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CEO overconfidence and M&A as innovation tool

**Filipa Mariana Fontão Santos**

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Supervised by

**Miguel Augusto Gomes Sousa, PhD**

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## **Abstract**

Studies relating manager's overconfidence with mergers and acquisitions have focus on value creation and other determinants of those transactions. However, merger and acquisitions can also be used to speed up the innovation process.

The present study aims to assess if innovation impacts firm's probability on pursuing merger and acquisitions transactions and whether overconfidence plays a role on it. Furthermore, it also seeks to understand the impact of overconfidence on firm's innovation after concluded merger and acquisitions.

To accomplish this purpose, it was analysed a total of 1,234 companies between 2006 and 2016. Our analysis measures overconfidence using "holder67" proxy developed by Malmendier and Tate (2005a, 2005b), and innovation as R&D scaled on assets, published patents and citations forward.

The results support our hypothesis that having an overconfident CEO in a more innovative firm, compared to their industry peers, has a positive impact on firm's acquisitiveness levels. Furthermore, merger and acquisitions concluded 1 or 2-years prior contribute to an increase in innovation, as well as having an overconfident CEO positively impact firm's innovation intensity.

**Keyword:** Firm innovation, CEO overconfidence, merger and acquisitions

**JEL-Codes:** G32, G34, G40

## Resumo

Estudos sobre excesso de confiança do gestor em fusões e aquisições têm tido como foco a criação de valor e outros determinantes destas transações. No entanto, fusões e aquisições poderão ser usadas para acelerar o processo de inovação de uma empresa.

O presente estudo visa avaliar se a inovação tem impacto na probabilidade de uma empresa desencadear operações de fusões e aquisições e se o excesso de confiança desempenha um papel nestes processos. Além disso, procuramos compreender qual o impacto do excesso de confiança dos CEOs na inovação da empresa após a conclusão de operações de fusões e aquisições.

Para alcançar este objetivo, foi analisado um total de 1,234 empresas entre 2006 e 2016. A nossa análise mede o excesso de confiança utilizando a *proxy* holder<sup>67</sup> desenvolvida por Malmendier and Tate (2005a, 2005b) e inovação como I&D ajustados pelos ativos da empresa, patentes publicadas e citações recebidas.

Os resultados apoiam as nossas hipóteses e, deste modo, ter um CEO com excesso de confiança numa empresa mais inovadora, em comparação com os seus *peers* da indústria, tem um impacto positivo na capacidade de aquisição da empresa. Além disso, as fusões e aquisições concluídas com sucesso 1 ou 2 anos anteriormente contribuem para um aumento da inovação, como também a presença de um gestor com excesso de confiança impacta positivamente a intensidade de inovação de uma empresa.

**Palavras-chave:** Inovação, excesso de confiança do CEO, fusões e aquisições

**JEL-Codes:** G32, G34, G40

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## Chapter 1| Introduction

Research on CEO overconfidence has focused on its impact on mergers and acquisitions, managements investment decisions and cash holdings (Doukas & Petmezas, 2007; Malmendier & Tate, 2004, 2005a, 2005b, 2008). According to Malmendier and Tate (2008), the presence of overconfident CEOs in merger and acquisitions activities has a negative impact in shareholder's value, as the market reaction to merger announcement is significantly more negative (-90 basis points) than for "rational" CEOs. Even more, overconfident CEOs rely less on external resources and more on internal resources, such as cash, than "rational" CEOs (Malmendier & Tate, 2015). It would be expected that overconfident managers would become rational with experience, however learning by experience in merger and acquisitions is less likely to happen and it is harder to do (Brehmer, 1980; Doukas & Petmezas, 2007). Furthermore, Billett and Qian (2008) concluded that high-order deals exhibit more negative effects than those of first deals, which is consistent with overconfidence stemming from self-attribution bias. The lack of monitoring by the corporate governance structure leads to an increase in CEO power, which is could increase the probability of that CEO becoming overconfident (Hwang, Kim, & Kim, 2020). Also, female directors on the boards tends to attenuate CEO overconfidence (Chen, Leung, Song, & Goergen, 2019).

The puzzle of firm's hires overconfidence CEOs has been widely studied in management beliefs and corporate decisions field, however the reasons associated to those decisions are still unclear. Corporate boards may hire overconfident CEOs as they have risk tolerance (Malmendier & Tate, 2008) and their leadership actions lead to greater relationships specific investment and higher durability in relationships (Phua, Tham, & Wei, 2018). Furthermore, Hirshleifer, Low, and Teoh (2012) concluded that CEO overconfidence leads to greater innovative success for a given research and development expenditures, in more innovative industries. Our findings suggest that merger and acquisitions have a positive impact on firm's innovation 2-years after, as overconfident CEOs also present a positive impact in firms' innovation. Additionally, more innovative firms, or firms with higher innovation intensity, and with an overconfident CEO are less likely to conduct a merger and acquisitions, compared to its industry competition.

Contrary to Hirshleifer et al. (2012), we include the impact of innovation (measured as patent count, patent citation and R&D expenditures) after merger and acquisitions and firm's performance afterwards. Furthermore, their research only considers US patents during the

period of 1993-2003 and divides firm's industry into 2 classes: innovative and noninnovative industries., while we investigate the **impact of CEO overconfidence in firm's innovation after merger and acquisitions transactions**. This will contribute to existing knowledge in overconfident CEOs in mergers and acquisitions by study the role of more innovation firms in such transactions. Furthermore, it will be studied the impact of CEO overconfidence on innovation and firm's performance with a more recent databased, while including Worldwide patents. To the best of our knowledge, this is the first study on this topic.

The main question this study will answer is:

*Do firms with overconfident CEOs become more innovative after a merger and acquisitions?*

Using a database that incorporate American and European companies, our results show that overconfidence plays an important role on firm's tendency to pursue merger and acquisitions, increasing firm's acquisitiveness levels. Additionally, overconfidence and merger and acquisitions impact positively firm's innovation.

