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The impact of CEO compensation incentives on the probability of executing M&As

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Dissertation
Master in Finance

Supervised by
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2025

Acknowledgements

Completing my academic studies, I would like to express my gratitude to those who have helped or supported me during this journey. I would like to thank my family and friends for all the encouragement and strength they gave me. Additionally, I would express my gratitude to Professor Jorge Farinha for all his recommendations, guidance, and understanding, which were crucial during the elaboration of this dissertation.

Abstract

While studies on mergers and acquisitions often focus on value creation, the role of executive compensation in shaping these transactions is also critical. CEOs compensated with stock options are due to their inherent risk-inducing payoff structure, often seen making bolder investments, including M&A deals.

This study aims to assess if CEO stock option pay impacts a firm's probability of pursuing mergers and acquisitions transactions and even more if this form of compensation, at higher levels can lead to frequent acquisition. Furthermore, it also seeks to understand the impact of CEO stock option pay on diversifying acquisitions and acquisitions with high premiums.

To accomplish this purpose, there were analyzed 436 companies between 2010 to 2020 that have completed 2,966 M&A transactions. Stock option pay was measured in four distinct metrics including granted value, percentage to total compensation, a three-period average, and an excessive stock option dummy variable.

The results obtained did not provide sufficient evidence to support the hypothesis that higher levels of CEO stock option pay have a positive impact on a firm's acquisitiveness. Furthermore, for the three-period average stock option it was found that it negatively influences frequent acquisition but positively influences high premium deals. Additionally, there was also not enough evidence found of a relationship between CEO stock options and diversifying deals.

Keywords: CEO, stock options, risk-taking, mergers and acquisitions

JEL-Codes: G32; G34; M12

Resumo

Embora os estudos sobre fusões e aquisições se concentrem frequentemente na criação de valor, o papel da remuneração dos executivos na formação destas transações é também relevante. Os CEOs compensados com opções sobre ações são, devido à estrutura desta forma de remuneração inerentemente indutora de risco, frequentemente vistos a realizar investimentos mais arrojados, incluindo fusões e aquisições.

Este estudo visa avaliar se a remuneração de CEOs com opções sobre ações afeta a probabilidade de uma empresa envolver-se em operações de fusões e aquisições. Além disso, investiga se níveis mais elevados desta forma de compensação podem levar a aquisições frequentes. Adicionalmente, procura compreender o impacto da remuneração dos CEOs com opções sobre ações em aquisições diversificadoras e em aquisições com prémios elevados.

Para alcançar este objetivo, foram analisadas 436 empresas que concluíram 2,966 transações de M&A entre 2010 e 2020. A remuneração com opções sobre ações foi medida utilizando quatro métricas distintas: valor concedido, percentagem de remuneração relativa ao total, uma média de três períodos, e uma variável dummy para opções sobre ações excessivas.

Os resultados obtidos não forneceram evidências suficientes para apoiar a hipótese de que níveis mais elevados de remuneração de CEOs com opções sobre ações têm um impacto positivo na propensão para a realização de aquisições. Além disso, para a média de opções sobre ações de três períodos, verificou-se que influencia negativamente as aquisições frequentes, mas positivamente as transações com prémios elevados. Adicionalmente, também não foi encontrada evidência suficiente para estabelecer uma relação entre as opções sobre ações e aquisições diversificadoras.

Palavras-chave: CEO, opções sobre ações, tomada de risco, fusões e aquisições

JEL-Codes: G32; G34; M12

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1 Introduction

Mergers and acquisitions are important restructuring events that can significantly impact a firm's future operations. Throughout the years, M&As have been a choice to respond to industry shocks, to benefit from synergies, to take advantage of tax benefits, or to exploit information asymmetries. The academic literature has extensively studied the potential outcomes of M&A, inherently risky transactions characterized by a significant variance in returns (Jensen & Ruback, 1983; Haspeslagh, 1993). In fact, most of the time, these transactions fail to create value for the acquirer's shareholders, with many deals actually destroying shareholder wealth (Cai and Vijh, 2007). Being such an important decision for the future of a company it is important to understand the reasons behind pursing M&As, considering the potential value destruction. Worldwide, according to the Institute for Mergers, Acquisitions & Alliances, there were more than half a million of M&As completed in the last decade, with the United States as a large driver of M&A activity. In addition, empirical research studying the period 1994 to 2020 suggests that the number of options granted to CEOs frequently changed over time (Athanasakou et al., 2022).

Stock options is a form of stock-based compensation for executives that many agency theorists are advocate of as they potentially reward executives for creating shareholder value (Jensen and Murphy, 1990a; Shleifer and Vishny, 1997), which suggests that boards can use this form of compensation to discourage managerial opportunism, fostering shareholder-wealth maximization behaviors (Jensen and Meckling, 1976; Jensen and Murphy, 1990a). This form of compensation has incentive properties that offer unlimited upside potential, however they have no real downside risk for the executives who receive them in their compensation.

Prior empirical research on the link between stock options and mergers and acquisitions has focused on two distinct issues. First, studies have examined acquisitions as a way for CEOs to achieve higher levels of compensation (Schmidt and Fowler, 1990; Rose and Shepard, 1997) and secondly, event studies have been used to investigate the correlation between incentives and stock price returns following acquisitions (Lewellen et al., 1985; Agrawal and Mandelker, 1987). This dissertation, in contrast, examines how stock option pay affects firms' propensity to engage in mergers and acquisitions. In fact, empirical papers such as Cai and Vijh (2007) have examined the impact of acquirer CEOs' stock and option holdings on their predisposition to engage in

M&As, having found a positive correlation between the two. Similarly, the author Sanders (2001) has examined the impact of stock ownership and stock option pay on acquisition activity, noting that options appear to lead executives to take risks, even risks that shareholders would otherwise avoid, such as M&As, under the belief that they will pay off. This dissertation will focus its investigation on the impact of CEO stock options on merger and acquisitions transactions, including the propensity to engage in diversifying acquisitions and the payment of high premiums for targets.

The main question this study will answer is:

Does CEO stock option pay induce them a higher propensity for engaging in mergers and acquisitions?

Using a database that incorporates American companies for the 2010 to 2020 period, and four measures for CEO stock options, which include the granted value, the percentage to total compensation, a three-year average, and a dummy for excessive stock option compensation, our results show no evidence that CEO stock options increase a firm's propensity to engage in M&A or diversifying M&A deals. However, for the three-average period measure of stock options, it was found that it negatively impacts frequent acquisition but positively impacts the completion of a high premium deal.

Following this introduction, Chapter 2 presents a literature review regarding the impact of CEO stock option pay on M&A activity and deal characteristics and in Chapter 3, the hypotheses are developed. In Chapter 4, the methodology used to measure stock options and mergers and acquisitions is detailed, as well as the presentation of the data sample, statistical results, and model specification. Chapter 5 presents the results from the various models. Finally, Chapter 6 presents the conclusions taken from the study.

2 Literature Review

2.1 Agency Theory

In the modern world, it is common to see a significant separation between ownership and control at firms. At firms, owners no longer manage, often not having either the skills or the resources, so they hire managers to control the company in a way that aligns with their objectives (Berle and Means, 1991). With this comes the agency problem, which is manifested in several forms.

Building upon the separation of ownership and control, Jensen and Meckling (1976) say that chief executives may prioritize personal benefits over firm performance due to benefiting from non-pecuniary aspects, having reduced ownership, and being effort averse. Second, a CEO may be myopic if his or her decisions benefit the company in the short term but harm it in the long term, focusing more on immediate results rather than on future consequences after their term has ended (Stein, 1989). Finally, the manager might be risk-averse, i.e., hesitant to take risks even if those could lead to significant rewards for the company, in case they feel their future career depends on their perceived ability, which is shaped by past performance (Holmström, 1999).

To address these agency problems, firms adopt corporate governance mechanisms as the ones seen forward (Denis and McConnell, 2003). One of the mechanisms is direct monitoring of the managers by major shareholders, aiming to minimize the misalignment between the two parties (Denis and McConnell, 2003).

Another mechanism that allows this alignment is the board of directors whose role is to monitor and advise and has a composition that is not static but rather changes according to how much power the CEO and the board each have (Hermalin and Weisbach, 2003). According to Jensen (1993), issues regarding the board monitoring quality exist because CEOs often influence director nominations, creating a sense of obligation on them. In addition, the board's agenda is usually controlled by CEO's, which sometimes leaves no time to monitor or question effectively the managers.

Even though agency theory, as noted by Carter et al. (2003), does not clearly predict the relationship between board diversity and the value it brings, their proponents Fama and Jensen

(1983) emphasize its importance. Fernández-Temprano and Tejerina-Gaite (2020) argue that board diversity influences board conduct and, therefore, firm performance.

There are several attributes of the board of directors that could be related to diversity. Concerning gender diversity, topic that has been increasingly discussed throughout the years, whose empirical evidence is still mixed, which is attributed by Owen and Temesvary (2018) to the U-shaped relationship between gender diversity and company performance[1].

The board size is determined by the number of directors, which larger companies, due to their complexity will need more. However, at some point, inefficient decision making could arise from increasing the board's size (Yermack, 1996). Therefore, Lipton and Lorsch (1992) argue that board should likely consist of seven or eight people to function effectively.

A board can be composed of non-independent and independent directors. The first ones can be executives, shareholders or employees and may have relationships with the company. The seconds meet the criteria for independence, having no conflicts of interest with the company, which is crucial to the supervisory role of the board (Fernández-Temprano and Tejerina-Gaite, 2020).

Regarding the leader of the board, the chairperson, this individual is essentially responsible for leading and guiding the board's activities. The chairperson can be a person involved in the company's activities or, contrastingly, a non-executive chairperson. If the chairman has a professional relationship with the firm, then the monitoring effectiveness is likely to decrease, potentially harming the shareholder's interests. In the specific case where the CEO also serves as board chair, known as CEO duality, information gaps among decision-makers may be reduced and decisions may be made more quickly (Finkelstein and D'Aveni, 1994). Even though the separation of the two roles may improve the board's monitoring effectiveness, Finkelstein and D'Aveni (1994) argue that the choice of separation of the two roles depends mostly on factors such as firm performance and informal CEO power.

Furthermore, the board of directors can either perform their duties as a whole or, by reducing free-riding, delegate authority to specialized committees that meet separately and focus on specific tasks (Klein, 1998; Chen and Wu, 2016).

[1] Finding that female participation has a positive effect once a threshold level of gender diversity is achieved.

Because of the 2002 Sarbanes-Oxley Act, US companies are required to have audit, compensation, and governance committees made solely of independent directors. Beyond these required committees, many boards have non-required committees concentrating on other issues of importance like finance or strategy (Chen and Wu, 2016).

Having established the agency problems that firms face, we will now analyze how compensation structures attempt to address these challenges. As one of the governance mechanisms, CEO compensation can be crucial in aligning executive and shareholder interests.

2.2 CEO Compensation

CEO compensation is a key aspect of corporate governance, serving as crucial contractual mechanism that aims to maintain the quality of the managers' actions and ensure the motivation necessary for the executive to act in the best interests of shareholders (Jensen and Meckling, 1976).

The compensation committee (CC), perhaps one of the most challenging roles on the board, must be concerned with structuring compensation packages, often doing it by using industry benchmarks and adjusting for firm size, while at the same time creating incentives for the top managers to maximize shareholder returns (Murphy, 1998; Anderson and Bizjak, 2003). This committee should be made uniquely of independent directors because according to Fama and Jensen (1983) they are better able to make unbiased decisions about CEO's compensation due to their independent decisions and reputations to protect. However, the presence of insiders on this committee, who might have firm-specific insights, may also contribute to the committee designing contracts aligned with shareholders' interests.

The compensation of CEOs can have different components, namely, base salary, bonuses, "miscellaneous" other compensation, stock options, and restricted stock (Murphy, 1998).

The base salary provides fixed compensation, while bonuses are cash payments made contingent on reaching specific performance goals at the corporation, both representing direct cash outflows for the company (Murphy, 1998). Additionally, other compensation can include life insurance, retirement plans and various other perks.

Stock options give the CEO the right, but not the obligation, to buy the company's stock at a given price, the exercise or strike price, which is usually the stock price when the option is

issued. However, if there is a vesting period and the executive leaves the company during it, they lose the options. Although no immediate cash leaves the company, the shares are diluted when exercised (Murphy, 1998).

Finally, restricted stock consists of stock that cannot be sold until the end of a vesting period, after which it becomes identical to regular stock. It represents no immediate cash cost to the company, but it dilutes existing shares when granted (Murphy, 1998).

2.2.1 Stock Options

The board of directors viewed stock option compensation as a way to align CEOs with shareholder goals, encouraging them long-term thinking, and considered risk-taking as a way to address the agency problem.

Stock options address self-interest, as their value is tied to stock price fluctuations helping ensure that CEO's rewards reflect the company's success (Jensen and Murphy, 1990b; Hall and Liebman's, 1998). This form of compensation also accounts for short-sightedness, as stock prices are forward-looking[2], so when a stock price appreciates, a CEO is rewarded for contributing to the future gains of the company (Fama, 1970). Finally, stock options incentivize CEOs to pursue high-variance risks (Jensen and Meckling, 1976; Sanders and Hambrick, 2007), by investing in strategic products, which according to Hou et al. (2018), if they turn out to be successful, the chief executive can benefit from the stock price increase by exercising their options. If not, and the stock price declines, then the CEO can choose not to exercise the options.

This incentive form is more adequate for high-growth industries due to managers holding private information about growth opportunities (Smith and Watts, 1992), however, Yermack (1996) found no evidence supporting this reasoning. Additionally, stock options are suggested for newer CEOs, as tenured executives loaded with stock options may keep pursuing big success with mediocre suggestions, which are less likely to produce big gains (Finkelstein and Hambrick, 1990).

However, stock option compensation can have negative effects, including the CEO's inappropriate timing of news release, the unethical use of inside information, the risk that they may manipulate earnings to improve the stock price if a large amount of their stock options is

[2] A consensus among the investors of the present value of all the future earnings of the firm

out of the money[3], and the possibility to induce excessive risk taking (Zhang et al., 2008; Sanders and Hambrick, 2007).

