmark) and MSCI Belgium index (Belgium) depending on the market that the acquirer is established. Moreover, it is important to refer that ideally the research should include

additional European countries, but because the information to construct the net buyer measure was hand-collected, it impacts and limits the availability of data, diminishing the possible number of European companies and M&A transactions that can be included in the sample.

4.5 Descriptive Statistics

4.5.1 Data collection and Sample selection

In this paper, the data sample consists of the information on 522 completed M&A transactions conducted by 182 European listed companies, which are announced from 2002 to 2020, excluding failed M&A transactions, divestitures, joint-ventures and management buyouts. Comparing the sample size with prior literature, the majority of past research include a large sample size due to the availability of data when conducting a study in the US. For the European context and due to the overconfidence measure chosen, the access to data is limited, which reduces the possible sample size.

For the collection of the sample several conditions are required, mainly that the acquiring firm must obtain more than 50% of the target after the deal, controlling less than 50% prior to the transaction, implying a change of ownership positions. The data used in this research was collected from different sources, in which data about the characteristics of the deal as well as financial information of the acquiring is retrieved from both Thomson Reuters Eikon and Zephyr and data about the CEOs and board characteristics is completed using the Execucomp database in addition to Thomson Reuters Eikon. Data about the stock market response to the announcement of a given acquisition, in order to calculate the cumulative abnormal returns for the acquirer firm is obtained by Thomson Reuters Eikon. In order to control for the confounding effects that may affect the results of the event study, we decided to include only one transaction per year for the same acquirer to avoid possible overlapping M&A deals that could jeopardize the results as a consequence of confounding events, choosing the largest M&A transaction in terms of deal value that was not associated with other M&A transaction in the same year. Furthermore, for a few deals not all the data regarding the control variables were accessible, so those deals have also been omitted from the sample. Moreover, financial firms with SIC 6000-6999 and utilities with SIC 4000-4999 were eliminated from the sample since there are differences in terms of investment characteristics, regulations, capital structure and corporate governance mechanisms (Berger *et al.,* 1997; Deshmukh *et al.,* 2013).

Table 9 in the appendix shows the percentage of M&A deals per European country, in which the majority of deals are from the UK, representing 54% of the sample, since it is a leading player in international acquisitions. Furthermore, with a lower percentage, 18% are transactions from Ireland, 9% from France acquirers and 7% related to Spain.

4.5.2 Descriptive Statistics

The descriptive statistics are based on a sample containing 522 firm-year observations, between the period 2002 and 2020, in which 310 deals are made by overconfident CEOs while 212 are conducted by non-overconfident CEOs.

Table 1 presents the summary statistics of all variables included in this research. The descriptive statistics of the overconfidence measure for the acquiring firm are shown in panel A. Approximately, 59% of all M&A deals are conducted by overconfident CEOs, which is in accordance with previous research (Campbell *et al.,* 2011; Hirshleifer *et al.*, 2012; Ferris *et al.,* 2013). Most of transactions were finalized by male CEOs, while only 5% of the sample is composed by female CEOs, demonstrating the dominance of males in top management roles. The average tenure is 6 years.

Panel B reveals the summary statistics of firm data. The acquirers in this sample are denoted as large companies with the average acquirer size being approximately 50,975 million USD, however, because the median for the acquirer size is 6564 million USD, it indicates that the sample presents some very large companies and some smaller ones. Cash flow has an average of 1,729 million USD and the acquiring firm's Tobin's Q indicates an average and median that are approximately 2.00 and 1.54, respectively, which may indicate that the firm has growth opportunities. Furthermore, the sample firms are not highly leveraged, with an average leverage ratio of 59%.

Panel C includes the summary of deal specific variables. The mean of the deal value is 1,655 million USD, which is significantly higher than the median of 174 million USD, which implies that the sample consists of relatively small deals and some very large deals, with the largest amount paid being 101,490 million USD. Based on the data, 46% of the acquisition deals have been financed exclusively with cash, while the remaining may be financed with stock or mixed. Considering the industry relatedness between the acquiring firm and its target, on average, 45% of all M&A deals are considered diversifying transactions.

Table 1: Summary Statistics

Panel A reveals the summary statistics of the measure of CEO overconfidence, the binary variable net buyer used as proxy. Looking at panel B, some variables are also included, the total assets, cash flow, capital and capex of the acquiring firm, all denoted in millions of USD. Furthermore, the leverage ratio and Tobin's Q are also included as control variables. Panel C shows the deal specific variables, being considered as dependent binary variable, cash payment, diversification and acquisitiveness. Control variables in panel D represent CEO specific variables, such as age, gender, tenure, the variable chairman and compensation. Panel E shows the summary statistics of board specific variables, being the board size, independent board and board diversity used as control variables. Lastly, panel F shows the summary statistics on the cumulative abnormal returns of the acquiring firm. The five-day, seven-day and eleven-day event windows are included for robustness checks.

Panel A. CEO Overconfidence	**Mean**	**Median**	**St. dev.**	**Min.**	**Max.**
Net Buyer	0.59	1	0.49	0	1
Panel B. Summary statistics of firm data					
Assets	50,975	6,564.5	193,344	48.361	2381,061
Capital	6,746.6	1059.5	17,777	0.285	219,386
Capex	973.5	142.4	2,682	0	33,250
Cash Flow	1,729	522.3	4,169	-29,858	34,168
Tobin's Q	2.00	1.54	2.92	0.58	47.3
Leverage Ratio	0.59	0.58	0.19	0.03	1.21
Panel C. Summary statistics of deal data					
Deal Value	1,655	174.3	7,240	1.528	101,490.6
Cash Payment	0.46	0	0.50	0	1
Diversification	0.45	0	0.50	0	1
Acquisitiveness	0.38	0	0.49	0	1
Panel D. Summary statistics of CEO data					
Age	53.01	53	6.83	32	81
Gender	0.95	1	0.21	0	1
Tenure	6.17	5	4.66	1	43
Chairman	0.24	0	0.42	0	1
Compensation	0.39	0.38	0.23	0	1.20
Panel E. Summary statistics of Board data					
Board Size	10.38	10	2.92	3	23
Independent Board	0.63	0.64	0.18	0	1
Board Diversity	0.18	0.18	0.13	0	1
Panel F. Cumulative Abnormal Returns					
CAR [-1, +1]	0.00538	0.00609	0.0616	-0.8557	0.3727
CAR [-2, +2]	0.00539	0.00388	0.0696	-0.8967	0.4802
CAR [-3, +3]	0.00548	0.00553	0.0631	-0.4505	0.5382
CAR [-5, +5]	0.00284	0.00472	0.0721	-0.6087	0.5589

In panel D, the summary statistics of CEO related variables are included. A CEO that also has the position of chairman of the board may be less monitored, having more power to decide. In this research, only 24% of deals are performed by CEOs that are simultaneously chairman of the board, which is a lower value when compared to prior empirical studies. Furthermore, in this sample, the average age of the CEO is 53, ranging from 32 to 81.

The summary statistics of board related variables are incorporated in panel E and aim to control for corporate governance. Board size consists of an average of 10 members, ranging from 3 to 23, similarly to the results found by Coles *et al.* (2008). The independent board variable has a mean of 63%, indicating that most of the directors on the board of the acquiring firm are not employed at the firm at the time a merger of acquisition is announced, while 37% corresponds to the insider fraction, which is larger than some other studies that found an insider fraction of approximately 20% (Huson *et al.,* 2001; Coles *et al.*, 2008). In addition, the board gender diversity shows that only 18% of the board of directors are females.

Finally, panel F presents summary statistics of the cumulative abnormal returns over different event windows. On average, there is a slightly positive effect on M&A announcements for the acquiring firm, in which the acquiror's stock has a cumulative abnormal return of 54 basis points over the three-day window surrounding the announcement of a M&A deal. However, previous literature has found a slightly negative return on M&A announcement for the acquiring company (Malmendier and Tate, 2008). For the robustness check, assuming different event-windows, the acquiror's stock remains with a slightly positive return on M&A announcement for the acquiring company.

Before performing the regression analysis and to identify possible problems with collinearity that would affect the validity of the results and lead to misinterpretations, the dataset of this research is examined for potential multicollinearity issues in the included variables. Multicollinearity is related with a high correlation between two or more explanatory variables, in which none of the values should exceed the benchmark of 0.7.

Table 2 presents the correlation matrix and suggests the correlations coefficients between the net buyer measure, proxy for overconfidence, and several control variables included in this research, in which several control variables are significantly correlated. In order to test if there is multicollinearity, it is important to verify if the variables are considered highly correlated or not.

Table 2: Correlation Matrix

This Table presents the cross-correlation matrix between several variables used in this research. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A: Correlations with firm characteristics (N = 522)

	Overconfidence	Cash Flow	Leverage Ratio	Assets	Tobin's Q
Overconfidence	1				
Cash Flow	0.101*	1			
Leverage Ratio	-0.0683	0.207***	1		
Assets	0.156***	0.196***	0.145***	1	
Tobin's Q	-0.0704	-0.0238	-0.0279	-0.0176	1

Panel B: Correlations with deal characteristics (N = 522)

	Overconfidence	Deal Value	Cash Payment	Diversification	Acquisitiveness
Overconfidence	1				
Deal Value	0.0955*	1			
Cash Payment	0.215***	0.147***	1		
Diversification	0.204***	-0.0330	0.0418	1	
Acquisitiveness	0.186***	0.0939*	0.143**	0.0344	1

Panel C: Correlations with CEO characteristics (N = 522)

	Overconfidence	Chairman	CEO Age	Gender	Compensation	Tenure
Overconfidence	1					
CEO chairman	-0.0556	1				
CEO Age	0.0830	0.133**	1			
Gender	-0.0698	0.0572	-0.0812	1		
Compensation	-0.0202	-0.0847	-0.235***	0.0559	1	
CEO tenure	-0.0644	0.1000*	0.357***	0.118**	-0.0508	1

Panel D: Correlations with board characteristics (N = 522)

	Overconfidence	Board Size	Independent board	Board Diversity
Overconfidence	1			
Board Size	0.127**	1		
Independent Board	-0.0206	-0.140**	1	
Board Diversity	-0.0223	0.176***	0.189***	1

Correlations exceeding 0.7 may lead to potential multicollinearity issues. Observing the correlation matrix, the correlations between the overconfidence measure and the control variables are generally weak, being the highest correlations with net buyer, the method of payment (0.21), diversification variable (0.20) and the acquisitiveness variable (0.18), which indicates that it is highly unlike that the results will suffer from any collinearity issues. Moreover, it is possible to exclude problems of multicollinearity.