After this introduction, Chapter 2 presents the key literature on the following subjects: overconfidence, innovation and merger and acquisitions; and then, it will be presented our hypothesis developed. After, Chapter 3 presents the methodology used to measure overconfidence and innovation. Then, Chapter 4 presents our data sample, statistical results, and model specifications, followed by Chapter 5, which will present the results from our models. Finally, Chapter 6 will present the main conclusions arrived from our study.

## **Chapter 2 | Theoretical background**

Merger and acquisition (M&A) refer to transactions involving two or more entities where there is a transfer of ownership between the companies involved. Some authors frequently use the terms “takeover”, “merger” and “acquisition” as synonymously, even though there are clear differences in the economic consequences of a takeover and a merger. While a “merger” is seen as a combination of two or more companies with each other to create a “new” legal entity, the terms “takeover” and “acquisition” apply when the acquiring company seeks to have more than 50% of ownership in the targets (Singh, 1971).

Several academic studies have explored the quality of M&A transactions by measuring the firm’s performance before and after the deal takes place. The determining factors for a successful deal are not completely understood by academics. Even more, not all mergers and acquisitions are successful (Loughran & Vih, 1997), which raises the question of why such transactions take place. Empirical studies on merger and acquisitions show that the market reacts more negatively when the CEO is overconfident, particularly for acquisitive firms. However, the reasons why acquisitive overconfident CEOs undertake wealth-destroying transactions are unclear.

The present chapter is divided in 3 sub-chapters. Firstly, it will be introduced the main concepts associated to overconfidence, followed by the relationship between overconfident and innovation. Finally, it will be presented our hypothesis.

### **2.1 | The concept of overconfidence and its applications**

Agency theory was first developed by Jensen and Meckling (1976) which described the relationship between the principals (shareholders) and the agents (managers). According to this theory, managers philosophy is of short-term and cost control whether shareholders look to their company’s performance in the long-term. Therefore, managers may not necessarily act in the best interest of shareholders, as they are opportunistic and self-interested, failing to meet shareholders’ interests. Shareholders must incur in costs to monitoring and bonding with managers, which are named agency costs.

Furthermore, some managers are not rational and make systematic mistakes, which markets do not fully correct, such as overinvestment and excessive risk raking.

### 2.1.1 | Overconfidence definitions

Overconfidence is “perhaps the most robust finding in the psychology of judgment” (De Bondt & Thaler, 1995, p. 6). Many authors give different definitions for the term overconfidence. Psychologists suggest that individuals are more overconfident to those outcomes which they believe are under their control and to which they are highly committed, while being unreasonably optimistic regarding their futures (Weinstein, 1980; Weinstein & Klein, 1995). Other authors define overconfidence as an excessive precision in individual’s beliefs (Ben-David, Graham, & Harvey, 2007; Moore & Healy, 2008). However, overconfidence can also be described as a human attribute that leads individuals to have a subjective confidence in a judgment exceed its target accuracy (Klayman, Soll, Gonzalez-Vallejo, & Barlas, 1999).

There are three distinct ways from which the literature defines overconfidence: (1) overestimation of future outcomes, (2) overplacement of one’s performance relative to others, and (3) excessive precision in one’s beliefs. Moore & Healy (2008) showed that overprecision is more persistent than the other two types of overconfidence’s. The authors found evidence which enduring that, on difficult task, individuals tend to overestimate their performance, however they mistakenly see themselves as worse than others; on easy tasks, individuals tend to underestimate their actual performance, while believing they are better than others.

There is an ambiguity regarding the term’s “optimism” and “overconfidence”, as they are both often used as replaces. Ben-David et al. (2007) separate the concept of overconfidence from optimism by defining it as “a general miscalibration in beliefs”. Overestimation of future outcomes is sometimes mention as optimism rather than overconfidence, while underestimation of confidence intervals is mention as overconfidence (Malmendier & Tate, 2008). Gervais, Heaton, and Odean (2003) argue that overconfidence implies both certainty and optimism, defining optimism as the belief that favourable future events are more likely to occur, while overconfidence is the perception that private information is more trustworthy and more accurate that what really is.

Roll (1986) formalized the “hubris hypothesis”, linking takeover auctions to the winner’s curse. His hypothesis states that decision makers in acquiring firms pay too much for their targets, showing that hubris helps explaining why managers pursue takeovers with no gains for the company. Similarly, Malmendier and Tate (2008, p. 1) sustain that overconfidence CEOs “overestimate the returns they generate internally and believe outside investors undervalue their companies”. The authors propose that overconfidence managers overvalue

their ability to create value and their leadership impact, leading to an overestimation of synergies between their company and a potential target (Malmendier & Tate, 2004).

### 2.1.2 | Self-attribution bias

“Self-attribution bias” is an important term related to overconfidence. Doukas and Petmezas (2007) found evidence that suggests managerial overconfidence stems from self-attribution. The authors found that higher-order acquisitions have lower wealth effects than low-order acquisitions<sup>1</sup>. This suggests that managers overrate their initial success by becoming overconfidence and engaging in more merger and acquisitions deals (Billett & Qian, 2008; Doukas & Petmezas, 2007).

Individuals tend to be unrealistically optimistic about the future. They will focus on factors which improves their own odds of getting the outcome they desire, falling to realize that other individuals may have the same factors to achieve that same outcome. The self-attribution bias occurs when there is illusion of control, which is considered to be very strong for overconfident managers as they believe the outcome of future mergers are under their control. In “highly committed mergers” this effect is even more sharpened, even more if CEO compensation is correlated with firm’s share price (Weinstein, 1980; Weinstein & Klein, 1995). Excess of optimism about future prospects in merger and acquisitions transactions can occur when illusion of control exists, creating a potential downside and an underestimated probability of failure, which can be considered as an overconfidence case (Doukas & Petmezas, 2007; Langer, 1975; Langer & Roth, 1975; March & Shapira, 1987).

CEO may believe that they have more knowledge and experience than others due to their background of successful deals, reinforcing their tendency to be overconfident (Doukas & Petmezas, 2007; Weinstein, 1980). It is expected that irrational agents would become rational by having experience, however investment decisions are less frequent from learning by experience and its outcomes are delayed. Thus, in merger and acquisitions learning by experience is less likely to happen and harder to do, making the odds of failure deals higher (Brehmer, 1980; Doukas & Petmezas, 2007).