These tendencies toward excessive risk-taking are relevant in strategic decisions like mergers and acquisitions. Before examining how stock options specifically influence M&A behavior, the reasons why companies pursue these deals will be examined.

2.3 M&A Reasons

Mergers and acquisitions are transactions used for corporate restructuring and control, where ownership, in whole or in part, is transferred or combined with another company. This type of transaction can happen with various frequencies, with frequent acquirers being firms capable of making five or more acquisitions within three years (Fuller et al., 2002).

However, studies on M&As suggest that not all of these transactions are successful, in fact, these often tend to be firm value destroying or neutral, for acquirors and firm value increasing for targets as shown by Cai and Vijh (2007). Therefore, it is important to understand the reasoning behind pursuing such a transaction.

In Nguyen et al. (2012) research, M&A motives are categorized into value-increasing and value-decreasing. However, research like the one from Berkovitch and Narayanan (1993) found that mergers overlap motives from the two types of categories.

As for the value-increasing motives, their focus is on synergistic benefits, including operational synergies (Healy et al., 1992), financial synergies (Ghosh and Jain, 2000), market power, response to industry shocks (Jensen, 1993), tax benefits (Hayn, 1989), and information asymmetry exploitation. However, evidence is mixed with Pound (1988) finding limited benefits from these motives.

Regarding the value-decreasing causes, these can include agency problems, hubris, market timing, and board self-interest.

Firstly, agency issues arise when managers prioritize personal interests over shareholder value, either through excessive growth (Morck et al., 1990), risk reduction through diversification (Amihud and Lev, 1981), or controlling more corporate resources (Jensen, 1986).

[3] When the exercise price greater than the current market value of a share.

Secondly, hubris-driven acquisitions happen when overconfident managers, chief executives with excessive certainty over the accuracy of their beliefs (Moore and Healy, 2008)[4], acquire companies for more than they are worth, even without potential synergies, benefiting target shareholders (Roll, 1986). Despite being expected that overconfident managers become more rational with experience, learning by experience is less likely and more difficult in the context of mergers and acquisitions (Brehmer, 1980; Doukas & Petmezas, 2007).

Thirdly, market timing, another value decreasing motive, arises from Shleifer and Vishny (2003) misvaluation theory, which explains that companies sometimes engage in M&A transactions because acquirer managers may believe their firm is overvalued, leading to acquisitions driven by mispricing rather than potential synergy's creation.

Even though Chen et al. (2008) argues that boards are expected to inspect CEO decisions on acquisitions to ensure alignment with shareholders' interests, directors may have their own incentives to support potential increases of the firm, as directors' compensation is often tied to a firm's size, giving them incentives to support acquisitions. Consequently, the board of directors may approve deals without proper consideration or even collude with the CEO to advocate for acquisitions that benefit both parties, compromising board independence (Chen et al., 2008).

Within this broader context of CEO compensation influencing M&A decisions, stock options emerge as one of the drivers of acquisition behavior.

2.4 Stock Options and M&A

2.4.1 Acquisitiveness

Scholars have argued that acquisitions are largely influenced by executive financial incentives (Jensen, 1986; Jensen and Murphy, 1990a). For example, without stock-based incentive structure, executives can be tempted to drive their firms to grow larger than optimal and to consistently acquire other companies (Jensen 1986; Jensen and Murphy, 1990a). However, the stock-based incentive structure, which can include stock options, exhibits different risk attributes (Sanders, 2001).

[4] This represents one of the many definitions of overconfidence. Other authors include Klayman, Soll, González-Vallejo & Barlas (1999); Weinstein (1980).

In this research, the focus is stock options, and to understand how this compensation mechanism influences chief executive behavior, it is important to consider their asymmetric payoff structure, which creates unique incentives for CEOs, as when investments succeed, they can realize gains by exercising their options as stock price rises. Conversely, if the investment fails and stock price falls, their losses are limited since they can choose not to exercise underwater options (Sanders and Hambrick, 2007). Due to this, stock options compensation leads managers to make riskier decisions, that may not align with shareholders' interests (Sanders and Hambrick, 2007; Malmendier and Tate, 2008), with uncertain outcomes, as this form of compensation does not penalize CEOs for their acquisition failures (Sanders, 2001).

In fact, Cai and Vijh (2007), who studied the impact of CEO stock and option holdings on M&A, argue that if the CEOs believe that the deal improves their firm's value, they will be motivated to complete the transaction because their own holdings of stock and options will be worth more. In the authors' empirical research they found, using different acquisition measures, acquisition ratio, acquisition count and the acquisition dummy, that the market value of CEO holdings was positively related to the probability of making an acquisition, with statistically significant at 1% or 5% level. Furthermore, according to Sanders (2001), CEO stock option was found to be positively associated to firm's acquisition activity, which was measured by the acquisition count, statistically significant at 0.1%.

So, even though there is a great deal of variance in the outcomes resulting from acquisitions (Jensen and Ruback, 1983), executives paid with stock options will aim to pursue acquisitions that have the potential of producing very large gains, creating an opportunity for CEOs to benefit significantly from an increase in the stock price (Sanders, 2001), and although the probability of those large gains is low, the CEO has nothing to lose as his/her compensation rarely declines after their acquisition underperforms (Grinstein and Hribar, 2004).

Sanders and Hambrick (2007) advocate for the use of stock options to motivate CEOs to take on risk, however, they argue that there is a point where the number of stock options in the compensation of chief executives becomes excessive, going beyond encouraging the necessary risk-taking, surpassing the level of riskiness that is prudent for shareholders, which will tend to generate more extreme performance. According to the authors, the excessive risk taking induced by stock options appears when this form of compensation represents 50% or more of the CEOs' compensation.

In fact, Becher and Juergens (2012) found that CEOs whose compensation packages include higher levels of stock options tend to strike more deals, with their marginal effects findings showing that a one standard deviation increase in a CEO's option-based compensation increases a firm's probability of undertaking a merger in a given year by 0.42%. This positive correlation suggests that the incentive structure of stock options encourages a higher volume of acquisition activity.

2.4.2 Diversifying M&A

According to Rose and Shepard (1997), the level of CEO compensation can affect the motives for diversification. Indeed, Cai and Vijh (2007) found that CEOs with large stock and option holdings make them less diversified, and due to the higher hurdles involved in acquiring and integrating firms from unrelated industries, the authors argue that only CEOs with such personal incentives may be motivated to pursue these acquisitions. These acquisitions are classified as risky because the acquiring company enters an unknown industry where it has less knowledge and information about the target firm sector (Croci and Petmezas, 2015).

CEOs holding a large quantity of stock options are assuming a concentrated exposure on the future success of the company, which can make their portfolio heavily weighted towards their own company. This situation can create on the CEO a stronger personal incentive to engage in diversifying acquisitions, with the expectation that their actions will result in an increase in the firm's economic value, and in turn enhance their own wealth, even though the reality is that in most cases these transactions lack synergies and are driven by managerial objectives that lead to a reduction in the firm's value (Morck et al., 1990).

2.4.3 Premium paid in M&A

Acquirer CEOs with higher holdings of stock and options were found to have a stronger personal incentive to be more aggressive in acquisitions, which leads the executive to pay a value above the market price of the target company in order to guarantee the completion of the deal, as was found by Cai and Vijh (2007). Hayward and Hambrick (1997) found a positive association between the overall executive pay level and the acquisition premium paid, which the authors attributed to the manager's pride.

CEOs with higher stock options holdings are, due to the nature of stock options, more incentivized to focus on the company performance, as their personal financial gain is tied to the company's stock price (Jensen and Murphy, 1990b), therefore, if they believe that the acquisition

will improve the value of their holdings, then in order to ensure the deal is secured, those larger holdings may motivate them to offer a higher premium, thereby increasing the likelihood of its completion.

Contrastingly, in Datta et al. (2001) study, the authors found that companies with managers who have high equity-based compensation tend to pay lower acquisition premiums, though these premiums are still higher than the normal 30% reported by Nielsen and Melicher (1973). Indeed, they found that the mean acquisition premium paid by managers with high stock option-based compensation was 35.88%, which is significantly lower than their counterparts in low equity compensation firms, who paid a mean of 44.66%.

Datta et al. (2001) attributed these differences in acquisition premiums between low and high equity-based compensation to the alignment of managerial interests with those of shareholders, in support of the hypothesis that equity compensation helps to reduce the tendency of acquirer managers to pursue non-value maximizing preferences, which would otherwise be at the expense of acquiring shareholders.

3 Research Hypotheses

This research aims to study the impact of CEO equity compensation, specifically stock options, on mergers and acquisitions, in order to understand if, in fact, and in what conditions stock options induce CEOs to engage more in M&A activity.

3.1 CEO stock options and the frequency of M&As

In the literature review, the different components of compensation were exposed, but, specifically, according to Sanders and Hambrick (2007), stock option compensation is more likely to encourage the CEOs to pursue actions that could increase the company's stock price, such as M&As. Sanders (2001) found that CEO stock option compensation was positively related to higher investments in acquisitions, a perspective also corroborated by Cai and Vijh (2007) who examined CEO stock and option holdings. Thus, the following main hypothesis arises:

H1 | CEO whose compensation packages include more stock options are more prone to complete more M&A.

3.2 CEO stock options and the M&A engagement

On the same reasoning above, regarding how stock options encourage a greater volume of M&A, this effect can also be observed in the fundamental decision to engage in any M&A. Cai and Vijh (2007) found this tendency in their empirical research. So, for this study, the following hypothesis arises:

H2 | CEO stock option compensation increases the likelihood of a firm engaging in M&A.

3.3 CEO stock options and frequent acquisition

In some cases, the amount of stock options a CEO receives can induce them to take on excessive risk, surpassing a level that is acceptable to shareholders. According to Sanders and Hambrick (2007) this occurs when stock options represent 50% or more of the CEO total compensation. Therefore, the aim of this hypothesis is to test whether such a level of stock options can induce a firm's CEO to become a frequent acquirer.

H3 | Excessive CEO stock option compensation is positively related to the probability of a firm being a frequent acquirer.

3.4 CEO stock options and diversifying M&A

Companies rewarding their CEOs with stock options make their personal wealth more susceptible to the company's stock price fluctuations. Consequently, this should motivate CEOs to reduce their concentrated option risk by pursuing diversifying acquisitions. Cai and Vijh (2007) found this tendency among acquirer CEOs with higher stock and option holdings. Specifically, for this study, the hypothesis is to test the impact of CEO stock options on the likelihood of a diversifying M&A.

H4 | CEOs whose compensation includes stock options are more likely to pursue diversifying acquisitions.

3.5 CEO stock options and high premium deals

Due to the nature of stock options, acquirer CEOs with such holdings may be less focused on negotiating acquisition prices because their primary goal is to complete acquisitions that will increase their company's value and, consequently, their own holdings. This makes them willing to pay a higher premium, a finding supported by Cai and Vijh (2007). This hypothesis aims to test whether CEOs with stock options make acquisitions by paying high premiums.

H5 | CEO stock option compensation induces them to make high premium acquisitions.

4 Methodology

As the main focus of this research is to analyze the impact of the stock option component of CEO compensation on a firm's acquisition activity while controlling for various economic determinants, a further explanation of the methodology used will be given.

4.1 Dependent variables

As CEO stock options, can make managers to be more prone to be risk-takers, and therefore to engage in multiple transactions (Sanders, 2001; Sanders and Hambrick, 2007; Malmendier and Tate, 2008), the study measures *acquisition activity* from 2010 to 2020, using two variables, one measuring the number of acquisitions completed, and another being an acquisition dummy, taking value one if an acquisition was completed in a given year, measure used by researchers like Sanders (2001), Cai and Vijh (2007), Boulton et al. (2014), Mishra (2020). The focus of this research is on the number of acquisitions completed rather than the value of the transactions, because the interest is the frequency with which acquisitions are completed, therefore using these variables matches the theory being tested. Additionally, most of the transactions in mergers and acquisitions are reported without a disclosed value by the firms involved, which would lead to a large number of deals to be ignored if the transaction value were the dependent variable, and could also bias the results towards large transactions.

Past literature has shown that CEO with excess stock options can be excessive risk-takers, which can lead them to be frequent acquirers (Fuller et al., 2002; Sanders and Hambrick, 2007), so a dummy variable *frequent acquirer* was created, in which a CEO is defined as frequent acquirer if it has completed at least five M&As in the previous three years (Fuller et al., 2002).

Furthermore, past research from Cai and Vijh (2007) has shown that CEOs with large stock and option holdings make more diversifying acquisitions. So, adapted to the study on CEO stock options, a dummy variable *diversification* was created, in which a M&A is defined as a diversifying deal if the two- digit Standard Industrial Classification (SIC) code of the acquirer and the target differs, i.e., if the two firms operate in different industries. The binary variable constructed takes value one if SIC codes differ for at least one acquisition in a given year, and zero otherwise.

Additionally, Hayward and Hambrick (1997) found a positive relation between executive pay and acquisition premium paid, so, a variable was created to see whether highly paid CEOs

with stock options make acquisitions with high premiums paid. The binary variable takes value one if for any of the firm acquisitions completed in a given year, the premium is higher than "normal", 30%, and zero otherwise, as defined by Nielsen and Melicher (1973). The acquisition premium was calculated as the excess of the deal value over the pre-deal target market capitalization, divided by the pre-deal target market capitalization.

4.2 Measures for Stock Options

The independent variables encompass a range of factors including control variables to provide a comprehensive framework, with the aim of understanding if stock options as the compensation of CEO's does truly drive firms to engage in takeovers. Based on the literature review, and other studies, the following variables will be used.

The study will encompass four different measures for *CEO stock option pay,* the value of stock options granted in a given year to a CEO whose valuation is based upon the fair value on the date they were granted. Since the aim is to capture CEO stock option compensation impact on M&As, then the measure is the dollar value of options granted rather than the percentage of pay in options, so on the first measure of stock options the variable is measured as their value from the previous year, as in Cai and Vijh (2007).