Panel A shows the cross-correlation coefficients between the overconfidence measure and several firm control variables. The correlation between the overconfidence measure and the size of the acquirer is positive and statistically significant, indicating that CEOs of larger firms tend to be associated with a more overconfident behavior (McCarthy and Dolfsma, 2012). Furthermore, the correlation of the overconfidence measure with cash flows is in line with the correlation found by Malmendier and Tate (2008), suggesting that overconfident CEOs work at firms with higher cash-flows.

Panel B reveals the cross-correlation coefficients between the overconfidence measure and several deal control variables. Most variables have significant correlation coefficients and are in line with the correlations found by Malmendier and Tate (2008). The deal value is positively and significant correlated with the overconfidence proxy implying that that overconfident CEOs tend to perform acquisitions with larger values.

As expected, overconfident CEOs conduct more often M&A deals since the overconfidence measure is positively related to the dummy variable acquisitiveness, revealing a positive and significant correlation between overconfidence and acquisitiveness. In addition, overconfident CEOs are also more often involved in diversifying acquisitions as the correlation between the two variables is significantly positive, which is also suggested by Malmendier and Tate (2008). Furthermore, there is a positive significant correlation between the overconfidence measure and the binary variable payment cash, which suggests that overconfident CEOs tend to use cash more often as a method of payment.

Panel C suggests the cross-correlation coefficients between the overconfidence measure and several CEO control variables, however none of the variables present significant values. Finally, Panel D indicates the cross-correlation coefficients between the overconfidence measure and several board control variables. Board size is considered statistically significant, with a positive correlation with the measure of managerial overconfidence.

Additionally, a Variance Inflation Factor (VIF) was estimated for all correlation pairs of variables to also check for multicollinearity. The value of the VIF should not exceed the limit of 10, or 1/VIF should not be lower than 0.1. None VIF's exceeded the thresholds, so no multicollinearity problems were found.

4.6 Methodology

4.6.1 Univariate Analysis

A Univariate Analysis is used to understand if overconfident CEOs make different choices regarding the level of acquisitiveness, the method of payment and the diversification of the transaction. For the categorical variables, a proportion z-test is used. Furthermore, mean-comparison test is assessed for the cumulative abnormal returns. Hence, using the Welch's test since cumulative abnormal returns are not normally distributed.

4.6.2 Multivariate Analysis

4.6.2.1 The influence of CEO overconfidence on acquisitiveness

The first hypothesis to be tested is the impact of CEO overconfidence on acquisitiveness. According to previous literature, overconfident CEOs are more likely to pursue M&A transactions when compared to non-overconfident CEOs (Malmendier and Tate, 2008). In order to test such hypothesis, a binary choice logit model is used. Following Malmendier and Tate (2008), the logit regression was developed:

$$Pr\{Y_{it} = 1|O_{it}, X_{it}\} = G(\beta_1 + \beta_2 O_{it} + X'_{it}B) \qquad (4)$$

Y represents a binary variable, that equals one if at least one successful transaction has occurred in a particular firm year, and zero otherwise. *O* is the *Overconfidence* measure, a binary variable that equals one if a CEO is net buyer in more years of the sample than net seller, and zero otherwise. *G* is the logistic distribution and X_{it} represents the control variables that will be used in this regression.

The firm specific control variables will include the *Acquirer Size* that is the natural logarithm of total assets. *Cash Flow* is measured as earnings before extraordinary items plus depreciations, normalized by capital. *Tobin's Q* is the ratio between the market value of assets and the book value of assets of the acquiring firm. *Leverage Ratio* of the acquirer is calculated as total liabilities over total assets.

Furthermore, the deal specific variables will incorporate the *Deal Size* as the natural logarithm of the transaction value. At the CEO level, the *Age* represents the CEO's age at the time of the M&A transaction. *CEO Tenure* corresponds to the number of years that the

CEO remains his position on the company. *CEO Chairman* that equals one if the CEO also holds a position of the chairman of the board, and zero otherwise. *Compensation* is ratio between fixed remuneration, defined as salary, and the total compensation of the acquirer firm, including bonus and options.

Finally, in terms of board related variables, it is included the *Board Size* assessed by the total number of board members at the end of the fiscal year. *Independent Board* is measured by the percentage of independent board members as reported by the company. *Board Gender Diversity* is calculated using the percentage of female on the board. All the variables used in the regressions are presented in Table 8 in the appendix.

4.6.2.2 CEO overconfidence and diversifying M&A

Secondly, we assess whether overconfident CEOs are more likely to pursue diversifying acquisitions when compared to non-overconfident CEOs. To test such hypothesis and following Malmendier and Tate (2008), we re-estimate Eq. (4) with a dependent variable that classifies deal as diversifying, equaling one if the two-digit SIC code of the acquirer and the target differ, and zero otherwise.

4.6.2.3 CEO overconfidence and the method of payment in M&A

The third hypothesis exploits the fact that overconfident CEOs use cash as a payment method more frequently than non-overconfident CEOs. To test such hypothesis, Eq. (4) will be re-estimated with a distinct dependent variable, representing the method of finance adopted in the M&A, with a binary variable that equals one if cash is used exclusively as a payment method for the M&A transaction, and zero otherwise.

4.6.2.4 Market reaction to M&A conducted by overconfident CEOs

Previous literature shows a negative market response to the announcement of an acquisition conducted by an overconfident CEO (Malmendier and Tate, 2008; Ferris *et al.,* 2013). To analyze the impact of CEO overconfidence on shareholder value creation, measured by the market reaction to the deal announcement, the fourth hypothesis is tested through an event study. The subsequent OLS regression is computed:

$$CAR_{it} = \beta_1 + \beta_2 O_{it} + X'_{it} G + \varepsilon_{it} \qquad (5)$$

The dependent variable represents a three-day window cumulative abnormal return. *Overconfidence* is a binary variable that equals one if a CEO is net buyer in more years of the sample than net seller, and zero otherwise. X represents the set of controls that will be included in the regression. Regarding control variables related to firm, deal, CEO and board characteristics, the variables have the same meaning as previously indicated.

4.6.2.5 Impact of corporate governance on CEO overconfidence

Following Kolasinski and Li (2013) we apply interaction variables between overconfidence and the corporate governance measures to analyze factors that may attenuate the effect of CEO overconfidence on the level of acquisitiveness, diversification, cash payment and M&A performance.

Firstly, interaction variables between board size, board independence, board gender diversity, CEO duality and the managerial overconfidence were created to examine whether such measures could attenuate the impact of managerial overconfidence on the level of acquisitiveness.

$$P\,(Acquisition = 1) = \Lambda(\alpha + \beta_1 overconfidence + \beta_2 boardsize * overconfidence + \beta_3 independentboard * overconfidence + \beta_4 boarddiversity * overconfidence + \beta_5 CEOchairman * overconfidence) \quad (6)$$

Similarly, we examine whether board composition attenuates the effect of overconfidence on diversifying acquisitions, replicating the previous model with the dependent variable being the diversification variable. Moreover, the same model will be applied for examining the impact of such interaction variables in attenuating the effect of overconfidence in the method of payment chosen, substituting the dependent variable for the cash payment variable. Finally, a similar model will be estimated, assuming the dependent variable as the M&A performance, measured by the cumulative abnormal returns around the announcement of the transaction.

4.6.3 Robustness Check

We check the robustness of our results using a different proxy for managerial overconfidence related with multiple acquisitions. Following Doukas and Petmezas (2007), a CEO will be considered overconfident when conducting five or more acquisitions within a 3-year period.

In addition, the validity of the results will be tested regarding the OLS regression, by changing the event window in which the cumulative abnormal returns are calculated from three days [-1, +1] to five days [-2, +2], seven days [-3, +3] and eleven days [-5, +5].

5. Results

In this research the datasets are panel because it consists of multi-dimensional data, being considered unbalanced due to time gaps. A Hausman test for endogeneity was performed to determine whether to use the fixed-effects model or the random-effects model, being the random-effects model the most appropriate one, in which the results can be found in appendix in Table 10.

Furthermore, potential heteroscedasticity in the regression models could result in biased estimators, as such, to test for heteroscedasticity, the White Test was performed for each regression model. To control for heteroscedasticity, the regressions include standard errors clustered by acquirer in the pooled and random-effects logits to generate more robust results (Malmendier and Tate, 2008).

5.1. Univariate Analysis

Table 11 in the appendix presents the mean-comparison test of the categorical variables of the acquirer between acquisitions conducted by overconfident CEOs and non-overconfident CEOs. Observing the results, the proportion of CEOs that are associated with a high level of acquisitiveness is significantly higher in the group of overconfident CEOs. Such result indicates that based on the univariate analysis, overconfident CEOS are more likely to conduct M&A transactions when compared to non-overconfident CEOs similarly to the results found by Malmendier and Tate (2008), hence H_1 cannot be rejected.