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<sup>1</sup> Higher-order acquisitions correspond to five or more deals within a three-year period. Lower-order acquisitions correspond to first deals achieved (Doukas & Petmezas, 2007)

### 2.1.3 | Overinvestment and excessive risk taking

Existing literature shows evidence regarding overinvestment and overconfidence relationship. The tendency for overconfident managers to overestimate their investment projects returns are linked to common distortions in corporate investment. Indeed, overconfident CEOs may invest in investment projects with negative net present value, due to their overoptimism, leading to overinvestment (Heaton, 2002). Furthermore, Malmendier and Tate (2005a, 2005b) studied the investment decisions of overconfident managers. Their study shown that overconfident managers overinvest when having excessive internal resources, preventing high dependency on external financing. Moreover, overconfidence CEOs are associated to overestimating their company's value, as they believe that outside investors are undervaluing their company's value. Consequently, overconfident CEOs tend to be reluctant to appeal for external financing, and thus overlook positive investment opportunities, such as value creating merger and acquisitions. However, when there are abundant internal resources, such issue is not raised and overconfident CEOs are more likely to overinvest.

An 'outcome history'<sup>2</sup> can act as a signal for managers to overestimate their capabilities while increasing their risk-taking behaviour. CEOs which succeeded in recent risky activities will view similar ones as less risky and they will engage more likely in such activities in the future, even without that favourable performance. Therefore, prior to those successful risk-related actions, managers will remain on pursuing the same risks (Sitkin and Weingart 1995). Excessive risk taking on overconfident CEOs is an argument supported by many authors, namely Gervais et al (2011). These authors have shown that overconfident managers embrace highly convex compensation which causes them to pursue excessive risk.

In the same way, as overconfident managers perceive that their company is being undervalued by outside investors, they will turn to external financing to repurchase their company's shares. This will directly affect the company's capital structure, and therefore, overconfidence and excessive leverage taking on managers can be related (Gervais et al., 2011, Heaton, 2002).

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<sup>2</sup> Outcome history is defined as *'the degree to which the decision maker believes that previous risk-related decisions have resulted in successful or unsuccessful outcomes'* (Sitkin and Weingart, 1995, p.1576)

#### 2.1.4 | Positive dimensions of overconfidence

Formal authority is different from leaderships which implies voluntary actions from stakeholders. In psychology literature, there are two opposing views on overconfidence, which can be a positive and a negative trade in individuals. Puri and Robinson (2007) suggest that many of the negative traits linked to behavioural biases may be only visible to individuals with extreme bias, while moderated behavioural biases, such as overconfidence, self-attribution bias or even optimism, may be linked with seemingly reasonable decision-making. This implies that certain levels of behavioural biases are not negative trades in individuals. Phua et al. (2018) hypothesize that corporate boards hire overconfident CEOs for their vision and leadership talent. Their study suggests that supplier commitment towards the company represent valuable leadership outcomes since suppliers are more likely to engage in a relationship-specific product when the other CEO is overconfident. In the same line, Gervais et al. (2003) argue that moderate levels of overconfidence align managers decisions with shareholders' interests. However, the authors disagree on compensating managers for their overconfidence stating that this compensation is a wealth transference from shareholders to managers.

Overconfident CEOs undertake riskier projects and invest heavily in innovative projects. However, the effects of overconfidence on the selection of project may derive from overestimation of expected cash flows or underestimation of risk. Furthermore, "rational managers" may prefer more trustfully projects than those with higher risk but more promising innovative opportunities. In fact, firms may prefer a degree of overconfidence if managers are pursuing innovation. Therefore, by accepting riskier projects, overconfident managers can achieve higher innovative productivity (Hirshleifer et al., 2012).

The literature in managerial beliefs is still trying to explain why firms hire overconfident CEOs and give them margin to pursue investment and financing decisions according to their beliefs (Ben-David et al., 2007; Malmendier & Tate, 2005a, 2005b, 2008). In order to explain this puzzle, Hirshleifer et al. (2012) study the relationship between overconfident CEO and the pursue for innovation in firms. The authors found that overconfident managers achieve greater innovation outputs in innovative industries, and thus presenting with another explanation (and a positive dimension) for companies to hire overconfident CEOs.

We hypothesis that overconfident CEOs will be specially enthusiasm on risky and challenging projects due to their risk-taking profile. As, overconfident CEOs tend to accept greater risk, we will study the effect of overconfidence on project selection and the

persecution for more innovative projects which could derive from overestimation of the expected cash-flows or underestimation of the associated risk.

## 2.2 | Evidence on merger and acquisitions

Merger and acquisitions are strategies for corporate restructuring and control. There are many reasons to engage in such transaction, however one of the reasons is that mergers and acquisitions are used for fast growth; as mechanism for capital market discipline; improving management efficiency and maximizing profits and public welfare (Piesse, Lee, Lin, & Kuo, 2013). Also, M&A allows firms to access competences and valuable human capital indwelling in other firms, a reason which has been highlighted in recent years (Kumar, Nagarajan, & Schlingemann, 2020; Ranft & Lord, 2002).

In the last few decades, a substantial amount of literature has investigated whether M&A create or destroy value for the shareholders of the firms involved. Most authors conclude that such transactions tend to be wealth-destroying, or at least wealth-neutral, for shareholders from the bidder firm, whereas they tend to be wealth-increasing from the target firms' shareholders (Sudarsanam & Sorwar, 2010).

*“Thus, the net effect of overconfidence on merger frequency is ambiguous. A positive net effect would indicate that overconfidence is an important explanation of merger activity in practice but is not a necessary implication of overconfidence”.*

*Malmendier and Tate (2008, p. 22)*

Many literature studies have shown the relationship between managers and shareholders among merger and acquisitions transactions. For instance, Malmendier and Tate (2008) studied the relationship between CEO overconfidence and their investment decisions in merger and acquisitions. The authors found evidence that CEOs are willing to invest in their companies as they believe they are acting in the shareholder's best interest, which leads to distortions in corporate investment as overconfident managers tend to overinvest when having abundant internal funds. CEOs overestimate the return of their company's projects, leading to an excess of confidence which causes overpayment of the target and wealth-destroying transactions, while perceiving outside finance to be over-priced (Malmendier & Tate, 2008).