Additionally, to understand the relative impact of stock options on M&A activity, this variable will be calculated as a percentage of total compensation, because a large absolute value of this component in one CEO compensation might not be as large for another CEO. This percentage will be calculated using the previous year's compensation data.

Furthermore, following Sanders (2001), stock options will be measured by calculating the average value granted to a CEO over the previous three years, as the author found difficult to define an appropriate lag.

Finally, to distinguish between CEOs who receive excess stock options from those who do not, a dummy variable was created, taking value one when the CEO stock option payment component from the previous year represents more than 50% of their total compensation, and zero otherwise, following Sanders and Hambrick (2007) definition of excessive stock option compensation.

4.3 Control variables

These variables represent other executives or firm attributes that may affect the relationship between the theorized influence of stock options on the completion of a takeover. Each of these variables is detailed below and in Table 7 in the appendix.

On firm characteristics*, firm size* was included, because it likely affects acquisition activity, being measured by the logarithm of firm assets in order to address skewness (Malmendier and Tate, 2008; Billett and Qian, 2008; Ferris et al., 2013). Concerning the expected signal of this parameter, it is ambiguous as literature has different perspectives (Sanders, 2001; Moeller et al., 2004; Vijh and Yang, 2013).

The incorrect valuation of companies by the market influences M&A activity, which will be measured through the *Tobin's q*, frequently used in finance literature to represent a firm's growth opportunities (Berger and Ofek, 1995; McConnell and Servaes, 1995). This parameter, Tobin's q is commonly used in M&A literature as a control variable, being the ratio of market value of assets to the book value of assets, which according to Malmendier and Tate (2008), the market value of assets is designated 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. The expected signal for this parameter is positive as firms with higher Tobin's q, growth opportunities, are more likely to pursue M&A deals (Servaes, 1991; Jovanovic and Rousseau, 2002; Rhodes–Kropf et al., 2005; Malmendier and Tate, 2008).

Since a firm's financial structure may also be a factor influencing M&A likelihood (Jensen, 1986) the debt-to-assets ratio is used as an indicator of *firm's leverage*, and since highly leveraged firms companies have their cash flow committed to debt serving rather than readily available, it can put pressure on their acquisitiveness level (Modigliani and Miller, 1958; Jensen and Meckling, 1976; Billett and Qian, 2008; Uysal, 2011), therefore the coefficient expected signal is negative.

Further, as firms with excess cash holdings can potentially absorb shocks coming from risky investments, making them more prone to pursue M&As, this was considered by adding a variable measuring the *firm's liquidity* through the ratio of cash and cash equivalents to assets (Lang et al., 1991; Jensen, 1986; Harford, 2002; Huang et al., 2021). Thus, the expected coefficient signal is positive.

Firm performance was also included as a control through the measure return on assets due to its frequent use in other studies (Sanders, 2001). Even though, on the study of Nguyen et al. (2012) the coefficient for ROA was positive, suggesting that acquiring firms tend to have higher ROA, it is not statistically significant, therefore no correlation was found by the authors between ROA and M&As. This reasoning is also supported by Renneboog and Vansteenkiste (2019).

Further, *recent acquisition activity* was added as a control variable, since it has been shown that acquisition activity tends to be a highly inertial practice (Amburgey and Miner, 1992; Sanders, 2001). Therefore, the expected relation with M&A activity is positive. For measuring, a dummy was included, taking value if the firm has done at least one deal in the previous three years, and zero otherwise.

Controls of all other forms of CEO pay were included because their levels of compensation can be a motive for pursing M&As, as a means to increase their levels of compensation. Also, the influence of stock options on these deals likely depends on the value of other forms of compensation (Sanders, 2001). These other forms of compensation include *cash compensation* and *bonus* earned by the executive during the fiscal year, *other compensation*, and *restricted stock* whose valuation is based upon the fair value on the grant date. The expected coefficient signal for CEO's salary is negative as it decreases risk-taking, due to being a form of fixed compensation that provides a sense of security to executives (Pratt, 1964; Jafri, 2013; Graffin et al., 2019). Conversely, bonus expected signal is positive, due to for example, bonuses tied to firm growth that can incentivize M&A activity (Grinstein and Hribar, 2004; Bakke et al., 2025). Regarding the compensation component related to perquisites, the expected signal is positive, with the market viewing these deals as poor quality as the executive is prioritizing their own interests over those of shareholders (Chan et al., 2023). Concerning restricted stock it may increase CEO risk aversion, possibly resulting in a negative relationship with M&A engagement (Bryan et al., 2000; Boli and Oh, 2024)

CEO stock ownership was measured as the percentage of stock owned by a firm's CEO, as is said by literature that 5% of managerial ownership assures control over a firm's decisions, which could seriously influence their decision to undertake an M&A (Herman, 1981). Because the interest of this study is to see the effects caused on the propensity to pursue M&A deals, we choose to measure stock ownership as the percentage shares owned by the CEO rather than the dollar value of shares owned to level across different companies as in Fidrmuc and Xia (2019).

The expected coefficient signal of the relationship between CEO stock ownership and M&A frequency is negative (Lilienfeld-Toal and Ruenzi, 2014) as CEOs with higher ownership can be more risk-averse (Kim and Lu, 2011).

Characteristics of the CEO that can be influencing factors include *CEO age*, which according to Barber and Odean (1998) and Yim (2013), younger CEOs tend to engage more in M&A activity, whereas older CEOs tend to be more cautious, reducing their level of risk-taking as they get elder (Levi et al., 2010; Ferris et al., 2013). Therefore, the expected signal is negative. Further, *CEO gender,* was added as a dummy variable taking value one if it is a female CEO and zero if not. In the study by Devers et al. (2008), it is argued that female and male chief executives differ in their risk-taking predispositions, with females tending to be more risk averse, and with less overconfidence compared to their male peers, and less likely to engage in mergers and acquisitions (Huang and Kisgen, 2013; Faccio et al., 2016). Therefore, for female CEOs, the coefficient signal is expected to be negative.

CEO position tenure was measured as the number of years that an executive held the CEO title at the sampled firm, as in Sanders (2001) and Jenter and Lewellen (2015). This variable is of importance as newer chief executives, being more agile are more likely to pursue value-creating acquisitions, to accelerate their strategies and have time for their targeted transformations completed, whereas, longer-tenured CEOs, associated to older CEOs are more rigid, narrowing their information research to their core expertise, making them less inclined to pursue transformative acquisitions (Yim, 2013; Zhou et al., 2020; Walters et al., 2007; Mattsson and Oostende, 2025). Thus, the expected signal of CEO tenure on mergers and acquisitions is negative.

Another dummy variable added was *CEO overconfidence*, as overoptimistic chief executives are more risk-takers, overestimating the returns of their investments (Malmendier and Tate, 2005, 2008). Even though there are several proxies to determine overconfidence, the one used was the "Holder 67" that states that a CEO is overconfident if (s)he fails to exercise twice, vested stock options, i.e. exercisable options, that are at least 67% in-the-money, with the dummy taking value one in this case and zero if otherwise (Malmendier and Tate, 2005, 2008). Once a CEO is overconfident, remains overconfident for the rest of the period, which is consistent with the characteristic being a persistent trait (Hirshleifer et al., 2012). Even though the option-holding behavior needs to happen twice, it is assigned beginning with the first time the CEO exhibits

the behavior (Campbell et al., 2011). Because detailed data concerning CEOs option holdings and exercises prices for each option grant is not available, it was used the notion of average moneyness of the CEO's option portfolio for each year from Campbell et al. (2011), an adjustment of the proxy developed by Malmendier and Tate. The authors first calculate the realizable value per option which is done by dividing the total realizable value of exercisable options[5] by the number of exercisable options[6]. Then they estimate the average exercise price of the options which results from the subtraction of the realizable value per option from the stock price[7] at the end of the fiscal year. Finally, the average percent moneyness of the options is calculated by dividing the per-option realizable value by the estimated average exercise price. Concerning the expected signal for the dummy variable, it is positive, as overconfident CEOs are more likely to make acquisitions (Doukas and Petmezas, 2007; Malmendier and Tate, 2008; Ferris et al., 2013).

$$Moneyness\ of\ options = \frac{Stock\ price\ at\ fiscal\ year\ end}{Stock\ price\ at\ fiscal\ year\ end - \frac{Total\ Realizable\ Value\ of\ Unexercised\ Exercisable\ Options}{Number\ of\ Unexercised\ Exercisable\ Options}} - 1 \quad (1)$$

CEO duality, CEOs who accumulate the chairman role, concentrating more power on them, lead to lower board oversight, whereas non-duality reflects the opposite (Finkelstein, 1992; Hayward and Hambrick, 1997; Krause et al., 2013). While some research has linked CEO duality to outcomes reflecting risk-taking behavior (Lewellyn and Muller-Kahle, 2012), others say that CEOs who are also chair of the board may face information overload and greater criticism, leading them to be more prudent and avoid risky choices (Oler et al., 2009; Chikh and Filbien, 2011). This variable was included as a dummy, taking value one if duality exists and zero otherwise, expecting an ambiguous signal for its coefficient.

Another measurement that can be connected to CEO power are the characteristics of the board. *Board size* was seen in literature to be a factor that positively impacts CEO's power, as larger boards have less consensus, coordination of tasks and reduced oversight, because

[5] OPT_UNEX_EXER_EST_VAL appears in ExecuComp as the estimated aggregate value of in-the-money unexercised exercisable options at fiscal year end.
[6] OPT_UNEX_EXER_NUM appears in ExecuComp as the aggregated number of unexercised options at fiscal year end that were vested.
[7] PRCCF appears in ExecuComp as the close price of the firm's stock for the fiscal year.

compared to smaller boards, it becomes harder and costlier for them to decide effectively, and easier for the CEO to take control, as it takes more negotiation and compromise to reach a final decision, which tends to be associated with less mergers and acquisitions (Jensen, 1993; Yermack, 1996; Cheng, 2008). This variable was measured by the actual number of board members, and the expected signal for tits coefficient is negative.

Additionally*, board independence* was seen to improve the functions of the board, especially their oversight, reducing CEO's influence, so this statistic will be represented as percentage of independent board members in the board of each firm (Hermalin and Weisbach, 2003). Literature on the impact of independent directors on mergers and acquisitions focuses more on how these directors contribute to a more informed M&A decision that results in either positive or negative outcomes, regardless of its frequency, as seen in Masulis and Zhang (2019). Therefore, there is no expectation for the coefficient signal.

Finally, the *diversity of gender* in the board was seen to be an influencing factor in the performance of the firm, as they bring different perspectives and professional experiences compared to men (Hillman et al., 2007; Ward and Forker, 2017). This variable was measured as the percentage of women on the board of directors. Concerning the relationship between female directors and frequency of mergers and acquisitions, Dowling and Aribi (2013) and Levi et al. (2014) argue that the two are negative correlated, so it is expected a negative coefficient signal.

4.4 Descriptive statistics

4.4.1 Data collection and Sample description

In this section it will be presented the sample used in this thesis, encompassing the criteria used to select the data after analyzed.

The data selected consists of the merge between the databases ExecuComp, Orbis, and Refinitiv DataStream, which provides extensive information on the firms, the chief executive compensation, and the acquisitions made. The ExecuComp database gives information regarding the compensation of US executives and firm financials, with the sample including only firms that provide CEO compensation information, that meet specific inclusion criteria for one of the major S&P indices[8], and have assets greater than zero. This information was then

[8] S&P 500, S&P Midcap Index or S&P Smallcap Index.

complemented with Orbis database, which contains information about mergers and acquisitions for US firms since 2001.

For a deal to be included in the sample the following conditions should be met:

1. The deals should have taken place during the period between January 1st, 2010, and December 31st, 2020. Furthermore, the deals must be classified as "Completed" and be either an "Acquisition" or "Merger".
2. The acquiror must be from the United States of America.
3. For the purpose of this dissertation, all the deals that satisfied the previous conditions were added, independently of whether or not the deal has a disclosed value.

After this, data coming from Refinitiv DataStream regarding board size, independence, gender diversity and the cash holdings for each company were included, being important to note that for simplification, it was assumed that all firms' fiscal year ended in the 12th month. The missing values were filled in recurring to SEC's EDGAR system, by consulting each firm's annual report so that no missing values remain for the independent and control variables.

To conclude, the sample obtained for this dissertation contains 436 US firms, in which 2,966 M&A deals were made between the period 2010 and 2020.

In table 8 in the appendix, the number of M&As completed is shown, for this sample. The figure shows that of the 3,341 firm-year observations never completed one M&A, while 27% of the firm-year observations have completed between 1 and 3 deals. This reveals that firms are not usually involved in M&As or they participate very rarely, however a small portion of the firms, 22 firm-year observations, completed 10 or more M&A transactions in a given year, which aligns with literature that for active firms, M&A is a persistent practice.

4.4.2 Descriptive statistics

Table 1 presents the summary statistics of the variables included in this research. Regarding the count of the number of M&A deals completed by each acquiring firm shows an overall average of 0.62 completed M&A deals, with a maximum of 43 completed deals. Furthermore, based on the data only 10% of the acquirers made acquisitions frequently. Concerning the industry relatedness between the acquiring firm and its target, 56% of the deals where considered diversifying transactions, and 4% where high premium deals. These deals were mostly completed by male CEOs, with only 5% of the sample being composed of female CEOs, revealing the dominance of the male gender among top executive positions.

Table 1: Summary Statistics

Table revealing the summary statistics of the deal variables, considered dependent variables, M&A frequency, M&A dummy, frequent acquisition, diversifying M&A and high premium deal. The stock option variables are described through four distinct measures, granted value, percentage of total compensation, 3-year average, and a dummy for excessive stock option compensation. Lastly, control variables represent firm specific variables, such as firm size, Tobin's q, firm leverage, liquidity and performance, recent acquisition activity. CEO specific control variables, include compensation variables, ownership, age, gender, tenure, overconfidence, and duality. Board specific control variables include, board size, independent board representation, and board diversity.