Furthermore, the proportion of acquisitions that are diversifying is higher in the group of CEOs classified as overconfident, which is in accordance with prior literature that overconfident CEOs are more likely to pursue diversifying mergers, being the difference significant at the 1% level, not allowing to reject H_2. Finally, the proportion of CEOs that tend to finance the deal with cash is significantly higher in the group of overconfident CEOs, showing that overconfident CEOS are more likely to finance M&A transactions with cash when compared to non-overconfident CEOs, hence not rejecting H_3.

Table 12 in the appendix provides the mean-comparison tests of Cumulative Abnormal Returns of the acquirer between acquisitions conducted by overconfident CEOs relative to non-overconfident CEOs. Prior literature suggests that the overconfidence bias is associated with lower wealth effects than those generated by non-overconfident CEOs. Comparing the cumulative abnormal returns earned by overconfident CEOs to the returns generated by non-overconfident CEOs, the market reaction to M&A deals conducted by overconfident CEOs tends to be lower. For non-overconfident CEOs, the mean

cumulative abnormal returns over the third-day window surrounding the announcement are 1.12%, while for the overconfident CEOs are 0.167%. The mean difference in cumulative abnormal returns between overconfident and non-overconfident CEOs is -0.96%, indicating that overconfident managers fail to outperform non-overconfident CEOs, resulting in a negative impact to the shareholder's wealth. Such results are in accordance with the predictions, being similar to the results found by Croci *et al.,* (2010).

5.2. The influence of CEO overconfidence on acquisitiveness

Previous literature shows empirical evidence that overconfident CEOs, known for maintaining high personal exposure to company risk, tend to perform more M&A deals that create on average less value, when compared to non-overconfident CEOs (Malmendier and Tate, 2008).

The first hypothesis aims to test whether overconfident CEOs are more likely to conduct a M&A transaction than non-overconfident CEOs, having a positive effect on overall acquisitiveness. First, in columns 1-3 of Table 3, pooled logit regressions are estimated, using all types of variation. After performing a Hausman test, present in Table 10 in the appendix, to determine whether to use the random-effects model or the fixed-effects model, the most suitable model to use was verified to be the random-effects model, estimated in columns 4-6. Furthermore, clustered standard errors were used in the pooled and random-effects logits to account for heteroskedasticity at the firm level.

Table 3 presents the results of the logit regressions concerning the effect of overconfidence on acquisitiveness, using the net buyer proxy for overconfidence. The dependent variable is a binary variable that equals one if at least one successful M&A transaction has occurred in the fiscal year, and zero otherwise. Since this is a logistic regression analysis, Table 3 shows the odds ratios instead of the coefficients that are also present in Table 15 in the appendix, due to its intuitive interpretation and the z statistics are included in the parentheses. Since the results are shown including the odds ratio, it is important to note that an odds ratio above one indicates that there is a positive relationship between the dependent and independent variable, while an odds ratio below one implies a negative relationship.

Analyzing Table 3, CEO overconfidence is positively related to serial acquisitions, significant at a 1% significance level, being robust to the inclusion of several firm, deal control variables, CEO specific characteristics and also board related variables.

Table 3: Effect of overconfidence on Acquisitiveness
Acquisitiveness is the dependent variable binary, one meaning that the firm made at least one successful M&A transaction in a given year. Overconfidence is a binary variable that represents the net buyer proxy for overconfidence. Regarding the control variables related to the acquirer, the firm size, cash flow, Tobin's Q are represented in millions of USD. Moreover, the leverage ratio and deal size are included as control variables. CEO related variables, such as age, tenure, compensation and CEO duality are also included in the research. Additionally, the board size, independent board and board gender diversity are introduced as control variables. Both the logit regression and the random-effects logit model are estimated with standard errors clustered by acquirer. All coefficients are presented as odds ratios and z-statistics are provided between the brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Pooled Logit			Random-Effects Logit		
	(1)	(2)	(3)	(4)	(5)	(6)
Overconfidence	2.154***	2.175***	2.158***	2.553***	2.655***	2.645***
	(3.53)	(3.48)	(3.46)	(3.40)	(3.40)	(3.34)
Acquirer Size	1.070	1.077	1.081	1.045	1.052	1.057
	(1.26)	(1.38)	(1.37)	(0.72)	(0.82)	(0.85)
Cash Flow	0.999	0.999	0.999	0.999	0.999	0.999
	(-0.73)	(-0.72)	(-0.52)	(-0.96)	(-0.91)	(-0.67)
Tobin's Q	1.049	1.052	1.051	1.078**	1.084**	1.080**
	(1.46)	(1.45)	(1.42)	(2.50)	(2.42)	(2.40)
Leverage Ratio	0.945	0.879	0.909	0.788	0.710	0.767
	(-0.10)	(-0.23)	(-0.17)	(-0.37)	(-0.52)	(-0.39)
Deal Value	0.969	0.964	0.955	0.991	0.988	0.980
	(-0.62)	(-0.71)	(-0.89)	(-0.15)	(-0.19)	(-0.33)
CEO Age		0.983	0.987		0.977	0.980
		(-1.00)	(-0.77)		(-1.20)	(-1.00)
CEO Tenure		0.981	0.979		0.972	0.971
		(-0.68)	(-0.78)		(-0.81)	(-0.91)
CEO Chairman		1.096	1.097		1.099	1.121
		(0.33)	(0.32)		(0.28)	(0.33)
CEO compensation		0.904	0.815		1.211	1.012
		(-0.22)	(-0.43)		(0.37)	(0.02)
Board Size			0.995			0.985
			(-0.09)			(-0.28)
Independent Board			0.764			0.450
			(-0.44)			(-1.10)
Board Diversity			0.379			0.404
			(-1.00)			(-0.78)
Constant	0.162***	0.455	0.611	0.143***	0.493	1.016
	(-3.47)	(-0.73)	(-0.48)	(-3.49)	(-0.61)	(0.01)
Observations	522	522	522	522	522	522

Looking at the pooled logit regression with firm and deal specific controls, an odds ratio of 2.154 is found, meaning that the odds of an overconfident CEO pursuing a successful M&A transaction is 2.154 times the odds of a non-overconfident CEO, being consistent with the results of Malmendier and Tate (2008) that found that the odds of an overconfident CEO making at least one acquisition is 1.65 times the odds of non-overconfident CEOs, significant at 1% as well. After including all the control variables,

regression 3 shows an increase of the coefficient of odds ratio, to 2.158, maintaining its 1% level of significance.

There are several variables that can potentially have an influence on the corporate acquisitiveness of the firm, however none of the firm and deal specific variables are statistically significant. Regression 3 introduces CEO and board specific variables, in which managerial overconfidence continues to have a positive relationship with acquisitiveness at a 1% significance level while none of the control variables reveal a statistically significant relationship.

Examining the random effects model, the overconfidence measure effect is robust to the inclusion of several control variables, maintaining the same positive and significant relationship with the level acquisitiveness, observing an odds ratio of 2.645. Looking at the results, only the control variable Tobin's Q is found to influence positively corporate acquisition intensity, with a 5% level of significance in all regressions (Jovanovic and Rousseau, 2002; Billett and Qian, 2008; Dowling and Aribi, 2013; Chen *et al.,* 2016). In line with the findings of Ferris *et al.* (2013), a significant positive relationship of Tobin's Q with acquisitiveness implies that firms with better investment opportunities are more likely to pursue a M&A deal. However, such result does not coincide with the one found by Malmendier and Tate (2008), indicating that a lower Tobin's Q is associated with a higher level of acquisitiveness.

Based on the empirical analysis, it was possible to conclude that overconfident CEOs tend to be more often involved in M&A deals than their non-overconfident counterparts, which goes accordingly with previous literature (Malmendier and Tate, 2008; Campbell *et al.,* 2011; Cain and McKeon, 2016). Even after the inclusion of several control variables, the effect of CEO overconfidence on merger frequency remained positive, indicating that there is a positive impact of CEO overconfidence on corporate acquisitiveness, significant at the 1% level for all regressions. Indeed, acquiring overconfident CEOs are significantly more acquisitive than non-overconfident CEOs (Malmendier and Tate, 2008), validating the first hypothesis that overconfident CEOs are more likely to be involved in an acquisition than non-overconfident managers. Therefore, H_1 should not be rejected based on the empirical results of this research.

5.3. CEO overconfidence and diversifying M&A

Table 4 presents both the pooled logit regressions and the random effects model that are used to estimate the effect that CEO overconfidence has on the tendency to make

unrelated acquisitions. Columns 1-3 reveals the pooled logistic regression and columns 4-6 show the results of the random-effects model with clustered standard errors by the acquirer, since after performing the Hausman test, the suitable model to use was the random-effects model, present in Table 10 in the appendix. For both the pooled logit and random-effects logit model, the sign of the coefficient of acquiring CEO overconfidence remains positive and significant, being managerial overconfidence positively related to conducting a diversifying M&A deal.

For the pooled logit model, there is a positive relationship between overconfidence and diversifying M&A, in which overconfident CEOs are significantly more likely than other CEOs to pursue diversifying M&A transactions, with an odds ratio of 1.934, significant at 5%, which is in line with the results presented by Malmendier and Tate (2008), with a odds ratio of 2.54, also significant at 1%. The odds of an overconfident CEO to conduct a diversifying acquisition is 1.934 higher compared to the odds of a non-overconfident CEO. So, this empirical finding indicates that M&A conducted by overconfident CEOs may be characterized as low quality. Moreover, after the inclusion of all control variables, the odds ratio increases to 1.964, remaining its significance at the 5% level of significance, while some controls remain insignificant in all regressions.