There is evidence showing that an overconfident CEOs will more likely pursue merger and acquisitions transactions. The effect is stronger in diversified mergers which do not require external funds. “Rational bidders” evidence higher announcement returns than overconfident bidders and better long-term performance (Doukas & Petmezas, 2007; Malmendier & Tate, 2004, 2005a, 2005b, 2008). When analysing the relationship between overconfidence and the likelihood in failed M&A’s, Paters and Dijk (2017) did not found any evidence.

There is a correlation between CEO overconfidence and dividend payment which shows that overconfident CEO tend to pay less dividends and rely on less equity-based finance than non-overconfidence CEOs. This implies that firms with overconfidence CEOs rely more on internal resources, such as cash, and less on external sources. Additionally, as overconfident CEOs tend to overestimate their company’s value, it would be expected that overconfident CEOs compensation would be linked to share price. However, less amount of company stock is incorporated in CEOs compensation when they are seen as overconfident (Malmendier & Tate, 2015).

Recent literature has focus on the impact of female participation on the board of directors. There is evidence showing that female directors are linked to less aggressive investment decisions, better acquisition decisions and improvement of the firm’s financial performance in industries where there is a high prevalence of overconfidence. Therefore, participation of female directs on boards tends to attenuate CEOs overconfidence as there is a lower probability of those CEOs to hold deep-in-the-money options<sup>3</sup> (Chen et al., 2019). CEO power<sup>4</sup> over the board of directors of its firm could increase the probability of that CEO being overconfidence, implying that *experiencing power could lead to overconfidence decision-making* (Hwang et al., 2020, p. 26). Power-driven overconfident CEOs tend complete more acquisition, diversifying mergers and pay for it with non-cash resources. Therefore, a board of directors which does not limit and monitor the power of a CEO, might enable CEOs to develop overconfidence. The existence of duality roles (chairman and CEO) and inside directors could also mitigate the power of an overconfident CEO, which, contrarily, could increase when the current CEO is also the company’s founder (Hwang et al., 2020).

When analysing the impact of overconfidence CEO in firm’s innovation, Hirshleifer et al. (2012) shown that overconfident CEOs secure greater innovation in more innovative

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<sup>3</sup> Proxy for overconfidence which will be explain further in this study.

<sup>4</sup> CEO power was measured “as an index variable, consisting of six distinct components – CEO pay slice, duality, tenure, the number of insider directors, and a founding CEO” (Hwang et al., 2020, p. 24)

industries, because overconfident managers invest more in R&D than “rational” managers and have a higher number of patent applications and patent citations in their firm. This study looks to understand the impact of overconfident CEOs in firm’s innovation after merger and acquisitions. It is believed that this study is the first on this particular topic.

## 2.3 | Hypothesis development

Hirshleifer et al. (2012) studied the relationship between overconfident CEOs and firm’s innovation, dividing their sample in innovative industries and noninnovative industries. The present study will follow a similar approach from the authors while including an important variable in the firm’s investment strategies – M&A deals. Therefore, in this first hypothesis it will be analysed the relationship between M&A deals<sup>5</sup> and the level of innovation of a certain company, dividing firms in innovative and noninnovative, within the same industry:

**Hypothesis 1.1 | “Innovative firms, within its industry, are more likely to conduct merger and acquisition deals than its rivalry (noninnovative) firms.”**

Overconfident CEOs are more likely to increase firm’s innovation, when its firm is more innovative, than its peers in the industry, than non-overconfident CEOs. Also, overconfident managers are expected to pursue more riskier projects and thus be susceptible to higher innovation intensity. Thus, arising the following hypothesis:

**Hypothesis 1.2 | “Firms with higher innovation intensity are more likely to conduct merger and acquisitions then firms with lower innovation intensity.”**

Innovation and M&A are investment strategies used by managers to growth their companies. Studies have focus on the relationship between manager and innovation (Hirshleifer et al., 2012) and managers and M&A deals (Malmendier & Tate, 2004, 2005a, 2008), however it was not found any research to date that seeks to understand the relationship between managers, M&A and innovation. As such, the second hypothesis looks to understand if overconfident CEOs tend to conduct more M&A deals, when their firm is considered as more innovative, within its industry . The hypothesis was stated as follow:

**Hypothesis 2.1 | “Overconfident CEOs in innovative firms, within its industry, tend to conduct more merger and acquisitions deals than non-overconfident CEOs.”**

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<sup>5</sup> For simplification, it was assumed all “concluded” M&A transactions on Capital IQ between the analysed period and firms selected in the sample.

Merger and acquisitions are seen as growth strategies for companies. Therefore, companies with high innovation intensity could pursue merger and acquisitions as an additional growth strategy. Consequently, the same rational from the previous hypothesis was applied:

**Hypothesis 2.2 | “Overconfident CEOs in firms with higher innovation intensity tend to conduct more merger and acquisitions than non-overconfident CEOs.”**

Finally, it was developed a hypothesis to test the relationship between overconfident CEOs and firm’s innovation after merger and acquisition, which is the aim of the present study. The hypothesis was stated as follow:

**Hypothesis 3 | “Overconfident CEOs are more likely to increase firm’s innovation after merger and acquisitions deals than non-overconfident CEOs.”**

## Chapter 3 | Methodology

In this study, it will be tested how CEO overconfident affects firm's tendency towards innovation after merger and acquisitions. It will be developed different hypothesis considering firm's innovation, CEO overconfidence, and different controlling variables following the approach of different authors.

### 3.1 | Measuring CEO overconfidence

The proxies for overconfidence developed by Malmendier and Tate (2004, 2005a, 2005b, 2008), which are considered to be the most important and influential measures of overconfidence, will be used in this study. The authors came up with three proxies, all of them assuming that CEOs are voluntarily expose to firm-specific risk by holding firm's stocks. In fact, a large proportion of CEOs compensation tends to be equity-based (Frydman & Jenter, 2010). Executive options are non-tradeable, and its sale can be restricted by the firm, to maximize incentive effects of the stock options. Furthermore, CEOs cannot, legally, hedge the risk of their holding by short selling them. Consequently, a negative outcome in the firm will negatively impact their personal portfolio, leaving CEOs highly expose to the idiosyncratic risk of their company.