Variable	Mean	Median	St. dev.	Min.	Max.
Dependent Variables					
M&A Frequency	0.618	0	1.898	0	43
M&A Dummy	0.303	0	0.460	0	1
Frequent Acquisition	0.102	0	0.303	0	1
Diversifying M&A	0.560	1	0.497	0	1
High Premium Deal	0.043	0	0.203	0	1
Stock Options Variables					
Stock Options	1,265.089	0	4,747.159	0	245,953.4
Percentage	0.156	0	0.208	0	0.999
3-Period Average	1,259.861	330.765	3,245.453	0	81,984.48
High Percentage	0.062	0	0.241	0	1
Control Variables					
Firm Size	29,600,000	5,614,629	129,000,000	26,584	2,820,000,000
Tobin's q	2.123	1.598	1.706	0.270	23.040
Firm Leverage	0.565	0.560	0.256	0.012	4.992
Firm Liquidity	0.089	0.057	0.101	0	1.270
Firm Performance	5.336	4.677	8.089	-96.104	52.954
Recent Acquisition Activity	1.877	1	5.089	0	111
Salary	932.149	922.415	401.213	0	5,000
Bonus	169.333	0	818.288	0	27,549.88
Other Compensation	305.884	78.345	2,090.616	0	84,673.05
Restricted Stock	3,820.342	2,556.315	5,087.439	0	131,939.80
CEO Stock Ownership	1.478	0.26	4.699	0	66.48
CEO Age	56.846	57	7.013	34	93
Gender	0.049	0	0.215	0	1
CEO Tenure	9.576	7	7.931	1	53
Overconfidence	0.380	0	0.485	0	1
CEO Duality	0.502	1	0.500	0	1
Board Size	9.988	10	2.295	3	19
Independent Board	81.152	84.62	10.778	9	100
Board Diversity	17.572	16.67	10.295	0	75

The independent variable stock option takes non-negative values with an overall mean of 1,265 thousand USD, whereas its median is 0, which reveals discrepancy in the sample's use of stock options for CEO compensation, aligning with Athanasakou et al. (2022) idea of stock options granted to CEOs frequently changing over time. Furthermore, stock options represent on average 15.6% of the total compensation received by CEOs, while some CEOs received no stock option compensation in a given year, others received nearly all of this form of compensation. Additionally, the overall mean of the previous three-year stock options granted is 1,260 thousand USD, which mirrors the overall mean of individual stock options granted in the current year. Finally, only 6.21% of the firm-year observations have CEOs who have received more than 50% of their compensation in the form of stock options.

According to the statistics summary of firm data, firm size, represented by its assets, are on average 29,600,000 thousand USD, and the median size is 5,614,629, which means that the sample reveals a wide range of firms of different sizes. The acquiring firm's average and median Tobin's q are 2.12 and 1.60, respectively, which may symbolize growth opportunities. The firm's leverage determined by the debt-to-assets ratio has a mean of 0.6, while the firm's liquidity ratio has an average of 0.09. Firm performance, measured by return on assets, has an average of 5%, however, there are firms with negative ROA values, which if sustained over a long period, can lead to financial distress. Finally, recent acquisition activity over the three previous years is close to two completed M&As.

Concerning other components of CEO compensation, the overall salary mean is 932 thousand USD, whereas bonus overall mean is 169 thousand USD which compared to its median of 0 indicates that at least half of the firm-year observations do not compensate their CEOs based on achieving specific firm goals, however, instead they might be using equity compensation. Based on the data, the overall mean of the variable other compensation is 306 thousand USD, with significant variation across observations, similar to restricted stock, which has an overall mean of 3,820 thousand USD.

Regarding the descriptive statistics on CEO characteristics, the overall mean of ownership, 1.5%, is below what is considered in literature to indicate the CEO taking control of decisions. The CEOs are on average approximately 57 years old and with nearly 10 years of experience in a given firm. CEOs that are also chairman, may be less monitored, representing in

this sample at least 50% of the observations, and overconfidence, a cause for excessive risk-taking, is present on 38% of the CEOs.

On the summary statistics of board data, board's size is on average composed of almost 10 directors, however, there are boards with a minimum of 3 members while the largest has 19 members, suggesting substantial variability among firms. There are on average 81% of independent directors, yet there some firm's boards do not have a majority of independent directors in a year, meaning that most of their directors are employed, impacting the supervisory role of the board (Fernández-Temprano and Tejerina-Gaite, 2020). Finally, firm's board members are on average approximately 18% female directors, with at least one firm reaching 75% female composition, highlighting diversity in female director presence across firm-year observations.

Before performing the regression analysis, the dataset was examined to identify possible problems with collinearity, as presented in Table 9 in the appendices. This problem is associated with the possibility of a high correlation between different variables, in which none of the absolute values should exceed 0.7. For example, in Table 9, a correlation of 0.38 between the variables salary and restricted stock suggests a tendency for higher salaries to be associated with more restricted stock, and vice versa. However, even though the correlation between M&A frequency and recent acquisition activity disrespects the defined benchmark, this can be due to the characteristics of the variables, which may indicate a strong expected predictive power.

4.5 Model

As this study aims to understand the impact of stock options on the engagement in M&A deals over the 2010 to 2020 period it makes sense to use panel data, allowing to understand the different changes over time. For this study a heterogeneous model will be used as, for example, CEOs vary in their risk appetites which makes the relationship being studied not uniform across all firms. Furthermore, because unobserved, time invariant unit characteristics, such as corporate culture, may influence the outcome and are correlated with the regressors, then a fixed effects model is used over a random effects model. Even though the Hausman test is commonly used to choose between the two models, it could not be performed here as the fixed effects model dropped time-invariant variables, meaning that the two models were not estimating the same set

of coefficients, which made the Hausman test results invalid. Given this limitation, we rely on firm fixed effects models.

Additionally, to control for any time-specific factors affecting all US firms between 2010 and 2020, such as the macroeconomic US event Tax Cuts and Jobs Act, effective in 2018, time fixed effects are included.

4.5.1 CEO stock options and M&A frequency

The first hypothesis to be tested is the impact of CEO stock options on the number of completed mergers and acquisitions. According to previous literature, stock options tend to induce CEOs to be risk-takers, inducing them to make more acquisitions (Sanders, 2001; Sanders and Hambrick, 2007; Malmendier and Tate, 2008). In order to test this hypothesis, a Poisson count model was used, as it is considered more robust for fixed effects estimation compared to the negative binomial model, according to Professor Joao Santos Silva advice on Stata's forum (2021). Therefore, the Poisson count model was developed:

$$\log(\mathrm{E}[Y_{it} \mid SO_{it}, X_{it}]) = \beta_0 + \beta_1 SO_{it} + X'_{it}\mathrm{B} \qquad (2)$$

Y represents a count variable, measuring the number of completed M&As in a particular firm year. *SO* is the *Stock Option* measuring in three different ways their granted value to a CEO in a given year or a binary variable, measuring whether the CEO stock options represent more than 50% of their total compensation. *Xit* represents the control variables used in the models.

The firm specific control variables include *Firm Size* that is the natural logarithm of acquirer's total assets. *Tobin's q* that is the ratio of market value of assets to the book value of assets of the acquiring firm. *Firm leverage* of the acquirer calculated as total liabilities over total assets. *Firm liquidity* of the acquirer firm measured by the ratio of cash holdings and total assets. *Firm performance* calculated by the return on assets, ratio between acquirer net income and total assets. *Recent Acquisition Activity* measured as the number of completed M&As in the previous three years.

Furthermore, at the CEO level, *Salary, Bonus, Other Compensation* and *Restricted Stock*, were included, each representing the remaining forms of compensation. *CEO stock ownership* represents the percentage of the firm owned by the executive. The *CEO age* represents the age of the chief executive. *Gender* represents the gender of the CEO, equaling to one if female, and zero otherwise. *CEO Tenure* corresponds to the number of years that the executive holds his position at the company. *Overconfidence* equals one if the CEO is classified as overconfident, and

zero otherwise. *CEO duality* equals one if the CEO also holds a position of the chairman of the board, and zero otherwise.

Finally, in terms of board related variables, it was included *Board size* assessed by the total number of board members at the end of the fiscal year. *Independent board* measured by the percentage of independent board members as reported by the company. *Board diversity* calculated using the percentage of female directors. All the variables used in the regressions are presented in Table 7 in the appendix.

4.5.2 CEO stock options and M&A engagement

Secondly, we exploit the second hypothesis by changing the previous dependent variable from a count to a categorical variable, as in Cai and Vijh (2007). To test such hypothesis, eq. (2) is re-estimated with a dependent variable that takes value one in case the firm has completed one acquisition, and zero otherwise. To test this hypothesis a correlated random effects probit regression will be estimated, for two reasons: firstly, the linear probability model for some measures of stock options yielded predicted probabilities that fell outside the standard interval [0,1]. Secondly, following Professor Jeff Wooldridge advice on Stata's forum (2019) the logit model with fixed effects specification is not robust when clustering at firm level, whereas the correlated random effects model is fully robust. So, the correlated random effects model was developed:

$$\Pr\{Y_{it} = 1 | SO_{it}, X_{it}, c_i\} = \Phi(\beta_1 + SO_{it}\beta_2 + X'_{it}B + c_i), \mathrm{t} = 2010, \ldots, 2020 \qquad (3)$$

The dependent variable represents the probability of a firm completing a merger and acquisition. *Stock options* are measured differently in each of the four models with both continuous and binary variables. *X* represents the set of control variables, included in the model. The unobserved firm-specific heterogeneity is represented by *c* (Appendix C). Only the coefficients from the time-varying explanatory variables will be analyzed, while those from the mean variables will be presented in the appendices.

4.5.3 CEO stock options and frequent acquisition

Thirdly, we assess whether CEOs with stock options are more likely to be frequent acquirers. To test such hypothesis, equation (3) is re-estimated with a dependent variable that classifies the acquirer as frequent if it has done at least five acquisitions in the previous three years, equaling to one in this case, and zero otherwise.

4.5.4 CEO stock options and diversifying M&A

On hypothesis 4 the aim is to see whether the impact of CEO stock options on the probability of pursuing a diversifying deal is positive. To test this hypothesis, equation (3) is re-estimated with a distinct dependent variable, measuring whether the deal classifies as diversifying or not, equaling one if the two-digit SIC code of the acquirer and the target differ, and zero otherwise.

4.5.5 CEO stock options and high premium deals

To test whether CEOs highly paid with stock options make acquisitions paying high premiums, equation (3) will be re-estimated with a dependent variable, equaling to one, if the amount an acquiring company pays above the target to complete the deal is above 30%, and zero otherwise.

4.5.6 Robustness checks

We check the robustness of our results using a different measure for the definition of frequent acquirer. Following, Billett and Qian (2008), a firm, will be considered frequent acquirer when completing at least two acquisitions within a five-year period.

In addition, the validity of the results will be tested by excluding the variable of CEO overconfidence, as it is usually a variable defined using stock options as a proxy.

5 Results

Each set of results is presented in a table showing the standard errors as well as the significance levels of the included variables. For each dependent variable, regressions were estimated using different specifications. The base specification included clustered standard errors at the firm level and year fixed effects while the second specification only used clustered standard errors at the firm level. Even though the two specifications were estimated using both random- and fixed-effects models, the results from the fixed-effects model with year fixed effects will be prioritized. Since the fixed-effects specification requires within-group variance in all variables for at least some of the groups, we did not include controls for industry, because this dimension is invariant over time for each firm.

5.1 CEO stock options and M&A frequency

In Table 2 four models are presented using the poisson models, with the dependent variable being the count of completed M&As, and the robust standard errors, clustered at the firm level, are included in parenthesis. Because this is a poisson regression analysis, Table 4 shows the incidence rate ratios (IRR) instead of the coefficients, as these are more intuitive to interpret, representing the change in the expected count of the dependent variable for a one-unit change in the independent variable.

Analyzing Table 2, CEO stock options is not statistically significant in any of the four different measures used to explain the dependent variable, a finding that does not align with the results of Sanders (2001) who obtained a coefficient value of 0.58 for CEO stock option pay that when interpreted as an incidence rate ratio, indicates that for a one-unit increase in stock options, leads to an expected 78.6%[9] increase in acquisition activity, holding other variables constant, a finding statistically significant at 0.1% level. Another similar, but smaller result was reported by Cai and Vijh (2007), who found that for a one unit increase in the market value of CEO holdings, the expected number of acquisitions increases by 11%[10], statistically significant at 1% level, holding other variables constant. Thus, these two authors identified a positive and statistically significant relationship, which contrasts with the non-significant results we obtained.

[9] Calculation of the IRR: $e^{0.58} \approx 1.786$ representing a $(1.786 - 1) * 100 = 78.6\%$ increase.
[10] Calculation of the IRR: $e^{0.104} \approx 1.1096$ representing a $(1.1096 - 1) * 100 = 10.96\%$

Table 2: Effect of CEO Stock Options on M&A frequency

The table presents the model results to determine the impact of CEO stock options on M&A activity. M&A frequency, the dependent variable, represents the number of deals completed within a given fiscal year. Each stock option variable was earlier defined. All predictor variables are from the previous fiscal year. Standard errors are estimated with clustering at the acquirer. Coefficients are presented as incidence rate ratio, with standard errors shown in brackets. Results are presented with three decimal places. *, **, and *** measure significance at the 10%, 5%, and 1% level, respectively.