Table 4 shows the pooled logit regressions, in which the first regression includes firm and deal specific controls, and it is possible to observe that the acquirer size has a positive relationship with diversifying acquisitions, being statistically significant at the 1% level. Larger companies have more resources and since they may already be established in markets that they are already familiar with and have a great knowledge, it becomes increasingly important to expand and evolve their business to new markets and create new opportunities, diversifying their transactions.

Observing a negative relationship between the leverage ratio of the acquirer and the likelihood of pursuing a diversifying acquisition with a level of significance of 1%, it is possible to associate a lower leverage ratio and subsequently lower level of financial constraint, to a higher tendency to diversify when pursuing transactions.

Similarly, the deal value has a negative relationship with unrelated transactions, being significant at the 1% level of significance. Larger deal values tend to be characterized as transactions between related firms.

Table 4: Effect of overconfidence on diversification
The dependent variable diversification is a binary variable that equals one if the target operates in a different industry than the acquirer, based on the two-digit SIC code, and zero otherwise. Overconfidence is a binary variable that represents the net buyer proxy for overconfidence. Regarding the control variables related to the acquirer, the firm size, cash flow, Tobin's Q are represented in millions of USD. Moreover, the leverage ratio and deal size are included as control variables. CEO related variables, such as age, tenure, compensation and CEO duality are also included in the research. Additionally, the board size, independent board and board gender diversity are introduced as control variables. Both the logit regression and the random-effects logit model are estimated with standard errors clustered by acquirer. All coefficients are presented as odds ratios and z-statistics are provided between the brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Pooled Logit			Random-Effects Logit		
	(1)	(2)	(3)	(4)	(5)	(6)
Overconfidence	1.934**	1.918**	1.964**	2.405**	2.352**	2.434**
	(2.46)	(2.41)	(2.46)	(2.44)	(2.37)	(2.42)
Acquirer Size	1.287***	1.269***	1.279***	1.454***	1.435***	1.437***
	(3.87)	(3.66)	(3.94)	(4.78)	(4.47)	(4.50)
Cash Flow	0.991	0.989	0.989	0.999	0.999	0.999
	(-2.14)	(-1.71)	(-1.55)	(-1.51)	(-1.53)	(-1.40)
Tobin's Q	0.968	0.968	0.963	1.027	1.019	1.019
	(-0.92)	(-0.96)	(-1.11)	(0.81)	(0.53)	(0.57)
Leverage Ratio	0.119***	0.124**	0.137**	0.076***	0.084***	0.091**
	(-2.72)	(-2.70)	(-2.43)	(-2.82)	(-2.75)	(-2.54)
Deal Value	0.781***	0.789***	0.784***	0.685***	0.694***	0.692***
	(-3.89)	(-3.85)	(-4.15)	(-4.92)	(-4.72)	(-4.77)
CEO Age		1.046**	1.046**		1.046	1.046
		(2.19)	(2.05)		(1.58)	(1.54)
CEO Tenure		0.997	0.996		1.020	1.017
		(-0.11)	(-0.14)		(0.49)	(0.47)
CEO Chairman		0.994	1.024		1.061	1.087
		(-0.06)	(0.08)		(0.17)	(0.24)
CEO compensation		1.737	1.716		1.869	2.094
		(1.20)	(1.12)		(1.00)	(1.10)
Board Size			0.969			0.976
			(-0.65)			(-0.38)
Independent Board			1.023			2.012
			(0.03)			(0.73)
Board Diversity			1.346			1.233
			(0.31)			(0.17)
Constant	0.749	0.061***	0.073**	0.541	0.036**	0.025**
	(-0.49)	(-2.64)	(-2.16)	(-0.78)	(-2.19)	(-2.06)
Observations	522	522	522	522	522	522

When adding both CEO and board related variables to the regression, only the CEO age is positively related with the deal being diversifying, with a significance level of 5%, while the remaining variables show no significance. Younger CEOs are expected to engage more frequently in M&A transactions with a higher risk associated, and since diversifying acquisitions are considered riskier due to the unknown factor regarding the industry, then we would expect that younger CEOs would conduct more often diversifying acquisitions

when compared to older CEOs. However, Serfling (2014) suggest that CEOs can reduce firm-specific risk by diversifying their operations, and in this case because older CEOs are more risk-averse in comparison to younger CEOs, then there should be a positive relationship between CEO age and conducting diversifying acquisitions. The results of this research show a positive relationship between the CEO age and the likelihood of conducting diversifying M&A deals.

Looking to the regressions for the random-effects logit model, managerial overconfidence is positively related to a diversifying deal with a 5% significance level, revealing an odds ratio of 2.405.

Observing the results, the acquirer size remains its positive and significant relationship with the likelihood of conducting diversifying acquisitions, being in line with the results presented by Malmendier and Tate (2008). Furthermore, the leverage ratio of the acquirer firm maintains a negative relationship towards diversifying M&A transactions, with a 1% significance level, as well as the deal value that continues to have a negative relationship with unrelated transactions, significant at the 1% significance level. When introducing both the CEO and board related variables, none of the variables show any level of significance, however there was an increase in the odds ratio of managerial overconfidence to 2.434, revealing a positive effect in unrelated M&A transactions, also maintaining the level of significance of 5%.

After analyzing the regressions, some conclusions can be drawn on the effect of managerial overconfidence on the probability that a deal is classified as diversifying. It is possible to deduce that indeed overconfident CEOs tend to pursue more diversifying M&A when compared to non-overconfident CEOs as it was previously suggested in other empirical studies. Since prior research find evidence of a diversification discounts (Lang and Stulz, 1994; Berger and Ofek, 1995; Servaes, 1996; Lamont and Polk, 2002), overconfident CEOs tend to make worse deals when compared to non-overconfident CEOs, since diversifying deals are a proxy for poorer deal quality.

After examining the impact that managerial overconfidence has on the quality of M&A deals, by investigating whether overconfident CEOs acquire more often companies across different industries or within the same industry, the second hypothesis was validated, and we concluded that overconfident CEOs indeed tend to perform more diversifying transactions, lowering the average deal quality.

5.4. The influence of CEO overconfidence on the method of payment in M&A

Previous empirical research suggests that managerial overconfidence often results in M&A transactions being financed exclusively with cash. Observing the results based on the logistic regressions, there is a significant positive relation between overconfidence and the use of cash as a payment method.

Table 5 includes both the pooled logit and random-effects logistic regression, after performing a Hausman Test present in Table 10 in the appendix, with standard errors clustered by firm to account for heteroskedasticity. In all regressions the coefficient of acquirer CEO overconfidence is positive, with an odds ratio of 2.251 indicating that overconfident CEOs are 2.251 times more likely to finance a deal with cash than non-overconfident CEOs, statistically significant at the 1% level, which is in line with the results of Malmendier and Tate (2008). After controlling for several variables, the coefficient for overconfidence remains positive and statistically significant.

Observing the results found with the pooled logit regressions, the size of the acquirer firm shows a significant positive relationship with the use of cash as a payment method. Larger companies have a higher tendency to use cash as a method of finance when pursuing acquisitions, which makes sense due to their higher availability of resources. In addition, the Tobin's Q also shows a positive significant relationship with the deal being financed exclusively with cash. This implies that companies with greater growth opportunities are more likely to use cash as a form of payment in M&A, which does not coincide with the results found by Malmendier and Tate (2008).

Moreover, when introducing CEO related variables, only the CEO age variable presents a 5% level of significance, indicating that an older CEO has a higher tendency to finance a M&A deal exclusively with cash. With the introduction of board related variables, CEO chairman variable presents a 5% level of significance, indicating that a CEO that is also the chairman of the board has a higher tendency to finance a M&A deal exclusively with cash. Furthermore, the board size reflects a positive and significant at the 1% level relationship with the likelihood of the deal being financed with cash. A larger board may result in a lower vigilance and control towards the CEO, which may end up resulting in CEOs choosing more often to finance M&A transactions with cash.

Table 5: Effect of overconfidence on Merger financing
The dependent variable cash payment is binary and equals one if a merger or acquisition is completely financed by cash, or zero otherwise. Overconfidence is a binary variable that represents the net buyer proxy for overconfidence. Regarding the control variables related to the acquirer, the firm size, cash flow, Tobin's Q are represented in millions of USD. Moreover, the leverage ratio and deal size are included as control variables. CEO related variables, such as age, tenure, compensation and CEO duality are also included in the research. Additionally, the board size, independent board and board gender diversity are introduced as control variables. Both the logit regression and the random-effects logit model are estimated with standard errors clustered by acquirer. All coefficients are presented as odds ratios and z-statistics are provided between the brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Pooled Logit			Random-Effects Logit		
	(1)	(2)	(3)	(4)	(5)	(6)
Overconfidence	2.251***	2.299**	2.213***	2.435***	2.299***	2.302***
	(3.64)	(3.79)	(3.80)	(3.43)	(3.79)	(3.64)
Acquirer Size	1.136*	1.141***	1.131**	1.138*	1.141*	1.131*
	(2.04)	(2.11)	(1.92)	(1.85)	(2.11)	(1.82)
Cash Flow	0.992	0.992	0.994	1.000	0.992	1.000
	(-1.22)	(-1.20)	(-1.43)	(0.19)	(-1.20)	(0.12)
Tobin's Q	1.354**	1.304	1.451**	1.346**	1.304**	1.449***
	(2.57)	(2.22)	(3.10)	(2.28)	(2.22)	(3.00)
Leverage Ratio	0.957	1.021**	0.843	0.896	1.021	0.830
	(-0.09)	(0.04)	(-0.33)	(-0.19)	(0.04)	(-0.34)
Deal Value	0.933	0.938***	0.926	0.938	0.938	0.930
	(-1.23)	(-1.12)	(-1.24)	(-1.00)	(-1.12)	(-1.11)
CEO Age		1.002**	1.023		1.002	1.021
		(0.11)	(1.28)		(0.11)	(1.11)
CEO Tenure		1.005	1.004		1.005	1.001
		(0.20)	(0.15)		(0.20)	(0.24)
CEO Chairman		1.714	1.493**		1.714**	1.525
		(2.07)	(1.56)		(2.07)	(1.61)
CEO compensation		1.160	1.465		1.160	1.509
		(0.30)	(0.79)		(0.30)	(0.82)
Board Size			1.103***			1.103**
			(2.50)			(2.45)
Independent Board			6.319***			6.879***
			(2.89)			(2.82)
Board Diversity			0.018**			0.017***
			(-4.29)			(-4.16)
Constant	0.0744***	0.047***	0.004	0.059***	0.047***	0.004***
	(-4.26)	(-2.67)	(-4.27)	(-4.17)	(-2.67)	(-4.12)
Observations	522	522	522	522	522	522