The optimal portfolio for a CEO depends on their individual wealth, degree of risk aversion and diversification. Therefore, CEOs must choose between the value of holding stock options against the cost of under diversification. Theoretically, investors which are risk-averse and under diversify, exercise their options early if the stock price is sufficiently high (B. J. Hall & Murphy, 2002). In the same way, under diversified CEOs, will minimize their holdings on firm's stock to remove the idiosyncratic risk. However, a subset of CEOs repeatedly overestimates the future returns of their investment projects. They believe the stock price of their firm is undervalued by the market; thus, it will continue to growth more than what is objectively expected, under their leadership. Consequently, overconfidence causes CEOs to postpone the decision to exercise firm's stock options, fail to exercise highly in-the-money vest options, or even to buy additional stock to benefit from expected future gains personally (Malmendier & Tate, 2005a, 2008).

The first proxy is "*Holder 67*", and it focus on the exercise decision prior to expiration. A CEO is considered as overconfidence if it fails to exercise options after the vesting period<sup>6</sup>,

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<sup>6</sup> The vesting period refers to the period that must pass before an employee (in this case, the CEO) completely owns the offered stock options or shares of the firm. Usually, it is the working period that employee

despite the option being 67%, or more, in the money. The second proxy is “*Longholder*”, which considers the expiration date of the option rather than the end of the vesting period. According to this proxy, a CEO is overconfidence when holding an option until the expiration date, despite being 40%, or more, in the money in the beginning of the expiration year. The final proxy is “*Net Buyer*”, which uses the habitual acquisition of company stock, implying that a CEO is overconfident when there is an exploit tendency in his/her behaviour to purchase additional shares of the company, despite already having a high exposure to the company’s risk (Malmendier & Tate, 2005a, 2005b, 2008).

For this research, it will be used the methodology developed by Hirshleifer et al. (2012) and by Malmendier and Tate (2005a, 2005b) to construct a proxy for overconfidence based on the “*Holder 67*”, as dummy variables. The “*Holder 67*” proxy used by Malmendier and Tate (2004, 2005a, 2005b, 2008) rely on detailed data on option holdings and exercise prices for each CEO option grant, which is unavailable to the public. To adjust the proxies developed by Malmendier and Tate, Hirshleifer et al. (2012) calculated the average moneyness of CEOs option portfolio of each year, using the method developed by (Campbell, Gallmeyer, Johnson, Rutherford, & Stanley, 2011) as follow:

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

Firstly, it was computed the average realizable value per option, which is given by dividing the total realizable value of the options<sup>7</sup> by the number of options held by the CEO<sup>8</sup>. Then, we computed the estimated strike price as the difference between the stock price<sup>9</sup> and the average realizable value per option. Finally, the average moneyness of the options was computed as the stock price divided by the estimated strike price minus one.

We included only vested options held by the CEO in these calculations, as we are only interested in options which the CEO can exercise. Therefore, if the CEO postpones the exercise of vested options at least two times and the average moneyness of options is at least

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has to work for the firm in order to get full ownership of the stock option or shares of the firm (Information retrieved on March 3<sup>rd</sup>, 2021, from <https://smartasset.com/financial-advisor/vesting-period>)

<sup>7</sup> OPT\_UNEX\_EXER\_EST\_VAL represents in ExecuComp the estimated aggregate value of the in-the-money vested options at fiscal year-end.

<sup>8</sup> OPT\_UNEX\_EXER\_NUM represents in ExecuComp the aggregate number of unexercised options held by the executive at fiscal year-end that were vested.

<sup>9</sup> PRCCF represents in ExecuComp the close price of the firm’s stock for the fiscal year.

67%, the variable *holder67* will be value 1, and 0 otherwise. When the CEO is identified as overconfident by this measure, he/she will remain with this classification for the rest of the sample. This treatment is consistent with the idea that overconfident is a persistent trait (Hirshleifer et al., 2012).

Even though this method is less precise, Malmendier, Tate, and Yan (2011) have showed that this method still gives significant results after controlling for past stock return performance since high returns increase the moneyness of options. By controlling for performance controls, this method can generate similar results to those achieved by Malmendier and Tate (2005a, 2005b, 2008).

The “*Net Buyer*” proxy was not included as, according to Malmendier and Tate (2005a), some of the increase in stockholdings may be caused by new stock grants. The “*Longholder*” proxy was also not included due to lack of public available information

### 3.2 | Measuring firm’s innovation

An overconfident CEO is associated to greater innovation in innovative industries (Hirshleifer et al., 2012) and is more likely to diversify into other industries (Malmendier & Tate, 2008), which might be more innovative or noninnovative. The present study differentiates from previous studies in terms of dataset since it will be used worldwide patents from both European and American companies, while previous studies have focus only on American patents.

In this study, innovation will be measured following the approach of Hirshleifer et al. (2012). Innovation input will be measure with R&D scaled book assets. Periods of month-years where there is missing information on R&D, it will be valued zero. Another measure for innovation will be based on patent counts. Patent data was extracted from PatBase, which accounts for millions of patent grants until recent years from worldwide patents offices<sup>10</sup>. The same patent can be published in multiple patent offices worldwide to share that information to the market, however few offices can truly grant patent protection. It will be included in the database the number of publishing patents<sup>11</sup>, which were eventually granted<sup>12</sup>

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<sup>10</sup> PatBase includes data from patents offices such as the European Patent Office (EPO), the World Intellectual Property Organisation (WIPO) and the United States Patent and Trademark Office (USPTO).

<sup>11</sup> Number of families that have published per year, and per assignee

<sup>12</sup> It was not considered if a patent granted during the beginning of the sample expired at the end of the sample, since the average duration of American patents is 20 years, and 14 years for European patents.

from 2006 until 2016<sup>13</sup>, and who's assigned has available public information on CEO stock options.