	Stock Options Variables			
	Stock Options	Percentage	3-Period Average	High Percentage
	(1)	(2)	(3)	(4)
Stock Options Variable	1.000	0.997	1.000	0.862
	(0.000)	(0.176)	(0.000)	(0.143)
Firm Size	1.053	1.032	0.994	1.078
	(0.125)	(0.121)	(0.136)	(0.128)
Tobin's q	1.039	1.053	1.045	1.038
	(0.054)	(0.058)	(0.073)	(0.055)
Firm Leverage	0.749	0.736	0.938	0.842
	(0.183)	(0.176)	(0.253)	(0.202)
Firm Liquidity	1.285	1.396	1.041	1.280
	(0.687)	(0.740)	(0.665)	(0.674)
Firm Performance	1.024***	1.023***	1.033***	1.023***
	(0.007)	(0.007)	(0.008)	(0.007)
Recent Acquisition Activity	1.003	1.003	0.986*	1.004
	(0.003)	(0.003)	(0.008)	(0.003)
Salary	1.000**		1.000	
	(0.000)		(0.000)	
Bonus	1.000		1.000	
	(0.000)		(0.000)	
Other Compensation	1.000		1.000	
	(0.000)		(0.000)	
Restricted Stock	1.000		1.000	
	(0.000)		(0.000)	
CEO Stock Ownership	1.027	1.019	1.027	1.023
	(0.024)	(0.025)	(0.025)	(0.024)
CEO Age	1.014*	1.015*	1.004	1.015*
	(0.008)	(0.008)	(0.010)	(0.008)
Gender	1.443	1.455	1.844*	1.449
	(0.489)	(0.488)	(0.646)	(0.486)
CEO Tenure	0.993	0.997	1.006	0.993
	(0.009)	(0.009)	(0.010)	(0.009)
Overconfidence	0.985	0.991	1.137	0.976
	(0.095)	(0.095)	(0.135)	(0.093)
CEO Duality	0.821*	0.822*	0.895	0.839
	(0.094)	(0.092)	(0.127)	(0.097)
Board Size	0.998	0.997	0.988	1.000
	(0.024)	(0.024)	(0.028)	(0.024)
Independent Board	0.997	0.995	0.985***	0.999
	(0.004)	(0.004)	(0.004)	(0.004)
Board Diversity	1.005	1.005	1.000	1.005
	(0.005)	(0.005)	(0.006)	(0.005)
Firm fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Observations	3,120	3,118	2,456	3,120
Chi-squared test	0.000	0.000	0.000	0.000

Analyzing the control variables, in all the presented models, it is observed that firms with higher firm performance are positively related to a higher number of expected completed M&As being significant at 1% significance level, consistent with Sanders (2001).

Additionally, in the first two models, CEO duality, reveals that CEO that are also chairman of the board of directors have a significant negative relationship with the expected number of completed M&As, statistically significant a 10% level, compared to CEO that are not chairman, which aligns with the negative relationship found by Oler et al. (2009) and Chikh and Filbien (2011). In models (1), (2) and (4), the CEO age presents a 10% level of significance, indicating a positive relationship with the expected number of completed M&As. However, such result does not coincide with what was expected.

In the first model, CEOs with higher salaries are expected to engage in more acquisitions, even though the effect is extremely small, which is consistent with Hou et al. (2018) findings for overall investments. Furthermore, in model (3), firms with higher recent acquisition activity are expected to engage in less M&As, significant at 10% significance level, which is inconsistent with Amburgey and Miner (1992), Sanders (2001), Billett and Qian (2008). Contrastingly, female CEOs present a positive relationship with the expected acquisitiveness, statistically significant at 10%, compared to male CEOs, which does not align with Huang and Kisgen (2013) and Levi et al. (2014). Finally, firms with higher percentages of non-employees on their boards show lower engagement in the expected M&A activity, statistically significant at 1% level.

Based on the empirical analysis, CEO stock options, the main variable of interest is not statistically significant in explaining the expected number of completed mergers and acquisitions, a finding that is not supported by the results from Sanders (2001) and Cai and Vijh (2007). Therefore, there is no statistically significant evidence to support hypothesis 1.

5.2 CEO stock options and M&A engagement

In Table 3 are presented the results of the correlated random effects probit models, where the dependent variable is binary, being one if the firm has done at least one M&A during a fiscal year and zero otherwise. Below, the coefficients of the time-varying explanatory variables will be analyzed, and the remaining results from the mean variables can be found in the Appendix E. Since this is a correlated random effects probit model, Table 3 shows the average marginal effects, and the robust standard errors, clustered at the firm level, are included in parenthesis.

The average marginal effects provide a more intuitive interpretation, as they represent the change in the predicted probability of the outcome for a one-unit change in the independent variable.

The results from Table 3 indicate that the four measures used for stock options in the different models are not statistically significant in explaining the predicted probability of engaging in mergers and acquisitions. These results differ from those of Cai and Vijh (2007), who found in their model that for every one-unit increase in the market value of CEO holdings the odds of a firm completing an M&A during a fiscal year increase by 10.7%[11], a result statistically significant at 1%. Therefore, our findings diverge from those of Cai and Vijh (2007), who identified a positive and statistically significant relationship.

In the four models it is found that firm size significantly reduces the probability of a firm engaging in M&A activity, statistically significant at the 1% level, which aligns with Sanders (2001). Similarly, firm leverage negatively impacts the outcome, statistically significant at 1%, consistent with what was the expected relationship for this variable, and with the results of Billett and Qian (2008). Conversely, an improvement in firm performance is associated with a corresponding increase in the probability of completing an M&A deal. Moreover, the findings suggest that a firm led by a female CEO is associated with a higher likelihood of M&A engagement, compared to male CEO.

Furthermore, models (2) and (3) reveal that an increase in the proportion of non-employee directors on the board is associated with a reduced probability of engaging in M&A activity. The same relationship was found when the dependent variable was the count of completed M&As, which may signal the board's monitoring role in evaluating acquisitions that can potentially be value destroying for the firm's shareholders.

[11] Calculation of the odds ratio: $e^{0.102} \approx 1.107$ representing a $(1.107 - 1) * 100 = 10.7\%$ increase.

Table 3: Effect of CEO stock option on M&A engagement

M&A dummy is a binary variable, valued one when a firm completes at least one deal in a given year, and zero otherwise. Each stock option variable was defined earlier. All predictor variables are from the previous fiscal year. Standard errors are estimated with clustering at acquirer. Coefficients are presented as average marginal effects, with standard errors shown in brackets. Results are presented with three decimal places. *, **, and *** measure significance at the 10%, 5%, and 1% level, respectively.

	Stock Options Variables			
	Stock Options	Percentage	3-Period Average	High Percentage
	(1)	(2)	(3)	(4)
Stock Options Variable	0.000	0.065	0.000	0.013
	(0.000)	(0.049)	(0.000)	(0.039)
Firm Size	-0.078***	-0.084***	-0.092***	-0.077***
	(0.028)	(0.028)	(0.034)	(0.028)
Tobin's q	0.003	0.003	0.011	0.003
	(0.010)	(0.010)	(0.013)	(0.010)
Firm Leverage	-0.171***	-0.183***	-0.152***	-0.166***
	(0.047)	(0.046)	(0.051)	(0.049)
Firm Liquidity	0.082	0.087	0.000	0.078
	(0.116)	(0.114)	(0.138)	(0.114)
Firm Performance	0.004**	0.003**	0.003*	0.003**
	(0.001)	(0.001)	(0.002)	(0.001)
Recent Acquisition Activity	0.014	0.011	0.013	0.014
	(0.009)	(0.009)	(0.010)	(0.009)
Salary	0.000		0.000	
	(0.000)		(0.000)	
Bonus	0.000		0.000	
	(0.000)		(0.000)	
Other Compensation	0.000		0.000	
	(0.000)		(0.000)	
Restricted Stock	0.000		0.000	
	(0.000)		(0.000)	
CEO Stock Ownership	0.004	0.004	0.002	0.004
	(0.004)	(0.004)	(0.004)	(0.004)
CEO Age	0.001	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Gender	0.124*	0.123*	0.203**	0.126*
	(0.071)	(0.070)	(0.096)	(0.069)
CEO Tenure	-0.002	-0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Overconfidence	-0.003	-0.002	0.007	-0.002
	(0.022)	(0.023)	(0.027)	(0.022)
CEO Duality	-0.025	-0.025	-0.020	-0.023
	(0.023)	(0.023)	(0.027)	(0.023)
Board Size	-0.001	-0.001	-0.007	0.000
	(0.005)	(0.005)	(0.006)	(0.005)
Independent Board	-0.001	-0.002*	-0.003**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Board Diversity	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Firm fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Observations	4,360	4,358	3,488	4,360
Pseudo R-squared	0.252	0.256	0.241	0.249

After analyzing the impact that CEO stock option pay has on the probability of a firm completing an M&A during a fiscal year, by investigating whether stock options increase the likelihood of a firm acquiring, there is not enough evidence to validate the second hypothesis, therefore it is not possible to conclude that stock options positively influence this probability, which does not align with the results from Cai and Vijh (2007).

5.3 CEO stock options and frequent acquisition

Table 4 presents the results on the probability of a firm becoming a frequent acquirer, i.e., having completed five or more acquisitions in the three previous years, among the firms that have engaged in at least one M&A during that period. The results of the time-varying explanatory variables are presented below as average marginal effects, whereas the results of the mean variables are presented in the Appendix F. Observing the results based on the correlated random effects probit models, there is an extremely small but significant negative relationship between the three-period average measure of CEO stock options and frequent acquisition. A possible explanation is that because M&A announcements often trigger a negative short-term impact on the acquirers' stock price (Moeller et al., 2004; Cai and Vijh, 2007), CEOs due to their compensation structure, via holding more stock options, may refrain from being frequent acquirers because this negative short-term impact would reduce the personal wealth of the CEO, making such a deal less attractive to them (Stein, 1989). Another possible cause is that according to the traditional incentive alignment hypothesis, CEOs compensated with stock options are more aligned with shareholders' interests and therefore may avoid transactions that could destroy shareholder value (Jensen and Meckling, 1976; Jensen and Murphy, 1990a).

Our results from Table 4 show that in models (1), (2) and (4), for the different measures of stock options, they are not statistically significant in explaining the probability of a firm becoming a frequent acquirer. However, the results from model (3) for the measure of CEO stock option average granted in the three previous years show that for every additional 10 thousand USD increase, the probability of frequent acquisition decreases by 0.00945 percentage points, and while statistically significant at 5%, the effect is extremely small. This finding is not supported by Sanders and Hambrick (2007) who reported a 0.87 coefficient, statistically significant at the 0.1% level, aligning with their hypothesis that higher stock option pay is

Table 4: Effect of CEO stock option on frequent acquisition

The dependent variable, frequent acquirer is binary, valued one when a firm completes at least five deals within a 3-year period, and zero otherwise. Every predictor was defined before and concerns to the previous fiscal year. Standard errors are estimated with clustering at acquirer. Coefficients are presented as average marginal effects, with standard errors shown in brackets. Results are presented with three decimal places. *, **, and *** measure significance at the 10%, 5%, and 1% level, respectively.

	Stock Options Variables			
	Stock Options	Percentage	3-Period Average	High Percentage
	(1)	(2)	(3)	(4)
Stock Options Variable	0.000	-0.064	0.000**	-0.027
	(0.000)	(0.062)	(0.000)	(0.044)
Firm Size	0.024	0.037	0.047	0.035
	(0.045)	(0.044)	(0.050)	(0.043)
Tobin's q	-0.003	-0.003	0.003	-0.001
	(0.017)	(0.017)	(0.019)	(0.017)
Firm Leverage	-0.120	-0.106	-0.080	-0.113
	(0.083)	(0.082)	(0.075)	(0.082)
Firm Liquidity	-0.302*	-0.286*	-0.339**	-0.294*
	(0.169)	(0.167)	(0.167)	(0.166)
Firm Performance	0.000	0.000	-0.002	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
Salary	0.000		0.000	
	(0.000)		(0.000)	
Bonus	0.000		0.000	
	(0.000)		(0.000)	
Other Compensation	0.000		0.000	
	(0.000)		(0.000)	
Restricted Stock	0.000		0.000	
	(0.000)		(0.000)	
CEO Stock Ownership	-0.001	-0.001	-0.002	-0.001
	(0.004)	(0.004)	(0.005)	(0.004)
CEO Age	0.003	0.003	-0.003	0.002
	(0.003)	(0.003)	(0.004)	(0.003)
Gender	-0.021	-0.018	-0.094	-0.028
	(0.134)	(0.133)	(0.143)	(0.126)
CEO Tenure	0.001	0.001	0.002	0.002
	(0.004)	(0.004)	(0.004)	(0.004)
Overconfidence	0.009	0.011	0.092***	0.006
	(0.030)	(0.030)	(0.035)	(0.030)
CEO Duality	-0.007	-0.006	-0.001	-0.007
	(0.030)	(0.029)	(0.038)	(0.029)
Board Size	-0.008	-0.008	-0.004	-0.008
	(0.007)	(0.007)	(0.009)	(0.007)
Independent Board	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.001)
Board Diversity	0.002	0.002	0.000	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Firm fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Observations	2,235	2,233	1,842	2,235
Pseudo R-squared	0.108	0.099	0.127	0.100

associated with more aggressive investment spending in acquisitions. Furthermore, our results also do not align with Sanders (2001) and Cai and Vijh (2007).

In the four models an increase in a firm's liquidity leads to a decreased probability of that firm being categorized as frequent acquirer, significant at 5% or 10% level, which is different from the findings of Billett and Qian (2008) and Levi et al. (2014).

Model (3) indicates a positive and statistically significant relationship at the 1% level between CEO overconfidence and frequent acquisition, which is consistent with Malmendier and Tate (2008) and Ferris et al. (2013).

Based on empirical analysis, a significant but extremely small negative relationship between stock options when measured as their three-period average and frequent acquisition is found, which leads to the rejection of hypothesis 3. However, these results contrast with previous literature (Sanders, 2001; Cai and Vijh, 2007; Sanders and Hambrick, 2007).

5.4 CEO stock options and diversifying M&A

Table 5 presents the results of the correlated random effects probit models regarding the probability of a firm undertaking a diversified M&A deal, i.e. acquiring a firm from another industry, by focusing on firms that have completed at least one M&A in a given year. The results concerning the time-varying explanatory variables are presented in the table below, whereas the remaining results of the mean variables are presented in Appendix G.

The findings indicate that none of the four different measures of CEO stock options are statistically significant in influencing a firm's propensity to engage in a diversified deal, therefore there is no evidence of a relationship between CEO stock options and diversifying M&A. This result contrasts with the one from Cai and Vijh (2007) who identified in their Tobit model that for every one-unit increase in the market value of acquirer CEO holdings the latent diversification ratio increases by 0.06, holding other variables constant, statistically significant at 5%. Thus, unlike our findings from Table 5, Cai and Vijh (2007) found that acquirer CEOs with higher stock and option holdings are more prone to making diversifying acquisitions.