Moreover, the independent board variable shows a positive statistically significant relationship with the use of cash to finance the deal, significant at the 1% significance level. Boards composed with a higher proportion of independent directors tend to be more vigilant towards the CEO's decisions. Concerning the board diversity variable, it has a negative effect on the use of cash as a method of payment, being significant at the 5% significance level.

Observing the random-effects logit model, the results obtained are similar to the pooled logit regressions previously analyzed, showing a positive relationship between managerial overconfidence and the probability that the deal is financed exclusively with cash, with a 1% significance level in all regressions. The acquirer size remains with a positive relationship with the method of payment being cash, at a 10% significance level, as well as the Tobin's Q of the acquirer firm with a 5% significance level. Additionally, the CEO chairman variable also presents a positive significant relationship with cash being the method of payment adopted. With the inclusion of board related variables, the board size remains its significant positive relationship with the variable cash payment and the independent board shows again a positive significant at the 1% level relationship with the deal being financed with cash. On the other hand, the board diversity variable shows a negative significant relationship with the probability that a transaction is paid with cash, with a 1% significance level.

Indeed, overconfident CEOs have a higher tendency to pursue M&A transactions that are financed exclusively with cash, in comparison with non-overconfident CEOs, as it is reported in previous studies (Malmendier and Tate, 2008). Furthermore, the third hypothesis is validated.

5.5. Market reaction to M&A announcements conducted by overconfident CEOs

The stock market reaction is an important indicator to evaluate if a M&A transaction creates shareholder value in the case of positive cumulative abnormal returns, or if on the other hand, is value-destroying demonstrating negative cumulative abnormal returns. Previous empirical research concludes that M&A transactions pursued more often by overconfident CEOs have lower average quality, and a negative market response when compared to non-overconfident CEOs (Malmendier and Tate, 2008).

Observing the results found in the pooled OLS model, the effect of managerial overconfidence on the market reaction is analyzed. Overall, the results show a significant negative relation between CEO overconfidence and the acquirer's returns around the announcement date.

Firstly, we control for firm specific variables and the results suggest that managerial overconfidence of the acquiring firm negatively affects the cumulative abnormal returns of the firm over a three-day event period, at a 5% significance level. Such results are in line with previous findings presented by Andrade *et al.* (2001); Doukas and Petmezas (2007); Malmendier and Tate (2008); Campbell *et al.* (2011) and Hirsheifer *et al.* (2012), in which

the market is able to identify M&A transactions that are conducted by overconfident CEOs and responds negatively to such deals.

Table 6: Market Reaction to CEO overconfidence
Table 6 reports the result of the OLS regression analysis. The dependent variable is the CARs of the bidder's stock from the day before the announcement of the bid through the day after [-1, +1]. Overconfidence is a binary variable that represents the net buyer proxy. The control variables firm size, cash flow, Tobin's Q are represented in millions of USD. Moreover, the leverage ratio and deal size are included as control variables. CEO related variables, such as age, tenure, compensation and CEO duality are also included in the research. Additionally, the board size, independent board and board gender diversity are introduced as control variables. The OLS model is estimated with standard errors clustered by acquirer. All coefficients are presented, and t-statistics are provided between the brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	OLS		
	(1)	(2)	(3)
Overconfidence	-0.0107**	-0.0105**	-0.0109**
	(-1.95)	(-1.99)	(-2.17)
Acquirer Size	-0.0016	-0.0014	-0.0013
	(-1.20)	(-1.07)	(-0.94)
Cash Flow	-5.64e-08	-1.81e-08	1.79e-07
	(-0.17)	(-0.05)	(0.57)
Tobin's Q	-0.0010	-0.0009	-0.0012
	(-1.31)	(-1.18)	(-1.56)
Leverage Ratio	-0.0152	-0.0160	-0.0140
	(-0.81)	(-0.84)	(-0.74)
Deal Value	0.0014	0.0013	0.0011
	(1.21)	(1.12)	(0.96)
Diversification	-0.0067	-0.0054	-0.0053
	(-0.86)	(-0.68)	(-0.67)
Cash Payment	0.0007	0.0012	0.0029
	(0.12)	(0.21)	(0.50)
CEO Age		-0.0008**	-0.0009**
		(-1.99)	(-2.37)
CEO Tenure		0.0003	0.0002
		(0.56)	(0.34)
CEO Chairman		-0.0030	-0.0020
		(-0.55)	(-0.37)
CEO compensation		-0.0069	-0.0130
		(-0.70)	(-1.21)
Board Size			-0.0008
			(-1.14)
Independent Board			-0.0373***
			(-2.76)
Board Diversity			0.0102
			(0.57)
Constant	0.0348***	0.0754***	0.1106***
	(3.16)	(3.07)	(3.78)
Observations	522	522	522

The first regression shows a significant negative coefficient of -107 basis points on the overconfidence measure, at the 5% level of significance, in which the coefficient of -0.0107

indicates that the market responds 1.07% worse to announcements conducted by overconfident managers when compared to non-overconfident CEOs. These results are robust and hold even after including a large set of controls related to financial attributes of the acquiring firm, deal specific characteristics, CEO and board related variables. This suggest that an overconfident CEO has a significant negative impact on M&A deal announcement abnormal returns, on average, of between -1.05%, and -1.09%.

When introducing CEO specific variables in the second regression, the CEO age shows a significant negative relationship with the acquiring firm's cumulative abnormal returns for a 3-day period, indicating that older CEOs tend to be perceived negatively by the market, which does not align with the prior literature. The coefficient of CEO overconfidence remains negative when adding the controls, being significant at the 5% significance level.

Moreover, when including board variables, the independent board variable shows a significant negative relationship with the cumulative abnormal returns, meaning that board composed with more independent directors is perceived negatively by the market, which does not coincide with prior literature, since outside directors tend to monitor better M&A deals when compared to non-overconfident CEOs.

Overall, overconfident CEOs are perceived by the market, generating negative cumulative abnormal returns around the announcement, as it is found in several previous studies (Malmendier and Tate, 2008), validating the fourth hypothesis that the market reacts worse to announcements conducted by overconfident managers when compared to non-overconfident CEOs.

5.6. Corporate governance

Table 7 shows the impact that corporate governance mechanisms may have in attenuating the effect of managerial overconfidence on M&A characteristics and performance.

Looking at the first logistic regression, a negative and significant relationship between the interaction variable of board diversity and overconfidence and the level of acquisitiveness is found. A coefficient of 0.665 on overconfidence implies that when a board it is not gender diverse, overconfidence increases the odds of an acquisition by a factor of 1.94[1]. However, a coefficient on the interaction of -1.61 implies that when the board is more gender diverse, overconfidence increases the odds of an acquisition by only a

[1] 1.94 = [exp(0.665)]

factor of 0.38[2]. As predicted, the interaction between board gender diversity and overconfidence is significantly negative. Thus, board gender diversity significantly attenuates the effect of overconfidence on acquisitiveness.

Table 7: Impact of corporate governance in attenuating CEO overconfidence
Table 7 shows the impact of corporate governance in attenuating managerial overconfidence with the board size, independent board, board gender diversity and CEO chairman as interactions variables. The coefficients are reported and standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Acquisitiveness (1)	Diversification (2)	Cash Payment (3)	CAR [-1, +1] (4)
Overconfidence	0.665	0.404	-1.299*	0.0047
	(0.662)	(0.657)	(0.693)	(0.020)
Boardsize_overconfidence	0.017	-0.009	0.150***	-0.0009
	(0.041)	(0.041)	(0.045)	(0.001)
Independentboard_overconfidence	0.299	0.567	1.683**	-0.0189
	(0.687)	(0.683)	(0.720)	(0.021)
Boarddiversity_overconfidence	-1.619*	0.969	-3.022***	0.0196
	(0.930)	(0.918)	(0.972)	(0.028)
CEOchairman_overconfidence	0.298	1.312	0.419	0.0033
	(0.281)	(0.282)	(0.295)	(0.009)
Constant	-0.977***	-0.729***	-0.707***	0.0128***
	(0.154)	(0.146)	(0.146)	(0.004)
Observations	522	522	522	522

Furthermore, we assessed the impact that the board composition has on attenuating the effect of overconfidence on diversifying acquisitions. However, none of the interaction variables created present a level of significance, not allowing for conclusions to be made.