Patents differ among their technology and economic importance, which might not be captured perfectly in patent counts (Griliches, Pakes, & Hall, 1986). As patents continuously receive citations from other patents after they have been granted, it can be inferred that the social value created by innovation is related to patent citations (B. Hall, Jaffe, & Trajtenberg, 2005; Trajtenberg, 1990). According to B. Hall, Jaffe, and Trajtenberg (2000); B. Hall et al. (2005), patent citations are linked to the "quality" of that patent, which can be associated to the firm's value. We hypothesize that citations also represent markets' perception of firm's innovation quality. Therefore, besides R&D to book assets and patent granted as a measure for innovation, we will also include the number of forward citations<sup>14</sup> ultimately received by patents applied (the results are similar when excluding self-citations<sup>15</sup>), for each year in the sample.

The data collected went by a matching process to identify patent's assignee within the same corporate tree, since patents can be associated to the parent's firm or its subsidiaries. To construct our database, a large effort was executed to match the names of patenting organizations to the firm's names on the ExecuComp database<sup>16</sup>. Citations are associated to a specific patent and not to a firm and, therefore, patents which belong to a firm currently out of existence may continue to receive citations for many years after the firm is bankrupt. Nevertheless, the survivorship bias is minimal<sup>17</sup> (Hirshleifer et al., 2012). As citations can be received during many years after patent creation, patents which are created near the end time period of our sample have less time to accumulate citations, which raises time truncation issues. Our model looks to patent count and patent citation intensity, and therefore citations received outside our window period will not be relevant in this analysis<sup>18</sup>.

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<sup>13</sup> According to Hirshleifer et al. (2012), there is an average gap of 2 years between patent application and patent granted. In their study, the latest year in the database used (NBER Patent) was 2003, because the NBER patent database only included process information on patent and patents citation until 2006. In this study, the data collected in PatBase does not raise such problem, since their database is being constantly updated and it includes patents information regarding worldwide patent offices before 2000 and until 2021.

<sup>14</sup> Number of forward citations per year and per assignee.

<sup>15</sup> According to Hirshleifer et al. (2012) study.

<sup>16</sup> Companies with no patent information for a particular year on PatBase were included in the sample and valued 0 in those years.

<sup>17</sup> Patents are attributed and counted to the applying firm at the publication date and that information doesn't change even if that firm is acquired or goes bankrupt.

<sup>18</sup> Patents can suffer from different citation intensities, for instance a patent which receives 10 citations for 10 years has a lower intensity than a patent which receives 9 citations in 1 year. However, such issue is not raised in this study.

Another problem associated to patents is their multiple ID's. Patents receive different ID's according to the office where it is being published; the process stage; and whether it was amended. An assignee that wants to protect its innovation in multiple zones of the globe would publish its patent in different patent offices, and thus a single patent would be associated to multiple ID's. PatBase links these same patents, which represent the same innovation, into a family of patents, eliminating these duplications. Family of patents which publish in multiple years is considered as an improvement in the quality of that innovation as companies would want to increase protection on patents of quality.

To test the first set of hypotheses, firms will be divided into 2 classes: innovative firms, if the number of citations per firm was greater than the average number of citations of the firm's industry during that year<sup>19</sup>; and noninnovative firm, if that number was lower than the industry average. The variable INDUSTRYCIT will be valued 1 when the company is more innovative, compared to its industry peers, and 0 otherwise. The same rationale was applied to the number of patents (INDUSTRYPAT) and R&A scaled on assets (INDUSTRYRD).

Finally, innovation intensity reflects the growth rate of patents and citations according to firm's size. To test the second set of hypotheses, it was computed innovation intensity assuming innovation as a measure of investment on R&D (INTRD, INTRD1 and INTRD2), number of patents (INTPATENTS, INTPATENTS1 and INTPATENTS2) and patents citations (INTCITATIONS, INTCITATIONS1 and INTCITATIONS2), forward by t years (where t will be valued 0, 1 and 2)<sup>20</sup>. The variables were computed as

$$IntensityInnov_{i,n} = \frac{\log(1+Innov_{i,n+t})}{\log(Sales_{i,n})} \quad (2)$$

### 3.3 | Measuring other variables

The "holder 67" proxy can be affected by past stock performance, since high stock returns increase the moneyness of options held by CEOs. Therefore, to control for past stock performance it was computed the annual return on stock<sup>21</sup> considering the closing price of the firm's stock for the fiscal year (RETURN). To control for CEO tenure and incentives, it was included, following (Malmendier & Tate, 2005a, 2005b, 2008) and Hirshleifer et al.

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<sup>19</sup> To compute the median number of patents/citations per firm across the firm's industry, we excluded all firms where the average number of citations, between 2004-2018, was lower than 0,5, since 467 firms in the sample had none or less than 7 forward citations during the period of 2006-2018.

<sup>20</sup> Company-years combinations with missing data on sales were valued zero.

<sup>21</sup> Returns on stocks are computed using log of prices,  $r_i = \log\left(\frac{price_i}{price_{i-1}}\right)$  at fiscal year-end.

(2012) studies, CEO age (AGE), gender (GENDER<sup>22</sup>), stock ownership<sup>23</sup> (STOCKOWN), compensation (COMPENSATION), tenure (TENURE), tobin-q (TOBIN-Q), cash holdings on assets (CASHHOLDINGS) and firm's size (SIZE) as control variables.

CEOs with higher stock ownership will have greater incentives to make decisions which maximize shareholder's wealth as both their interest are aligned (Jensen & Meckling, 1976). Therefore, the smaller the percentage of fixed compensation<sup>24</sup> on total compensation<sup>25</sup>, the higher will be CEOs incentives to maximize shareholders' wealth, and the more overconfident the CEO will be (Berger, Ofek, & Yermack, 1997). CEO compensation (COMPENSATION) is defined as the ratio between fixed compensation and total compensation, while incentives to increase the firm's stock price will be measured by CEO stock ownership (STOCKOWN), which is defined as the CEO percentage of firm's stock. The CEO tenure (TENURE) is the number of years during which the CEO was in the firm's office. The TOBIN-Q ratio will be measured as the ratio of market value of assets to book value of assets, where the market value of assets is defined as the book value of assets plus market value of equity minus book value of equity. The market value of equity will be defined as the product of the number of outstanding shares and the share price, while the book value of equity will be defined as the common equity on the firms' balance sheet (Malmendier & Tate, 2005a, 2005b, 2008). The CASHHOLDINGS variable is defined as the percentage of cash holdings<sup>26</sup> on total assets, as higher cash holdings are associated with less financial constraints. Finally, firm's size (SIZE) will follow the approach of Hirshleifer et al. (2012) by computing firm size as the logarithm of sales.