In the four models an improvement in a firm's performance shows a positive effect on the outcome, which is statistically significant at 1% or 5% level. Additionally, in models (2), (3) and (4) an increase in a given firm's growth opportunities, Tobin's q, is associated with a

Table 5: Effect of CEO stock option on diversification

The table displays the models outcomes concerning the influence of CEO stock options on the probability of diversifying deals. Diversifying M&A is a binary variable, valued one when a firm acquires at least one company in a given year that is from a different industry from its own, and zero otherwise. The predictors were defined earlier and are drawn from the previous fiscal year. Standard errors are estimated with clustering at acquirer. Coefficients are presented as average marginal effects, with standard errors shown in brackets. Results are presented with three decimal places. *, **, and *** measure significance at the 10%, 5%, and 1% level, respectively.

	Stock Options Variables			
	Stock Options	Percentage	3-Period Average	High Percentage
	(1)	(2)	(3)	(4)
Stock Options				
Variable	0.000	0.134	0.000	0.012
	(0.000)	(0.112)	(0.000)	(0.075)
Firm Size	0.061	0.052	0.034	0.048
	(0.057)	(0.058)	(0.064)	(0.058)
Tobin's q	-0.033	-0.045*	-0.043*	-0.046**
	(0.021)	(0.023)	(0.024)	(0.023)
Firm Leverage	-0.035	-0.034	0.034	-0.034
	(0.140)	(0.140)	(0.154)	(0.140)
Firm Liquidity	-0.509*	-0.477*	-0.371	-0.472*
	(0.260)	(0.264)	(0.296)	(0.266)
Firm Performance	0.008**	0.009**	0.012***	0.009**
	(0.004)	(0.004)	(0.004)	(0.004)
Salary	0.000		0.000	
	(0.000)		(0.000)	
Bonus	0.000		0.000	
	(0.000)		(0.000)	
Other Compensation	0.000		0.000	
	(0.000)		(0.000)	
Restricted Stock	0.000**		0.000***	
	(0.000)		(0.000)	
CEO Stock				
Ownership	-0.013	-0.011	-0.019	-0.012
	(0.015)	(0.015)	(0.016)	(0.015)
CEO Age	0.003	0.003	-0.005	0.003
	(0.005)	(0.005)	(0.005)	(0.005)
Gender	0.176	0.192*	0.053	0.197*
	(0.113)	(0.115)	(0.172)	(0.114)
CEO Tenure	-0.001	-0.001	0.007	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)
Overconfidence	-0.023	-0.034	-0.049	-0.028
	(0.048)	(0.048)	(0.054)	(0.048)
CEO Duality	0.019	0.010	-0.020	0.010
	(0.049)	(0.050)	(0.055)	(0.050)
Board Size	-0.012	-0.012	0.004	-0.011
	(0.012)	(0.012)	(0.014)	(0.012)
Independent Board	0.001	0.001	0.004	0.001
	(0.002)	(0.002)	(0.003)	(0.002)
Board Diversity	0.004	0.004	0.001	0.004
	(0.002)	(0.002)	(0.003)	(0.002)
Firm fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Observations	1,332	1,331	1,045	1,332
Pseudo R-squared	0.076	0.062	0.109	0.062

decreased probability of undertaking a diversified deal.

Furthermore, it is observed in models (1), (2) and (4), that an increase in the firm's liquidity is associated with a reduced probability of engaging in a diversified M&A. Similarly, the effect of an increase in CEO restricted stock compensation decreases the likelihood of diversified M&A, in models (1) and (3).

Results in models (2) and (4) indicate that when a firm's leadership changes from a male to female CEO, it is associated with an increased likelihood of engaging in a diversified M&A deal.

After examining the impact of stock options on the probability of a firm completing a diversifying acquisition, no statistically significant evidence was found to support their relationship, consequently, preventing the validation of hypothesis 4. These findings are inconsistent with those of Cai and Vijh (2007).

5.5 CEO stock options and high premium deals

Table 6 presents the results of the correlated random effects probit models that test the probability of a firm paying a high premium, defined as above 30%, to finance a merger and acquisition deal. The results are specific to firms that completed a deal and paid a premium for the completion of the deal in a given year. Regarding the time-varying explanatory variables, their results are presented in the table below, whereas the results of the mean variables are presented in the Appendix H. Observing the average marginal effects, they show a significant even though extremely small positive relationship between the three-period-average stock options granted to CEOs and paying a high premium.

Across models (1), (2) and (4), for the different measures of stock options they do not statistically influence the probability of a deal being paid with a high premium. However, when measuring stock options as a three-period average, a significant positive average marginal effect is observed, at the 1% significance level, indicating that for every 1 thousand unit increase, the predicted probability of high deal premium increases by 0.01295 percentage points, representing an extremely small effect. This finding aligns with the results from Cai and Vijh (2007), who identified that an increase in the market value of holdings of the acquirer CEO increased the acquisition premium by 4.10%, as the CEO, having more to gain from a successful, value creating acquisition, is more motivated to pay a higher premium to secure the deal. Additionally,

Table 6: Effect of CEO stock option on high premium deal

The models results to examine the impact of CEO stock options on the probability of the acquirer paying a high premium are illustrated in this table. High premium deal is a binary variable, valued one when the acquirer pays a premium higher than 30%, and zero otherwise. Predictors were defined previously and related to the previous fiscal year. Standard errors are estimated with clustering at acquirer. Coefficients are presented as average marginal effects, with standard errors shown in brackets. Results are presented with three decimal places. *, **, and *** measure significance at the 10%, 5%, and 1% level, respectively.

	Stock Options Variables			
	Stock Options	Percentage	3-Period Average	High Percentage
	(1)	(2)	(3)	(4)
Stock Options Variable	0.000	0.361	0.000***	0.275
	(0.000)	(0.239)	(0.000)	(0.183)
Firm Size	-0.160	-0.016	-0.229*	-0.031
	(0.140)	(0.134)	(0.137)	(0.134)
Tobin's q	0.072	0.136	0.095	0.130
	(0.074)	(0.095)	(0.082)	(0.096)
Firm Leverage	0.415	0.344	0.484	0.286
	(0.320)	(0.352)	(0.407)	(0.352)
Firm Liquidity	1.054	1.172	0.668	0.947
	(0.723)	(0.834)	(0.876)	(0.826)
Firm Performance	-0.012	-0.007	-0.017	-0.007
	(0.010)	(0.012)	(0.011)	(0.012)
Salary	0.000		0.001**	
	(0.000)		(0.000)	
Bonus	0.000***		0.000	
	(0.000)		(0.000)	
Other Compensation	0.000		0.000	
	(0.000)		(0.000)	
Restricted Stock	0.000		0.000	
	(0.000)		(0.000)	
CEO Stock Ownership	0.047	0.038	-0.050	0.045
	(0.053)	(0.054)	(0.057)	(0.055)
CEO Age	0.019**	0.017**	0.007	0.019**
	(0.009)	(0.009)	(0.011)	(0.009)
Gender	0.162	0.176	0.252***	0.159
	(0.133)	(0.114)	(0.057)	(0.120)
CEO Tenure	0.002	-0.001	-0.001	-0.001
	(0.010)	(0.010)	(0.012)	(0.009)
Overconfidence	-0.112	-0.172	-0.261*	-0.134
	(0.118)	(0.121)	(0.154)	(0.124)
CEO Duality	-0.065	0.004	0.087	0.055
	(0.105)	(0.111)	(0.111)	(0.106)
Board Size	0.004	-0.015	-0.025	-0.012
	(0.024)	(0.028)	(0.031)	(0.028)
Independent Board	0.006	0.004	-0.002	0.005
	(0.006)	(0.007)	(0.006)	(0.007)
Board Diversity	-0.004	-0.007	0.002	-0.008
	(0.006)	(0.007)	(0.005)	(0.007)
Firm fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Observations	184	183	152	184
Pseudo R-squared	0.348	0.254	0.461	0.260

the results are also consistent with Datta et al. (2001), who found that managers in high equity-based compensation firms pay an average acquisition premium of 35.88%, as they are more willing to take on more risk, a motivation coming from their compensation structure.

In models (1), (2) and (4), CEO's age has a positive impact on the M&A deal being paid with high premium, with the effect being statistically significant at 5%. Furthermore, in model (3), a similar positive impact is observed for female CEOs. Additionally, in the same model, firm size seems to negatively influence the probability of paying a high premium, significant at a 10% level. Concerning variables related to CEO compensation, salary, in model (3), positively impacts the outcome, whereas bonus, in model (1), negatively, both statistically significant but small effects. Finally, overconfident CEOs seem to be less likely to pay a high premium for the acquisition of the target, statistically significant at 10%, as seen in model (3).

The empirical analysis shows an extremely small positive and statistically significant impact of CEO stock options, when measured as the three-period average, on the probability of a high premium deal, which subsequently validates hypothesis 5 and is supported by previous literature (Datta et al., 2001; Cai and Vijh, 2007).

5.6 Robustness checks

To verify the reliability of the empirical analysis, some robustness checks were performed. The definition of frequent acquirer will be revised from Fuller's et al. (2002), which required five acquisitions in the previous three years, to Billet and Qian's (2008) definition of at least two acquisitions within a five-year period.

Results from the correlated random effects probit, presented in Table 14, Appendix I, show an extremely small statistically significant negative relationship at a 5% level between CEO stock options and the probability of frequent acquisition when stock options are measured by their three-year average. Therefore, compared to previous findings, this measure of stock options is robust to an alternative definition of the frequent acquisition variable.

Furthermore, compared to previous results, firm performance is statistically significant in all models, negatively influencing the likelihood of a firm being a frequent acquirer. With an opposite effect, in models (1) and (3), the variable representing CEO's other compensation gained statistical significance on the likelihood of a firm being a frequent acquirer, even though

its effect is extremely small. In the third model, more control variables gained statistical significance, both firm size and CEO bonus compensation positively influence the outcome, whereas CEO experience in the company negatively influences the probability of frequent acquisition, at 10% significance level.

Another robustness check performed is inherent to overconfidence. Because the main point of this study is to investigate the effect of CEO stock options on decision-making regarding M&A activity, and since in some studies like the ones form Malmendier and Tate, stock options are used as a proxy for overconfidence, then using both might lead to multicollinearity problems. Therefore, the regressions were now estimated excluding the overconfidence variable.

Compared to the results presented previously, the exclusion of the dummy variable measuring CEO overconfidence did not bring any significant alterations to the conclusions already obtained. The significance and effect of the 3-period average stock option remained consistent to predict frequent acquisition and high premium deals.

6 Conclusion

Mergers and acquisitions are one of the top strategies used by firms aiming to accelerate growth and gain competitive advantage. Given the inherent payoff structure of stock options, CEOs with such compensation are often driven to be risk-takers, potentially leading to an increase in investments such as M&A deals. Over the years, several authors have examined how stock options, alone or as part of a broader compensation package can explain M&A decisions and the various characteristics around these transactions. Literature argues that stock options tend to induce CEOs to take more risk, which often results in larger investments, translating into more acquisitions, and entry into different industries, often by paying high premiums for their targets.

This research examines the impact of CEO stock option pay on a firm's acquisition activity, its propensity to enter new industries and the tendency to overpay in acquisitions, specifically within the American context. With a sample of 436 firms and 2,966 M&A transactions from 2010 to 2020 and thus compiling more than 4,700 observations, the study utilizes four different measures of stock options.

Overall, the study's findings diverged from the expectations set by previous literature. Firstly, no evidence was found to conclude that CEO with higher stock option pay is more prone to engage in M&A activity, as no statistical significance was obtained, which is inconsistent with the findings of Sanders (2001) and Cai and Vijh (2007).

Similarly, the impact of CEO stock option pay on an M&A dummy variable could not be observed, as the average marginal effect lacked significance, contradicting Cai and Vijh's (2007) study which identified a statistically significant positive relationship.

Regarding the probability of frequent acquisition, an unexpected and extremely small influence was observed when measuring CEO stock option pay as their three-period average. Our results indicated that, using this definition, CEO stock options are associated with a marginal decrease of 0.00945 percentage points in a firm's likelihood of being a frequent acquirer, which is not in line with prior literature that suggests higher stock option grants associated with increased M&A investments (Sanders, 2001; Cai and Vijh, 2007; Sanders and Hambrick, 2007). This discrepancy can be attributed to either the negative short-term impact on the stock price following an M&A announcement or the alignment of the CEO's interests with

those of shareholders due to the stock options in their compensation structure (Jensen and Meckling, 1976; Jensen and Murphy, 1990a; Moeller et al., 2004; Cai and Vijh, 2007).

Furthermore, no statistically significant result was obtained when examining the impact of CEO stock option on the probability of pursuing a diversifying M&A deal, consequently, no definite conclusion can be drawn from our evidence, which contrasts with the positive relationship reported by Cai and Vijh (2007).

Conversely, a positive statistically significant relationship appeared concerning the acquiror paying a high premium. Specifically, CEOs with a higher three-period average of stock option pay increased the predicted probability of a high premium deal by an extremely small 0.01295 percentage points, a finding consistent with Datta et al. (2001) and Cai and Vijh (2007), who attribute higher premiums to the compensation structure that provides managers with incentives to complete the deal. However, the result was not robust for the other measures of stock option.

Furthermore, some robustness checks were performed to see whether the results hold robust to a distinct definition of frequent acquirer, as well as when excluding the variable overconfidence, as stock options are frequently used as a measure of overconfidence. Overall, the main conclusions remained the same.

As with all studies, this one has limitations. Firstly, while the variables were lagged by one period, consistent with other studies, as it is assumed that a delayed impact on M&A activity, determining the precise appropriate lag is difficult and that can influence the obtained results. Secondly, although the study was designed to examine the effect of stock options on M&As, it did not investigate the impact of these acquisitions on shareholder wealth by determining whether they created value or not.

Additionally, the methodological choice to measure stock options solely by their granted value or relative to total compensation, rather than employing alternative metrics like the conjunction of CEO stock options and stock (Cai and Vijh, 2007), could also account for the findings obtained, given the divergence we obtained from prior literature.