Next, we examine whether the board structure attenuates the effect of overconfidence on the deal being financed exclusively with cash. The coefficient of -1.299 on overconfidence implies that when the board is larger, overconfidence increases the odds of an acquisition by a factor of 0,27[3]. The coefficient on the interaction variable between board size and overconfidence of 0.150 implies that when the board is larger, overconfidence increases the odds of an acquisition by a factor of 0.32[4]. This can be related with the fact that larger boards tend to be associated with a difficulty in the monitoring role, not helping in attenuating managerial overconfidence, which is in line with prior literature. Moreover, the interaction variable for the independent board presents a positive and significant coefficient. In this case, boards with a larger proportion of independent members do not attenuate the effect of managerial overconfidence on conducting M&A

[2] 0.38 = [exp(0.665-1.61)]
[3] 0.27 = [exp(-1.299)]
[4] 0.32 = [exp(-1.299+0.150)]

transactions exclusively financed by cash. However, for the board gender diversity there is a negative and significant coefficient, which indicated that a higher percentage of woman as members of the board helps to attenuate the effect of CEO overconfidence on conducting M&A deals that use exclusively cash as the payment method. Such findings coincide with the findings from prior literature that point out board gender diversity as a effective corporate governance measure.

Finally, an analysis between effective corporate governance measures and their impact on attenuating managerial overconfidence on M&A performance, measured by the cumulative abnormal returns, however none of the interaction variables reveal a statistically significance, so we are not able to take any conclusions.

5.7. Robustness checks

To verify the structural validity of the empirical analysis, some robustness checks will be performed. Moreover, for the OLS regression, the event window in which the cumulative abnormal returns are calculated will be increased from three days [-1, +1] to five days [-2, +2], seven days [-3, +3] and eleven days [-5, +5].

Observing the results from the OLS model, Table 13 in the appendix shows a significant negative relation between CEO overconfidence and the acquirer's returns around the announcement date for all event windows. The first regression introduces as a dependent variable, the CARs for [-2, +2], showing that there is a negative market response towards overconfident CEOs, with a 5% significance level. Comparing to previous results, more control variables present statistical significance towards the CARs of the acquirer. Both Tobin's Q of the acquirer, CEO age, CEO compensation and independent board show a significant negative effect on the reaction of the market, which does not align with prior literature.

For the second regression, then the event window is extended to [-3, +3], showing that managerial overconfidence of the acquiring firm negatively affects the cumulative abnormal returns of the firm over a seven-day event period, at a 1% significance level. Looking at the control variables, all control variables remain with negative significant relationship with the cumulative abnormal returns over a period of seven-days. In addition, the board size also reveals a negative reaction from the market, which is in accordance with prior studies indicating that larger boards are negatively perceived by the market.

Lastly, the final regression includes the cumulative abnormal returns of the acquirer over an eleven-day event period, in which the relationship between CEO overconfidence and

M&A performance remains negative, with a 5% level of significance. Cash flow has a positive significant effect on M&A performance, meaning that a higher level of profitability is positively viewed by the market. Moreover, all the remaining controls maintain its negative significant relationship with the market reaction.

The robustness check supports the previous results found in this research, confirming the negative relationship that exists between CEO overconfidence and the market response towards M&A transactions.

Furthermore, we check the validity and sensitivity of the results by adopting a distinct overconfident measure. Following Doukas and Petmezas (2007), we will classify managers as overconfident when they conduct 5 or more acquisitions within a 3-year period, which is consistent with Malmendier and Tate (2008) that considers overconfident managers to conduct more M&A transactions than non-overconfident CEOs.

Observing the acquisitiveness regression in Table 14 in the appendix, when assuming a new overconfidence measure, the relationship between managerial overconfidence and the likelihood of conducting M&A transactions has a stronger positive and significant relationship when compared to the previous results obtained, being significant at the 1% level. Higher levels of Tobins' Q may capture growth opportunities and be associated with companies engaging more in M&A transactions.

Regarding the diversification regression, overconfident CEOs maintain their preference for conducting diversifying deals, as we have seen in the previous model, however there is no statistical significance, not allowing to infer and conclude such hypothesis.

Moreover, the third regression suggests that overconfident CEOs have a higher tendency to finance M&A transactions exclusively with cash, being such result significant at the 1% level, obtaining the same conclusion as previous models.

Finally, as it is possible to observe through the last regression, managerial overconfidence reveals a positive influence on M&A performance, measured by the cumulative abnormal returns, which does not coincide with the previous results found. However, there is not statistically significance, so no conclusion can be made but indeed M&A transactions conducted by overconfident CEOs may not be always value destructive, but also null in terms of value.

6. Conclusion

Globally, M&A activity is one of the key strategies for many corporations. Overconfident CEOs consider themselves with superior decision-making abilities when compared to their peers, underestimating the risks and overestimating the possible synergy gains of M&A, engaging more often in transactions that end up being negatively viewed by the market. Several authors throughout the years have examined the extent to which overconfidence can help to explain merger decisions and various characteristics of the transactions. The main results show a higher tendency for overconfident CEOs to pursue acquisitions, especially diversifying ones, in which such behavior tends to be intensified in the case of abundant internal resources. Moreover, it is also observed that overconfident CEOs have a higher tendency to use cash to finance M&A deals.

Managerial overconfidence plays a crucial role in M&A decisions. The impact of managerial overconfidence on M&A has been a subject of many empirical studies, in which overconfident CEOs tend to overestimate their own abilities and the value created in their acquisitions, resulting in an overpayment and in a transaction that is often value destroying.

This research examines the impact that CEO overconfidence has on the type of characteristics adopted in M&A transaction, while analyzing the M&A performance through the market response to such transactions for the European context, understanding whether overconfident managers act in the interest of their shareholders wealth through M&A. Most literature is based on the US while some on the UK, which leaves a gap to examine whether previous results hold for the European market since none of previous research focus exclusively on the European market. With a sample of 522 M&A transactions from 2002 to 2020, presenting a more recent database, in which 212 transactions are conducted by non-overconfident CEOS and 310 by overconfident CEOs.

Overall, the results for the European market were close to the ones found from previous literature for the US and UK. Firstly, overconfident CEOs have indeed a higher tendency to conduct M&A in comparison to non-overconfident CEOs, showing a significance level of 1%, being robust to the change of overconfidence measure. The odds of an overconfident CEO pursuing a successful M&A transaction is 2.154 to 2.655 times the odds of a non-overconfident CEO, being consistent with the results found by Malmendier and Tate (2008) of an odds ratio of 1.65, significant at the 1% level as well.

Additionally, it was possible to observe that managerial overconfidence leads to a higher likelihood of pursuing a diversifying M&A deal, being this result also significant at the 5%

level of significance. Overconfident CEOs are significantly more likely than other CEOs to pursue diversifying M&A transactions, with an odds ratio of 1.918 to 2.434, significant at 5%, which is in line with the results presented by Malmendier and Tate (2008), with a odds ratio of 2.54, also significant at 1%. However, such finding is not robust to the change in the overconfidence measure, since the result is no longer significant.

Regarding the method of payment used to finance the deal, there is a positive significant relationship between overconfidence and the likelihood of the deal being financed exclusively with cash. In fact, overconfident CEOs tend to finance a M&A deal more often with cash, with an odds ratio of 2.213 to 2.435, significant at the 1% level, being robust to the change in overconfidence measure.

Moreover, when testing the impact of CEO overconfidence on stock returns during the announcement of a M&A, the results suggest a significant negative effect on the European acquirer's short-run market performance due to a negative coefficient of CEO overconfidence on stock returns, being the results robust to the introduction of different event-windows. Results shows a significant negative coefficient of -109 basis points on the overconfidence measure, at the 5% level of significance, indicating that the market responds 1.09% worse to announcements conducted by overconfident managers when compared to non-overconfident CEOs. Indeed, there is shareholder value destruction when transactions are conducted by overconfident CEOs, which is also in line with the literature. This research provides support to the theoretical prediction of Malmendier and Tate (2008) that state that overconfident managers fail to generate superior abnormal returns relative to non-overconfident CEOs, showing a poor short-term performance due to this behavioral bias.

CEOs play a major role in the structure of the company, and even though they are not fully responsible for the M&A decisions undertaken, their behavioral biases will influence the decision-making process, being important to establish strong corporate governance measures to make sure that CEOs have the same interests as shareholders and end up conducting transactions that are value-creating. Firm corporate governance can impact CEO decisions, in which managerial overconfidence can be attenuated in firms with more strict and effective corporate governance mechanisms. Furthermore, an analysis between corporate governance measures and their impact in attenuating managerial overconfidence was conducted. Prior research suggests that effective corporate governance measures can

impact the decisions made by overconfident CEOs, with the aim of avoiding heuristic errors and to attenuate such behavioral bias.

Indeed, the results show that board gender diversity significantly attenuates the effect of managerial overconfidence on acquisitiveness. Moreover, both board size and independent board does not help to alleviate the impact of CEO overconfidence on the deal being financed exclusively with cash. However, board gender diversity helps to mitigate this behavioral bias regarding the method of payment adopted.

Finally, some robustness checks were performed to see if the results hold to distinct event windows for the calculation of the cumulative abnormal returns and for a different overconfidence measure. Overall, our conclusions are robust to the different event windows for the estimation of the cumulative abnormal returns as well as the inclusion of a new overconfidence measure.

6.1 Limitations

Some limitations must be considered, in which the biggest challenge was to create a plausible measure for managerial overconfidence. Over the years, different measures were adopted to determine CEO overconfidence, in which Malmendier and Tate (2005) explored the CEOs under diversification towards CEOs personal portfolio transactions, however none of the proxies are direct and a precise measurement of overconfidence. Hence, the main limitation of this research lies on the fact that it is very complex to assess an overconfidence measure that will precisely measure such behavioral bias. In this research, the net buyer measure is used to distinguish overconfident from non-overconfident CEOs, in which a CEO is considered overconfident due to the high exposure to firm stock holdings across time, however such behavior may be related with other factors, and not necessarily overconfidence. Since this is an European study, previously overconfidence measures adopted in US studies cannot be computed for this market due to the limited number of options that the CEOs of European companies receive. Following this and with the aim of limiting such difficulty and the risk associated with the overconfidence proxy chosen, a robustness check was performed with a distinct managerial overconfidence, that distinguishes managers through the acquisition of five companies in a three-year period.