Considering recent studies on corporate governance, and the presence of female directors on corporate boards, it was included some variables to test its importance on the subject on study. As such, we included three dummy variables: Duality, Inside Directors and Founder CEO. If CEOs also sits in the board as a chairman, then they hold more power in the firm. As such, the duality dummy (DUALITY) will assume 1 if the existence of CEO-chair duality is present, and 0 otherwise. Also, a higher proportion of inside directors is

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<sup>22</sup> If the CEO is male, the variable will be value 1, otherwise it will be valued 0. When there is no information on the gender of the CEO, in a given year, the variable will be classified as "NA".

<sup>23</sup> SHROWN\_TOT\_PCT represents in ExecuComp the percentage of the total number of shares outstanding owned by the executive, if greater than 1%.

<sup>24</sup> In this study, fixed compensation is defined as salary.

SALARY represents in ExecuComp the dollar value of the base salary earned by the executive, during the fiscal year.

<sup>25</sup> TDC2 represents in ExecuComp the total compensations of the executive, including salary, bonus, non-equity incentives, fair value of options granted, stock awards, among other type of compensation.

<sup>26</sup> Cash holdings were defined as the sum of "Cash and Equivalents" and "Short Term Investments", on Capital IQ database.

associated to higher CEO power. Thus, the inside directors dummy (INSIDE) assumes the value of 1 if the proportion of inside directors of the firm is above industry median in each year, and 0 otherwise. As founder CEOs tend to be associated to a higher premium when compared to professional CEOs, it was included the founder CEO dummy (FOUNDER), which will be valued 1 if the CEO is also the founder of the firm, and 0 otherwise.

Also, considering the study of Chen et al. (2019), it will be considered the presence of female directors in the board, as they are linked to less aggressive investment decisions, better acquisition decisions and improvement of the firm's financial performance in industries where there is a high prevalence of overconfidence. Therefore, the variable for female directors (FEMALE) will count the number of female directors/executives on the board.

To control for deals characteristics, it be included three variables: DIVERSIFY, CROSSBORDER and PAYMENT. The first variable will include the number of diversified transactions; the second variable will include the number of cross-border deals; and the third, the number of all-cash offers, for each company-year combination.

Firm's characteristics, it will be included the following variables: GROWTH1Y<sup>27</sup>, EPS (earnings per share, excluding extraordinary items and discontinued operations), ROA (return on assets) and ROE (return on equity). To control for the abundance of internal resources, it was included the variable KZINDEX. Some studies (Baker, Stein, & Wurgler, 2003; Lamont, Polk, & Saa-Requejo, 2001; Malmendier & Tate, 2004) have used the estimates made by Kaplan and Zingales (1997) to construct an index of financial constraints (or equity dependence). Kaplan-Zingales index was created using information from firm's annual reports and direct information from executives. Then, the authors estimated a regression including five accounting ratios, namely cash flow to total capital, Q, debt to total capital (or leverage), dividends to total capital, and cash holdings to capital. Malmendier and Tate (2008) used the Kaplan-Zingales index to measure companies' reliance to use external financing. The index score is defined as:

$$\begin{aligned}
 KZindex_{i,t} = & -1,001909 * \frac{CF_{i,t}}{K_{i,t-1}} + 0,2826389 * Q_{i,t} + 3,139193 * \frac{Debt_{it}}{T.Capital_{i,t}} \\
 & - 39,3678 * \frac{Dividend_{i,t}}{K_{i,t-1}} - 1,314759 * \frac{Cash_{i,t}}{K_{i,t-1}}
 \end{aligned} \tag{3}$$

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<sup>27</sup> SALECHG represents in ExecuComp the year-to-year percentage change in sales

where,

$CF_{i,t}$  is the cash flow of company  $i$  in the year  $t$ . The cash flow is defined as earnings before extraordinary items and discontinued operations<sup>28</sup>, plus total depreciation and amortization.

$K_{i,t-1}$  (total capital) is the net property, plant, and equipment valued the beginning of the year  $t$  (lagged by one year).

$Q_{i,t}$  is the tobin-Q of the company  $i$  in the year  $t$ .

$Debt_{i,t}$  is the level of total debt of the company  $i$  in the year  $t$ .

$T.Capital_{i,t}$  is the total capital used to finance company  $i$  activity during the year  $t$ .

$Dividends_{i,t}$  is the number of dividends paid by the company  $i$  in the year  $t$ .

$Cash_{i,t}$  is the balance sheet amount of cash of company  $i$  in the year  $t$ .

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<sup>28</sup> The variable was computed by multiplying the earnings per share (excluding extraordinary items and discontinued operations), from ExecuComp – EPSEX -, and the number of outstanding shares, as reported on the Balance Sheet, from Capital IQ.

## Chapter 4 | Data & model specifications

The chapter starts with data collection, followed by models' specifications from the developed hypothesis.

### 4.1 | Data collection

The datasets used were based on information collected from Capital IQ, ExecuComp, and PatBase. The Capital IQ contains information regarding merger and acquisition transactions from 1990 up to now and accounting data from the involved companies. ExecuComp has available executive compensation from 1992 up to now covering S&P 1000 firms. Finally, the PatBase databased will be used to collect data on the number of patents and patents citations.

We join three large and different datasets which were linked by an elaborate matching process: the first dataset included firm's and CEO data extract from ExecuComp; the second dataset included patents granted by PatBase between 2006 to 2016, including patent citations; and lastly, M&A transactions and firm's accounting data were extracted from Capital IQ. The matching process of these datasets, made by firm's name, proved to be an intense work and associated to a great time of our research efforts. To improve time on this matching process in our research, it was only included American and European companies with CEO data available, which have conducted M&A transactions between 2006 to 2016. Furthermore, missing data on the studied variables were excluded, in line with the research of Hirshleifer et al. (2012).