It is also important to note that this thesis research focuses on the US market, which is similar to previous studies, therefore future research could explore companies from different continents, such as Europe or Asia, as differences between countries can impact CEOs decision

to complete an M&A. Finally, in future work it could be examined whether completed M&As were or not creators of value by analyzing the Cumulative Abnormal Returns (CAR).

To finish, as advice to a firm's compensation committee or its manager, I would say that given the results obtained, CEO stock option compensation does not automatically lead to more M&A activity. In fact, our results suggest that stock options are not a significant factor influencing a CEO decision to complete a deal, therefore, contrary to expectations, shareholders concerned about excessive M&A might not need to worry about high levels of stock options.

7 References

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8 Appendices

Appendix A - Summary of the variables

Table 7: Summary of the variables

Variable	Description	Expected signal	Relevant literature
Firm Size	Natural logarithm of total assets reported by the company (in thousands).	Ambiguous	Sanders, 2001; Moeller et al., 2004; Vijh and Yang, 2013
Tobin's q	Ratio of market value to the book value of assets.	+	Servaes, 1991; Jovanovic and Rousseau, 2002; Rhodes-Kropf et al., 2005; Malmendier and Tate, 2008
Firm Leverage	Ratio of total liabilities over total assets	-	Modigliani and Miller, 1958; Jensen and Meckling, 1976; Billett and Qian, 2008; Uysal, 2011
Firm Liquidity	Total cash and cash equivalents over total assets	+	Lang et al., 1991; Jensen, 1986; Harford, 2002; Huang et al., 2021
Firm Performance	Net income over total assets.		Nguyen et al., 2012; Renneboog and Vansteenkiste, 2019
Recent acquisition activity	Acquirer's activity of the three previous years.	+	Amburgey and Miner, 1992; Sanders, 2001
Salary	CEO's cash compensation (in thousands).	-	Pratt, 1964; Jafri, 2013; Graffin et al., 2019
Bonus	CEO's performance compensation (in thousands).	+	Grinstein and Hribar, 2004; Bakke et al., 2025
Other Compensation	Perquisite compensation (in thousands).	+	Chan et al., 2023
Restricted Stock	A form of equity-based compensation (in thousands).	-	Bryan et al., 2000; Boli and Oh, 2024
CEO Stock Ownership	Percentage of the firm's stock owned by the CEO.	-	Kim and Lu, 2011; Lilienfeld-Toal and Ruenzi, 2014
CEO Age	Age of the CEO.	-	Barber and Odean, 1998; Levi et al., 2010; Ferris et al., 2013; Yim, 2013
Gender	Gender of the CEO.	-	Devers et al., 2008; Huang and Kisgen, 2013; Faccio et al., 2016
CEO Tenure	Number of years holding the CEO's position.	-	Zhou et al., 2020; Walters et al., 2007; Mattsson and Oostende, 2025
Overconfidence	Dummy variable taking value one if the CEO is considered overconfident according to "Holder 67" measure.	+	Doukas and Petmezas, 2007; Malmendier and Tate, 2008; Ferris et al., 2013
CEO Duality	Dummy variable equaling one if the individual is both CEO and chairman of the board.	Ambiguous	Oler et al., 2009; Chikh and Filbien, 2011; Lewellyn and Muller-Kahle, 2012
Board Size	Number of individuals in the board.	-	Jensen, 1993; Yermack, 1996; Cheng, 2008
Independent Board	Percentage of total directors classified as independent.		Masulis and Zhang, 2019
Board Diversity	Percentage of female directors on board.	-	Dowling and Aribi, 2013; Levi et al., 2014;

Appendix B - M&A activity distribution

Table 8: Frequency of M&A deals per firm-year

Table presenting the frequency distribution of M&A deals completed per firm-year observation.

M&A Frequency	Firm-Year Observations	Percentage
0	3341	69.66
1	889	18.54
2	316	6.59
3	100	2.09
4	55	1.15
5	23	0.48
6	22	0.46
7	13	0.27
8	6	0.13
9	9	0.19
10	5	0.1
11	2	0.04
14	2	0.04
15	2	0.04
16	1	0.02
22	1	0.02
23	1	0.02
24	1	0.02
26	1	0.02
31	2	0.04
37	2	0.04
38	1	0.02
43	1	0.02
Total	4796	100

Appendix C - Unobserved firm-specific heterogeneity

$$c_i = \psi + \overline{SO}_i \xi_1 + \bar{X}_i' \Gamma + a_i$$

$$a_i \sim Normal(0, \sigma_a^2)$$

Where ψ represents a constant term, $\overline{SO}_i$ represents the firm-specific time-averages of the time-varying stock option variable, $\bar{X}_i$ represents individual-specific time-averages of the time-varying control variables. In general, this will account for the unobserved firm-specific factors that might be correlated with the other variables from equation (3).

Appendix D - Correlation matrix

Table 9: Correlation matrix for all variables

	M&A Frequency	M&A Dummy	Frequent Acquisition	Diversifying M&A	High Premium Deal	Stock Options	Percentage Stock Options	3-Period Average Stock Options	High Percentage Stock Options	Firm Size	Tobin's q	Firm Leverage	Firm Liquidity	Firm Performance
M&A Frequency	1.00													
M&A Dummy	.	.												
Frequent Acquisition	0.34	.	1.00											
Diversifying M&A	0.15	.	0.09	1.00										
High Premium Deal	-0.03	.	-0.02	-0.05	1.00									
Stock Options	-0.02	.	0.02	0.04	0.02	1.00								
Percentage Stock Options	-0.02	.	0.07	0.06	-0.01	0.33	1.00							
3-Period Average Stock Options	-0.01	.	0.18	0.08	0.10	0.18	0.53	1.00						
High Percentage Stock Options	-0.02	.	-0.01	-0.01	0.04	0.28	0.56	0.29	1.00					
Firm Size	0.06	.	0.06	0.09	0.06	-0.01	-0.11	-0.01	-0.04	1.00				
Tobin's q	0.02	.	0.06	0.04	-0.09	0.08	0.19	0.15	0.12	-0.05	1.00			
Firm Leverage	0.04	.	0.05	-0.05	-0.07	-0.04	-0.07	0.02	-0.06	0.19	-0.08	1.00		
Firm Liquidity	-0.06	.	-0.07	0.06	-0.06	0.01	0.09	0.04	0.02	-0.13	0.40	-0.27	1.00	
Firm Performance	0.03	.	0.05	0.06	-0.09	0.02	0.22	0.09	0.16	-0.04	0.57	-0.11	0.25	1.00

(continued)

	M&A Frequency	M&A Dummy	Frequent Acquisition	Diversifying M&A	High Premium Deal	Stock Options	Percentage Stock Options	3-Period Average Stock Options	High Percentage Stock Options	Firm Size	Tobin's q	Firm Leverage	Firm Liquidity	Firm Performance
Recent Acquisition Activity	**0.86**	.	0.51	0.11	-0.05	-0.02	-0.01	0.01	-0.03	0.07	0.02	0.06	-0.09	0.03
Salary	0.11	.	0.17	0.13	0.07	0.01	0.09	0.32	0.00	0.29	0.01	0.30	-0.08	0.10
Bonus	0.03	.	0.03	0.04	0.07	0.01	-0.04	0.07	0.12	0.23	-0.05	0.11	-0.02	-0.04
Other Compensation	-0.01	.	-0.02	0.02	0.03	0.00	-0.05	0.00	-0.02	0.04	-0.04	0.01	-0.02	0.00
Restricted Stock	-0.03	.	0.09	0.00	0.07	-0.02	-0.18	0.08	-0.15	0.22	0.17	0.10	0.01	0.07
CEO Stock Ownership	0.00	.	0.00	0.00	-0.03	-0.03	-0.14	-0.09	-0.04	0.05	0.01	-0.06	0.08	-0.06
CEO Age	0.06	.	-0.03	0.02	0.04	-0.05	-0.07	-0.02	-0.09	0.10	-0.04	0.06	0.01	0.00
Gender	-0.04	.	-0.07	-0.01	0.04	0.00	-0.01	0.01	-0.01	0.00	-0.05	0.05	-0.09	-0.03
CEO Tenure	0.13	.	0.06	0.05	0.02	0.06	-0.05	-0.01	-0.01	0.04	0.02	-0.04	0.07	-0.06
Overconfidence	0.03	.	-0.01	0.05	-0.03	0.10	0.32	0.28	0.12	-0.14	0.21	-0.08	0.09	0.13
CEO Duality	0.03	.	0.01	0.11	0.06	0.01	0.08	0.13	-0.01	0.09	-0.01	0.04	0.02	0.02
Board Size	-0.01	.	0.12	0.07	0.07	0.00	-0.06	0.15	-0.07	0.28	-0.09	0.37	-0.15	-0.07
Independent Board	0.05	.	0.09	0.11	0.06	0.02	0.16	0.12	0.06	0.05	0.04	0.13	-0.06	0.08
Board Diversity	0.04	.	0.11	0.05	0.05	0.01	0.00	0.09	-0.05	0.15	0.08	0.17	-0.11	0.07

(continued)

	Recent Acquisition Activity	Salary	Bonus	Other Compensation	Restricted Stock	CEO Stock Ownership	CEO Age	Gender	CEO Tenure	Overconfidence	CEO Duality	Board Size	Independent Board	Board Diversity
Recent Acquisition Activity	1.00													
Salary	0.14	1.00												
Bonus	0.00	0.04	1.00											
Other Compensation	-0.02	0.04	0.00	1.00										
Restricted Stock	0.00	0.38	0.09	0.05	1.00									
CEO Stock Ownership	0.00	-0.26	-0.04	-0.01	-0.17	1.00								
CEO Age	0.05	0.04	0.04	-0.01	-0.04	0.05	1.00							
Gender	-0.06	0.02	-0.03	-0.02	0.01	-0.05	-0.04	1.00						
CEO Tenure	0.13	-0.08	0.05	-0.01	-0.13	0.36	0.46	-0.05	1.00					
Overconfidence	0.03	0.03	-0.05	-0.03	-0.03	-0.10	-0.07	-0.06	0.08	1.00				
CEO Duality	0.05	0.15	0.09	0.02	0.01	0.22	0.24	-0.05	0.32	0.04	1.00			
Board Size	0.02	0.35	0.17	0.04	0.29	-0.09	0.13	0.06	0.03	-0.11	0.18	1.00		
Independent Board	0.09	0.21	-0.12	-0.03	0.12	-0.26	0.04	0.07	-0.12	0.02	0.11	0.12	1.00	
Board Diversity	0.09	0.27	-0.03	0.00	0.22	-0.02	0.11	0.18	0.00	0.00	0.13	0.25	0.26	1.00

Appendix E - Effect of CEO stock options on M&A engagement (mean variables)

Table 10: Effect of CEO stock options on M&A engagement (mean variables)

The dependent variable, M&A dummy, is one when a firm completes at least one deal in a given year, and zero otherwise. Each predictor variable was defined earlier and concern about the previous fiscal year. Standard errors are estimated with clustering at acquirer. Coefficients of the mean variables are presented as average marginal effects, with standard errors shown in brackets. Results are presented with three decimal places. *, **, and *** measure significance at the 10%, 5%, and 1% level, respectively.

	Stock Options Variables			
	Stock Options	Percentage	3-Period Average	High Percentage
Mean Variables	(1)	(2)	(3)	(4)
Stock Options Variable	0.000	-0.042	0.000	-0.071
	(0.000)	(0.075)	(0.000)	(0.084)
Firm Size	0.069**	0.079***	0.082**	0.070**
	(0.030)	(0.029)	(0.036)	(0.030)
Tobin's q	-0.022*	-0.016	-0.029*	-0.014
	(0.012)	(0.011)	(0.015)	(0.011)
Firm Leverage	0.119*	0.104*	0.099	0.082
	(0.064)	(0.062)	(0.072)	(0.065)
Firm Liquidity	-0.049	-0.064	-0.044	-0.039
	(0.153)	(0.155)	(0.167)	(0.156)
Firm Performance	-0.002	-0.002	-0.001	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Recent Acquisition Activity	0.085***	0.090***	0.083***	0.084***
	(0.014)	(0.015)	(0.015)	(0.014)
Salary	0.000**		0.000**	
	(0.000)		(0.000)	
Bonus	0.000		0.000	
	(0.000)		(0.000)	
Other Compensation	0.000		0.000	
	(0.000)		(0.000)	
Restricted Stock	0.000**		0.000*	
	(0.000)		(0.000)	
CEO Stock Ownership	-0.003	-0.003	-0.001	-0.003
	(0.005)	(0.005)	(0.005)	(0.005)
CEO Age	0.001	-0.001	0.001	-0.001
	(0.002)	(0.002)	(0.003)	(0.002)
Gender	-0.173**	-0.171**	-0.252**	-0.177**
	(0.074)	(0.072)	(0.103)	(0.073)
CEO Tenure	-0.001	-0.001	-0.002	-0.001
	(0.002)	(0.002)	(0.003)	(0.002)
Overconfidence	0.048*	0.031	0.042	0.044
	(0.029)	(0.029)	(0.037)	(0.029)
CEO Duality	0.032	0.018	0.020	0.020
	(0.030)	(0.030)	(0.035)	(0.030)
Board Size	0.010	0.006	0.012	0.008
	(0.008)	(0.007)	(0.009)	(0.008)
Independent Board	0.002	0.002*	0.004***	0.002*
	(0.001)	(0.001)	(0.002)	(0.001)
Board Diversity	-0.003**	-0.003**	-0.003*	-0.003**
	(0.002)	(0.002)	(0.002)	(0.002)
Firm fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Observations	4,360	4,358	3,488	4,360
Pseudo R-squared	0.252	0.256	0.241	0.249

Appendix F - Effect of CEO stock options on frequent acquisition (mean variables)

Table 11: Effect of CEO stock options on frequent acquisition (mean variables)

Frequent acquisition, the dependent variable, is one when a firm completes at least five deals within a 3-year period, and zero otherwise. The predictors concern the previous fiscal year. Standard errors are estimated with clustering at acquirer. Coefficients represent the mean variables, presented as average marginal effects, with standard errors shown in brackets. Results are presented with three decimal places. *, **, and *** measure significance at the 10%, 5%, and 1% level, respectively.