Furthermore, the sample used in this research comprises of 522 observations for 182 European companies from 10 European countries, being a small sample when compared to previous studies due to the limited available information to construct the net buyer

proxy. A larger sample would increase the reliability and generalization of the results. Additionally, it is important to consider that the European countries may have different board structures, some following a one-tier structure and others a two-tier structure, having distinct monitoring mechanisms and forms of being managed.

6.2 Future Investigation

Since most of the research focus on the US market due to the availability of data, it would be important to continue to present studies for the European market or even the international context to examine if prior results hold to different markets. Furthermore, future research may include the impact of managerial overconfidence on the target cumulative abnormal returns for the European market.

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Appendices

Appendix 1 – Summary of the variables

Table 8: Summary Statistics

Table 8 presents all variables included in the regressions. All variables were retrieved by Eikon database.

Variable	Description	Relevant Literature
Firm Size	Natural logarithm of total assets at the beginning of year.	Malmendier and Tate (2008); Ferris *et al.* (2013)
Cash Flow	Earnings before extraordinary items plus depreciations, normalized by beginning-of-the-year capital.	Malmendier and Tate (2008); Ferris *et al.* (2013)
Tobin's Q	Ratio of market value to the book value of assets.	Malmendier and Tate (2008); Ferris *et al.* (2013)
Leverage Ratio	Total liabilities over total assets.	Ferris *et al.* (2013); Aktas *et al.* (2016)
Deal Value	Natural logarithm of deal value.	Huang and Kisgen (2013); Aktas *et al.* (2016)
Acquisitiveness	Dummy equaling one if the firm conducts at least one successful M&A transaction in a year.	Malmendier and Tate (2008); Huang and Kisgen (2013)
Diversification	Binary variable that equals one if the two-digit SIC code of the acquirer and the target differ, and zero otherwise.	Malmendier and Tate (2008); Croci *et al.* (2010); Ferris *et al.* (2013)
Cash Payment	Dummy variable assuming a value of one if the transaction is financed exclusively with cash and, zero otherwise.	Malmendier and Tate (2008); Croci *et al.* (2010); Ferris *et al.* (2013); Levi *et al.* (2014); Aktas *et al.* (2016)
CEO Age	Age of CEO.	Yim (2013); Levi *et al.* (2014)
CEO tenure	Number of years holding the CEO's position.	Malmendier and Tate (2008)
CEO Chairman	Dummy variable that equals one if the individual is both CEO and Chairman of the Board.	Malmendier and Tate (2008); Huang and Kisgen (2013); Chen *et al.* (2016)
CEO compensation	Proportion of fixed compensation to total compensation.	Berger *et al.,* 1997; Schrand and Zechman, 2012
Board Size	Number of individuals constituting the board.	Kolasisnki and Li (2010); Levi *et al.* (2014); Chen *et al.* (2016)
Independent Board	Percentage of total directors that are classified as independent.	Kolasisnki and Li (2010); Levi *et al.* (2014); Chen *et al.* (2016)
Gender Diversity	Percentage of female directors of the board.	Huang and Kisgen (2013); Levi *et al.* (2014); Chen *et al.* (2016)

Appendix 2 – Number of M&A deals per European country

Table 9: Mergers and Acquisitions transactions by European country

Nation	Index	Firm-Year Observations	Percentage
UK	FTSE	284	54.41%
Ireland	ISEQ	95	18.20%
France	CAC 40	49	9.39%
Netherlands	AEX	40	7.66%
Spain	IBEX 35	30	5.75%
Switzerland	SMI	18	3.45%
Germany	DAX 30	2	0.38%
Belgium	MSCI Belgium	2	0.38%
Sweden	OMX Stockholm 30	1	0.19%
Denmark	OMX Copenhagen	1	0.19%

Appendix 3 – Hausman Test

Table 10: Hausman Test

Table 10 presents the p-values obtained in the Hausman Test for the regressions.

Hausman Test	P-value
Acquisitiveness Model	0.0525
Diversification Model	0.0565
Payment Model	0.4946

Appendix 4 – Univariate Analysis: Proportion Test

Table 11: Univariate Analysis: Proportion tests

Table 11 provides the results of the proportion tests of the categorical variables acquisitiveness, diversification and cash payment. CEOs are classified as overconfident, based on the net buyer proxy. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

	All CEOs	Non-overconfident	Overconfident	Difference
Acquisitiveness	0.383	0.226	0.525	0.299***
Diversification	0.448	0.411	0.482	0.071***
Cash Payment	0.460	0.330	0.548	0.218***
N	522	203	319	522

Appendix 5 – Mean-Comparison Test: Numerical dependent variable

Table 32: Mean-Comparison Test: Numerical dependent variable

Table provides a mean-comparison test between CARs of acquirers during acquisitions done by overconfident and non-overconfident CEOs, based on Welch's T-Test. Net buyer used as overconfidence measure. $^{***}p<0.01$, $^{**}p<0.05$, $^{*}p< 0.1$.

	All CEOs	Non-overconfident	Overconfident	Difference
CAR [-1, +1]	0.00538	0.01123	0.00167	-0.0096***
CAR [-2, +2]	0.00539	0.01024	0.00231	-0.0079***
CAR [-3, +3]	0.00548	0.01079	0.00209	-0.0087***
CAR [-5, +5]	0.00284	0.00693	0.00023	-0.0067***
N	522	203	319	522

Appendix 6 – Robustness Check: Market reaction to CEO overconfidence

Table 43: Market Reaction to CEO overconfidence

Table 13 reports the result of an OLS regression analysis. The dependent variable is the Cumulative abnormal return on the bidder's stock for [-2, +2], [-3, +3] and [-5, +5]. Overconfidence is a binary variable that represents the net buyer proxy. The OLS model is estimated with standard errors clustered by acquirer. All coefficients are presented, and t-statistics are provided between the brackets.

OLS	CAR [-2, +2] (1)	CAR [-3, +3] (2)	CAR [-5, +5] (3)
Overconfidence	-0.0131**	-0.0159***	-0.0145**
	(-2.43)	(-3.09)	(-2.45)
Acquirer Size	-0.0018	-0.0014	-0.0008
	(-1.17)	(-0.86)	(-0.45)
Cash Flow	8.75e-08	3.33e-07	5.97e-07***
	(0.22)	(0.77)	(1.52)
Tobin's Q	-0.0018**	-0.0020**	-0.0013
	(-2.38)	(-2.56)	(-1.53)
Leverage Ratio	-0.0095	-0.0043	-0.0237
	(-0.44)	(-0.23)	(-1.27)
Deal Value	0.0013	0.0006	0.0001
	(0.99)	(0.42)	(0.07)
Cash Payment	0.0037	0.0047	0.0030
	(0.58)	(0.88)	(0.39)
Diversification	-0.0044	-0.0023	0.0031
	(-0.50)	(-0.34)	(0.47)
Age	-0.0010**	-0.0008*	-0.00107**
	(-2.28)	(-1.92)	(-2.25)
Tenure	-0.0002	-0.0001	0.0003
	(-0.33)	(-0.19)	(0.56)
Chairman	0.0019	0.0065	0.0029
	(0.35)	(1.25)	(0.41)
Compensation	-0.0274**	-0.0264**	-0.0227*
	(-2.08)	(-2.14)	(-1.65)
Board Size	-0.0011	-0.0016*	-0.0020*
	(-1.39)	(-1.98)	(-2.20)
Independent Board	-0.0481***	-0.0458***	-0.0530***
	(-2.85)	(-2.80)	(-2.71)
Board Gender Diversity	0.0239	0.0080	0.0078
	(1.08)	(0.34)	(0.30)
Constant	0.1376***	0.1350***	0.1548***
	(3.84)	(3.60)	(3.95)
Observations	522	522	522
R-squared	0.047	0.060	0.054

Appendix 7 – Robustness Check: Deal characteristics and market reaction to CEO overconfidence

Table 54: Deal characteristics and market reaction to CEO overconfidence

Table 14 reports the result of the random-effects model for the deal characteristics, acquisitiveness, diversification and cash payment. Moreover, an OLS regression analysis is conducted, in which the overconfidence measure differs from previous models. Overconfidence is assessed by CEOs that conduct five or more acquisitions within a 3-year period. Both the random-effects logit model and the OLS model are estimated with standard errors clustered by acquirer. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Acquisitiveness	Diversification	Cash Payment	CAR [-1, +1]
	(1)	(2)	(3)	(4)
New Overconfidence	5.472***	1.235	2.028***	0.0039
	(5.69)	(0.56)	(3.22)	(0.85)
Acquirer Size	1.044	1.472***	1.146**	-0.0017
	(0.65)	(4.54)	(2.00)	(-1.27)
Cash Flow	0.999	0.999	1.000	1.49e-07
	(-0.03)	(-1.34)	(0.58)	(0.42)
Tobin's Q	1.086***	1.013	1.387***	-0.0011
	(3.65)	(0.36)	(2.66)	(-1.53)
Leverage Ratio	0.957	0.073***	0.689	-0.0093
	(-0.06)	(-2.70)	(-0.67)	(-0.49)
Deal Value	0.978	0.683***	0.918	0.0015
	(-0.37)	(-4.74)	(-1.29)	(1.25)
Cash Payment				0.0002
				(0.04)
Diversification				-0.0071
				(-0.92)
Age	0.999	1.053*	1.031	-0.0009**
	(-0.05)	(1.75)	(1.63)	(-2.21)
Tenure	0.933**	1.011	0.985	0.0001
	(-2.25)	(0.28)	(-0.51)	(0.29)
Chairman	0.995	1.007	1.452	-0.0013
	(-0.01)	(0.02)	(1.40)	(-0.25)
Compensation	0.800	2.027	1.362	-0.0134
	(-0.42)	(1.03)	(0.59)	(-1.21)
Board Size	0.985	0.992	1.110**	-0.0009
	(-0.30)	(-0.12)	(2.72)	(-1.35)
Independent Board	0.565	2.089	7.360***	-0.0356**
	(-0.82)	(0.76)	(3.02)	(-2.56)
Board Gender Diversity	0.583	1.058	0.019***	0.0117
	(-0.45)	(0.04)	(-3.95)	(0.63)
Constant	0.369	0.021	0.003***	0.1055***
	(-0.78)	(-2.08)	(-4.28)	(3.54)
Observations	522	522	522	522

Appendix 8 – The effect of overconfidence on Acquisitiveness with the coefficients

Table 15: The Effect of overconfidence on Acquisitiveness

Acquisitiveness is the dependent variable binary where one signifies that the firm made at least one successful M&A transaction in a given year. Overconfidence is a binary variable that represents the net buyer proxy for overconfidence. Both the logit regression and the random-effects logit model are estimated with standard errors clustered by acquirer. All coefficients are presented, and robust standard errors are provided in the parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Pooled Logit			Random-Effects Logit		
	(1)	(2)	(3)	(4)	(5)	(6)
Overconfidence	0.767***	0.777***	0.769***	0.937***	0.977***	0.973***
	(0.217)	(0.223)	(0.222)	(0.275)	(0.287)	(0.291)
Acquirer Size	0.0677	0.0740	0.0775	0.0442	0.0512	0.0550
	(0.0536)	(0.0536)	(0.0566)	(0.0616)	(0.0626)	(0.0651)
Cash Flow	-1.82e-05	-1.75e-05	-1.23e-05	-2.33e-05	-2.17e-05	-1.55e-05
	(2.49e-05)	(2.44e-05)	(2.37e-05)	(2.43e-05)	(2.37e-05)	(2.30e-05)
Tobin's Q	0.0484	0.0505	0.0497	0.0748**	0.0804**	0.0775**
	(0.0332)	(0.0349)	(0.0350)	(0.0299)	(0.0333)	(0.0323)
Leverage Ratio	-0.0566	-0.128	-0.0955	-0.238	-0.342	-0.266
	(0.544)	(0.548)	(0.557)	(0.647)	(0.661)	(0.679)
Deal Value	-0.0319	-0.0365	-0.0458	-0.00868	-0.0116	-0.0195
	(0.0511)	(0.0516)	(0.0517)	(0.0583)	(0.0598)	(0.0600)
CEO Age		-0.0173	-0.0133		-0.0235	-0.0200
		(0.0173)	(0.0172)		(0.0196)	(0.0200)
CEO Tenure		-0.0197	-0.0215		-0.0282	-0.0293
		(0.0290)	(0.0273)		(0.0347)	(0.0321)
CEO Chairman		0.0918	0.0931		0.0949	0.114
		(0.279)	(0.288)		(0.334)	(0.343)
CEO compensation		-0.100	-0.204		0.191	0.0119
		(0.461)	(0.472)		(0.517)	(0.540)
Board Size			-0.00451			-0.0154
			(0.0489)			(0.0555)
Independent Board			-0.269			-0.798
			(0.609)			(0.727)
Board Diversity			-0.971			-0.907
			(0.972)			(1.163)
Constant	-1.819***	-0.788	-0.493	-1.944***	-0.707	0.0156
	(0.524)	(1.086)	(1.028)	(0.557)	(1.158)	(1.229)
Observations	522	522	522	522	522	522

Appendix 9 – The effect of overconfidence on Diversification with the coefficients

Table 16: The Effect of overconfidence on Diversification

Diversification is the dependent variable binary where one signifies that the firm made at least one successful M&A transaction in a given year. Overconfidence is a binary variable that represents the net buyer proxy for overconfidence. Both the logit regression and the random-effects logit model are estimated with standard errors clustered by acquirer. All coefficients are presented, and robust standard errors are provided in the parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Pooled Logit			Random-Effects Logit		
	(1)	(2)	(3)	(4)	(5)	(6)
Overconfidence	0.683**	0.676**	0.696**	0.878**	0.855**	0.892**
	(0.269)	(0.271)	(0.274)	(0.360)	(0.361)	(0.369)
Acquirer Size	0.256***	0.242***	0.247***	0.375***	0.361***	0.363***
	(0.0690)	(0.0686)	(0.0649)	(0.0783)	(0.0807)	(0.0806)
Cash Flow	-1.74e-05	-1.88e-05	-1.62e-05	-4.53e-05	-4.58e-05	-4.59e-05
	(2.86e-05)	(2.78e-05)	(2.88e-05)	(3.01e-05)	(3.00e-05)	(3.27e-05)
Tobin's Q	-0.0312	-0.0320	-0.0368	0.0269	0.0186	0.0196
	(0.0335)	(0.0332)	(0.0329)	(0.0332)	(0.0348)	(0.0345)
Leverage Ratio	-1.964***	-1.907**	-1.828**	-2.573***	-2.473***	-2.392**
	(0.745)	(0.741)	(0.793)	(0.911)	(0.901)	(0.942)
Deal Value	-0.250***	-0.241***	-0.245***	-0.378***	-0.365***	-0.368***
	(0.0651)	(0.0632)	(0.0594)	(0.0767)	(0.0774)	(0.0772)
CEO Age		0.0452**	0.0446**		0.0447	0.0450
		(0.0208)	(0.0219)		(0.0284)	(0.0291)
CEO Tenure		-0.00386	-0.00432		0.0169	0.0166
		(0.0252)	(0.0261)		(0.0344)	(0.0354)
CEO Chairman		-0.0109	0.0230		0.0596	0.0839
		(0.284)	(0.292)		(0.357)	(0.356)
CEO compensation		0.457	0.458		0.625	0.739
		(0.462)	(0.483)		(0.626)	(0.674)
Board Size			-0.0271			-0.0244
			(0.0529)			(0.0643)
Independent Board			0.0494			0.699
			(0.685)			(0.956)
Board Diversity			0.292			0.210
			(0.953)			(1.250)
Constant	-0.411	-2.866***	-2.729**	-0.614	-3.324**	-3.681**
	(0.583)	(1.062)	(1.248)	(0.788)	(1.518)	(1.789)
Observations	522	522	522	522	522	522

Appendix 10 – The effect of overconfidence on Merger Financing with the coefficients

Table 17: The Effect of overconfidence on Merger Financing

The dependent variable diversification is a binary variable that equals one if the target operates in a different industry than the acquirer, based on the two-digit SIC code, and zero otherwise. Overconfidence is a binary variable that represents the net buyer proxy for overconfidence. Both the logit regression and the random-effects logit model are estimated with standard errors clustered by acquirer. All coefficients are presented, and robust standard errors are provided in the parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Pooled Logit			Random-Effects Logit		
	(1)	(2)	(3)	(4)	(5)	(6)
Overconfidence	0.816***	0.676**	0.838***	0.890***	0.917***	0.834***
	(0.222)	(0.271)	(0.219)	(0.259)	(0.257)	(0.229)
Acquirer Size	0.123*	0.242***	0.127**	0.130*	0.136*	0.124*
	(0.0642)	(0.0686)	(0.0638)	(0.0700)	(0.0700)	(0.0677)
Cash Flow	5.12e-06	-1.88e-05	5.44e-06	4.16e-06	4.41e-06	2.77e-06
	(2.26e-05)	(2.78e-05)	(2.28e-05)	(2.21e-05)	(2.20e-05)	(2.25e-05)
Tobin's Q	0.300**	-0.0320	0.262**	0.297**	0.268**	0.371***
	(0.117)	(0.0332)	(0.119)	(0.130)	(0.129)	(0.124)
Leverage Ratio	-0.00688	-1.907**	0.0547	-0.110	-0.0669	-0.186
	(0.501)	(0.741)	(0.514)	(0.571)	(0.581)	(0.539)
Deal Value	-0.0660	-0.241***	-0.0609	-0.0636	-0.0589	-0.0724
	(0.0577)	(0.0632)	(0.0584)	(0.0635)	(0.0642)	(0.0651)
CEO Age		0.0452**	0.00124		-0.00157	0.0208
		(0.0208)	(0.0174)		(0.0194)	(0.0187)
CEO Tenure		-0.00386	0.00489		0.00699	0.00664
		(0.0252)	(0.0237)		(0.0266)	(0.0272)
CEO Chairman		-0.0109	0.544**		0.601**	0.422
		(0.284)	(0.260)		(0.282)	(0.262)
CEO compensation		0.457	0.130		0.255	0.412
		(0.462)	(0.483)		(0.518)	(0.500)
Board Size			-3.024***			0.0986**
			(1.147)			(0.0403)
Independent Board			0.838***			1.929***
			(0.219)			(0.683)
Board Diversity			0.127**			-4.063***
			(0.0638)			(0.976)
Constant	-2.601***	-2.866***	5.44e-06	-2.822***	-3.218***	-5.491***
	(0.612)	(1.062)	(2.28e-05)	(0.676)	(1.234)	(1.332)
Observations	522	522	522	522	522	522