	Stock Options Variables			
	Stock Options	Percentage	3-Period Average	High Percentage
Mean Variables	(1)	(2)	(3)	(4)
Stock Options				
Variable	0.000	0.204	0.000**	-0.077
	(0.000)	(0.133)	(0.000)	(0.115)
Firm Size	0.017	0.008	-0.014	0.012
	(0.048)	(0.046)	(0.053)	(0.046)
Tobin's q	0.033	0.030	0.030	0.033
	(0.022)	(0.021)	(0.022)	(0.021)
Firm Leverage	-0.080	-0.073	-0.110	-0.070
	(0.131)	(0.127)	(0.123)	(0.127)
Firm Liquidity	0.033	0.037	-0.018	0.041
	(0.283)	(0.283)	(0.280)	(0.287)
Firm Performance	0.001	0.001	0.003	0.002
	(0.005)	(0.005)	(0.005)	(0.005)
Salary	0.000		0.000	
	(0.000)		(0.000)	
Bonus	0.000		0.000	
	(0.000)		(0.000)	
Other Compensation	0.000		0.000	
	(0.000)		(0.000)	
Restricted Stock	0.000		0.000	
	(0.000)		(0.000)	
CEO Stock				
Ownership	0.002	0.001	0.003	-0.001
	(0.009)	(0.009)	(0.009)	(0.009)
CEO Age	-0.009*	-0.009*	-0.003	-0.009*
	(0.005)	(0.005)	(0.006)	(0.005)
Gender	-0.239	-0.229	-0.147	-0.220
	(0.201)	(0.199)	(0.261)	(0.199)
CEO Tenure	0.005	0.005	0.005	0.005
	(0.006)	(0.006)	(0.006)	(0.006)
Overconfidence	-0.063	-0.057	-0.166**	-0.021
	(0.057)	(0.057)	(0.064)	(0.055)
CEO Duality	-0.067	-0.061	-0.098	-0.057
	(0.055)	(0.054)	(0.059)	(0.054)
Board Size	0.011	0.012	0.012	0.011
	(0.015)	(0.016)	(0.016)	(0.015)
Independent Board	0.004	0.003	0.003	0.004
	(0.003)	(0.003)	(0.003)	(0.003)
Board Diversity	0.002	0.002	0.005	0.002
	(0.003)	(0.003)	(0.003)	(0.003)
Firm fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Observations	2,235	2,233	1,842	2,235
Pseudo R-squared	0.108	0.099	0.127	0.100

Appendix G - Effect of CEO stock options on diversification (mean variables)

Table 12: Effect of CEO stock options on diversification (mean variables)

Diversifying M&A is a binary dependent variable, being one when a firm acquires at least one company per year from a different industry, and zero otherwise. The predictors relate to the previous fiscal year. Standard errors are estimated with clustering at acquirer. Coefficients of the mean variables are presented as average marginal effects, with standard errors shown in brackets. Results are presented with three decimal places. *, **, and *** measure significance at the 10%, 5%, and 1% level, respectively.

	Stock Options Variables			
	Stock Options	Percentage	3-Period Average	High Percentage
Mean Variables	(1)	(2)	(3)	(4)
Stock Options				
Variable	0.000	-0.170	0.000	-0.122
	(0.000)	(0.177)	(0.000)	(0.148)
Firm Size	0.009	0.003	0.045	0.008
	(0.062)	(0.062)	(0.069)	(0.062)
Tobin's q	0.033	0.016	0.040	0.018
	(0.034)	(0.033)	(0.036)	(0.033)
Firm Leverage	-0.481**	-0.355*	-0.646***	-0.359*
	(0.194)	(0.199)	(0.205)	(0.200)
Firm Liquidity	1.005**	0.910**	1.073**	0.888**
	(0.401)	(0.433)	(0.434)	(0.436)
Firm Performance	-0.009	-0.005	-0.011*	-0.005
	(0.006)	(0.006)	(0.006)	(0.007)
Salary	0.000		0.000	
	(0.000)		(0.000)	
Bonus	0.000		0.000	
	(0.000)		(0.000)	
Other Compensation	0.000		0.000	
	(0.000)		(0.000)	
Restricted Stock	0.000		0.000	
	(0.000)		(0.000)	
CEO Stock				
Ownership	0.019	0.017	0.028	0.018
	(0.017)	(0.018)	(0.019)	(0.018)
CEO Age	-0.006	-0.005	0.004	-0.005
	(0.006)	(0.006)	(0.006)	(0.006)
Gender	-0.234	-0.301*	-0.039	-0.303*
	(0.149)	(0.158)	(0.195)	(0.162)
CEO Tenure	0.003	0.004	-0.007	0.004
	(0.005)	(0.005)	(0.006)	(0.005)
Overconfidence	0.068	0.092	0.135	0.090
	(0.074)	(0.077)	(0.087)	(0.074)
CEO Duality	0.062	0.087	0.107	0.082
	(0.073)	(0.076)	(0.081)	(0.076)
Board Size	0.012	0.009	0.002	0.007
	(0.018)	(0.019)	(0.020)	(0.019)
Independent Board	0.005	0.005	0.003	0.005
	(0.004)	(0.004)	(0.004)	(0.004)
Board Diversity	-0.004	-0.005	-0.004	-0.005
	(0.004)	(0.004)	(0.004)	(0.004)
Firm fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Observations	1,332	1,331	1,045	1,332
Pseudo R-squared	0.076	0.062	0.109	0.062

Appendix H - Effect of CEO stock options on high premium deal (mean variables)

Table 13: Effect of CEO stock options on high premium deal (mean variables)

High premium deal is one when the acquirer pays a premium higher than 30%, and zero otherwise. All predictors were defined previously and are based on data from the previous fiscal year. Standard errors are estimated with clustering at acquirer. Coefficients of the mean variables are presented as average marginal effects, with standard errors shown in brackets. Results are presented with three decimal places. *, **, and *** measure significance at the 10%, 5%, and 1% level, respectively.

	Stock Options Variables			
	Stock Options	Percentage	3-Period Average	High Percentage
Mean Variables	(1)	(2)	(3)	(4)
Stock Options Variable	0.000	-0.560	0.000**	-0.297
	(0.000)	(0.361)	(0.000)	(0.254)
Firm Size	0.149	0.082	0.186	0.094
	(0.139)	(0.135)	(0.128)	(0.135)
Tobin's q	-0.102	-0.114	-0.100	-0.114
	(0.102)	(0.119)	(0.116)	(0.115)
Firm Leverage	-0.501	-0.707*	-0.393	-0.667*
	(0.380)	(0.398)	(0.416)	(0.379)
Firm Liquidity	-1.324	-1.217	-0.668	-1.010
	(0.850)	(0.954)	(0.966)	(0.938)
Firm Performance	0.005	-0.001	-0.001	0.001
	(0.013)	(0.015)	(0.014)	(0.014)
Salary	0.000**		0.000	
	(0.000)		(0.000)	
Bonus	0.000**		0.000	
	(0.000)		(0.000)	
Other Compensation	0.000		0.000	
	(0.000)		(0.000)	
Restricted Stock	0.000		0.000***	
	(0.000)		(0.000)	
CEO Stock Ownership	-0.015	-0.029	0.082	-0.033
	(0.058)	(0.060)	(0.064)	(0.060)
CEO Age	-0.011	-0.023**	0.003	-0.025**
	(0.012)	(0.012)	(0.013)	(0.012)
Gender	-0.187	-0.241	-0.708*	-0.221
	(0.333)	(0.278)	(0.397)	(0.275)
CEO Tenure	-0.009	-0.007	-0.007	-0.008
	(0.011)	(0.011)	(0.013)	(0.011)
Overconfidence	0.214	0.289*	0.396*	0.173
	(0.173)	(0.174)	(0.236)	(0.172)
CEO Duality	0.072	0.202	-0.105	0.116
	(0.149)	(0.153)	(0.144)	(0.140)
Board Size	-0.081***	-0.051	-0.034	-0.050
	(0.031)	(0.033)	(0.035)	(0.034)
Independent Board	-0.002	-0.001	0.005	-0.002
	(0.008)	(0.008)	(0.008)	(0.008)
Board Diversity	-0.002	0.001	-0.008	0.002
	(0.009)	(0.009)	(0.007)	(0.009)
Firm fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Observations	184	183	152	184
Pseudo R-squared	0.348	0.254	0.461	0.260

Appendix I - Robustness check: Frequent acquisition

Table 14: Robustness check: Frequent acquisition

Frequent acquirer is a binary, valued one when a firm completes at least two deals within a 5-year period, and zero otherwise. Each stock option variable was defined previously and relate to the previous fiscal year. Standard errors are estimated with clustering at acquirer. Coefficients are presented as average marginal effects, with standard errors shown in brackets. Results are presented with three decimal places. *, **, and *** measure significance at the 10%, 5%, and 1% level, respectively.

	Stock Options Variables			
	Stock Options	Percentage	3-Period Average	High Percentage
	(1)	(2)	(3)	(4)
Stock Options Variable	0.000	0.008	0.000**	0.018
	(0.000)	(0.067)	(0.000)	(0.049)
Firm Size	0.053	0.050	0.108**	0.051
	(0.043)	(0.044)	(0.054)	(0.044)
Tobin's q	-0.001	-0.001	0.016	-0.001
	(0.013)	(0.013)	(0.016)	(0.013)
Firm Leverage	-0.066	-0.069	-0.033	-0.072
	(0.079)	(0.078)	(0.088)	(0.078)
Firm Liquidity	-0.114	-0.092	-0.173	-0.101
	(0.154)	(0.152)	(0.168)	(0.152)
Firm Performance	-0.003*	-0.003*	-0.005**	-0.003*
	(0.002)	(0.002)	(0.002)	(0.002)
Salary	0.000		0.000	
	(0.000)		(0.000)	
Bonus	0.000		0.000**	
	(0.000)		(0.000)	
Other Compensation	0.000**		0.000*	
	(0.000)		(0.000)	
Restricted Stock	0.000		0.000	
	(0.000)		(0.000)	
CEO Stock Ownership	-0.007	-0.007	-0.010	-0.007
	(0.004)	(0.005)	(0.006)	(0.005)
CEO Age	0.003	0.002	0.004	0.002
	(0.003)	(0.003)	(0.003)	(0.003)
Gender	0.045	0.041	0.049	0.042
	(0.057)	(0.060)	(0.070)	(0.060)
CEO Tenure	-0.002	-0.003	-0.005*	-0.002
	(0.002)	(0.002)	(0.003)	(0.002)
Overconfidence	0.041	0.037	0.048	0.037
	(0.032)	(0.032)	(0.039)	(0.032)
CEO Duality	-0.014	-0.013	-0.026	-0.014
	(0.040)	(0.040)	(0.047)	(0.040)
Board Size	-0.013	-0.011	-0.011	-0.011
	(0.008)	(0.008)	(0.010)	(0.008)
Independent Board	0.001	0.001	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Board Diversity	-0.001	-0.001	-0.002	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Firm fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Observations	2,587	2,585	2,112	2,587
Pseudo R-squared	0.049	0.042	0.059	0.043

Table 15: Robustness check: Frequent acquisition (mean variables)

Dependent variable, frequent acquirer, is one when a firm completes at least two deals within a 5-year period, and zero otherwise. Every predictor was defined previously and correspond the previous fiscal year. Standard errors are estimated with clustering at acquirer. Coefficients of the mean variables are presented as average marginal effects, with standard errors shown in brackets. Results are presented with three decimal places. *, **, and *** measure significance at the 10%, 5%, and 1% level, respectively.

	Stock Options Variables			
	Stock Options	Percentage	3-Period Average	High Percentage
Mean Variables	(1)	(2)	(3)	(4)
Stock Options Variable	0.000	0.023	0.000	-0.113
	(0.000)	(0.138)	(0.000)	(0.106)
Firm Size	-0.048	-0.043	-0.104*	-0.042
	(0.049)	(0.047)	(0.059)	(0.047)
Tobin's q	-0.020	-0.019	-0.035	-0.016
	(0.024)	(0.022)	(0.025)	(0.023)
Firm Leverage	-0.017	-0.029	-0.043	-0.033
	(0.143)	(0.136)	(0.149)	(0.135)
Firm Liquidity	-0.140	-0.132	-0.159	-0.126
	(0.309)	(0.310)	(0.313)	(0.309)
Firm Performance	0.010**	0.010**	0.011**	0.010**
	(0.005)	(0.005)	(0.005)	(0.005)
Salary	0.000		0.000	
	(0.000)		(0.000)	
Bonus	0.000		0.000	
	(0.000)		(0.000)	
Other Compensation	0.000***		0.000*	
	(0.000)		(0.000)	
Restricted Stock	0.000		0.000	
	(0.000)		(0.000)	
CEO Stock Ownership	0.008	0.008	0.011	0.008
	(0.011)	(0.011)	(0.014)	(0.011)
CEO Age	-0.010**	-0.010**	-0.010**	-0.010**
	(0.004)	(0.004)	(0.005)	(0.004)
Gender	-0.180	-0.161	-0.216	-0.156
	(0.144)	(0.148)	(0.156)	(0.146)
CEO Tenure	0.005	0.005	0.005	0.005
	(0.004)	(0.004)	(0.004)	(0.004)
Overconfidence	-0.060	-0.061	-0.062	-0.051
	(0.056)	(0.058)	(0.066)	(0.056)
CEO Duality	-0.009	-0.019	0.015	-0.017
	(0.060)	(0.062)	(0.069)	(0.061)
Board Size	0.034**	0.034**	0.035**	0.034**
	(0.014)	(0.014)	(0.015)	(0.014)
Independent Board	0.003	0.002	0.002	0.003
	(0.003)	(0.003)	(0.003)	(0.003)
Board Diversity	0.001	0.001	0.002	0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Firm fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Observations	2,587	2,585	2,112	2,587
Pseudo R-squared	0.049	0.042	0.059	0.043