The first database to be constructed was the ExecuComp which included 1,234 companies with data on CEO number of stocks owned in the US and European countries<sup>29</sup>. Due to time management, it was only considered those companies, as information regarding patents was very time consuming. During the period under analysis, using the identifiers Company name, according to ExecuComp, and Year, it was observed a total of 12,767 observations for *Holder67*<sup>30</sup> proxy between 2006 to 2016.

The second dataset was constructed by aggregating the extracted data from PatBase for each company on the database. The data was extracted and associated by the company's name, resulting on 861 companies with information on the number of publishing patent

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<sup>29</sup> It was excluded 5 companies from the matching process which were based outside the US and Europe.

<sup>30</sup> Company-years with not stock price information for the end of the fiscal year were excluded.

families and 801 companies with information on forward citations<sup>31</sup>, per year and per assignee. The last dataset included a total of 10,013 concluded M&A transactions, between 2006 and 2016, the R&D variable and 19 control variables, from Capital IQ and ExecuComp.

## 4.2 | Regression specification

In our study we will conduct an analysis on 3 main variables: CEO overconfidence, number of merger and acquisitions deals and firm's innovation. Therefore, our analysis will be done using multiple regressions.

To measure if firm's innovation, where the CEO is overconfident, is related to the number of merger and acquisition deals, it will be performed a regression analysis using econometric models. The datasets used will include panel data with yearly frequency. A panel dataset consists of more than one firm observed across a period of time. Regressions will include year and industry fixed effects, where the industry is defined as a two-digit NAICS level.

The first hypothesis was stated as: *“Innovative firms, within its industry, are more likely to conduct merger and acquisition deals than its rivalry (noninnovative) firms”* To test this hypothesis, several models were regressed where *Innovation* represents the variables for industry innovation – INDUSTRYRD, INDUSTRYCIT and INDUSTRYPAT. At the same time, it was tested if *“Firms with higher innovation intensity are more likely to conduct merger and acquisitions then firms with lower innovation intensity”*, where *Innovation* represents the variables for innovation intensity – INTRD, INTRD1, INTRD2, INTCITATION, INTCITATION1, INTCITATION2, INTPATENTS, INTPATENTS1 and INTPATENTS2 -, described in the previous chapters. Therefore, it was estimated a total of 12 regressions with the following structure:

$$\Pr(MA = 1|0) = \beta_1 + \beta_2 \times Innovation_i + \beta_x \times Controls_i + \varepsilon_i \quad (4)$$

*MA* represents the binary variable, where 1 means that at least one deal has occurred in the fiscal year and 0 means that no deal has taken place, for a specific firm. The control variables included were TOBIN-Q, CASHHOLDINGS, SIZE, ROA, ROE, GROWTH1Y, EPS, RETURN, KZINDEX, DIVERSIFY and PAYMENT. The variable CROSSBORDER was not included in the regression due to high correlation with the dependent variables (Appendix D).

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<sup>31</sup> It was assumed a value of zero for each company-year with no information.

To measure the impact of overconfidence in the CEOs tendency to pursue merger and acquisitions deals, it was stated the following hypothesis: “*Overconfident CEOs in innovative firms, within its industry, tend to conduct more merger and acquisitions deals than non-overconfident CEOs*”, and “*Overconfident CEOs in firms with higher innovation intensity tend to conduct more merger and acquisitions than non-overconfident CEOs*”. It was introduced our overconfidence variable – HOLDER67 - and the number of acquisitions concluded by firm- year in the sample (AQUISITIONS). It was also included our controls variables, namely AGE, GENDER, STOCKOWN, COMPENSATION, TENURE, DUALITY, INSIDE, FEMALE and FOUNDER to control for the impact of CEO characteristics and firm’s governance characteristics, as well as the control variables included in the first hypothesis.

$$\begin{aligned}
 AQUISITIONS_i = & \beta_1 + \beta_2 \times HOLDER67_i + \beta_3 \times Innovation_i \\
 & + \beta_4 \times HOLDER67_i \times Innovation_i + \beta_x \times Controls_i + \varepsilon_i
 \end{aligned} \tag{5}$$

The purpose of this study if to test the relationship between overconfident managers in firm’s innovation after merger and acquisitions deals. It will be tested whether the intensity of the firm’s innovation is higher after merger and acquisitions deals, when there is an overconfident CEO. Therefore, it was stated the following hypothesis: “*Overconfident CEOs are more likely to increase firm’s innovation after merger and acquisitions deals than non-overconfident CEOs*”. The variable *IntensityInnov<sub>i</sub>* represents innovation intensity lagged by t=0 years (INTCITATION, INTPATENTS, INTRD) and the variable *AQUISITIONS<sub>i,n-t</sub>* represents the number of acquisitions lagged by t years (where t will be valued 1 or 2). The control variables included will control for CEO and firm characteristics, namely AGE, GENDER, STOCKOWN, COMPENSATION, TENURE, DUALITY, INSIDE, FEMALE, FOUNDER, TOBIN\_Q, CASHHOLDINGS, SIZE, ROA, ROE, GROWTH1Y, RETURN and EPS. It was tested a total of 12 regressions with the following structure:

$$\begin{aligned}
 IntensityInnov_{i,N} \\
 = & \beta_1 + \beta_2 \times HOLDER67_i + \beta_3 \times AQUISITIONS_{i,N-t} \\
 & + \beta_4 \times HOLDER67_i \times AQUISITIONS_{i,N-t} + \beta_x \times Controls_i + \varepsilon_i
 \end{aligned} \tag{6}$$

The datasets use multi-dimensional data – more than one observation for more than one variable at different moments in time – and as it was not possible to construct overconfident proxies for all firms, thus there will be missing data between datasets. Thought this leads to inequality between datasets, they will remain comparable. Consequently, our panel is unbalanced, due to the existence of time gabs, since the same company can be observed for each period, even if with missing data.

## Chapter 5 | Results

In this chapter the results are presented, and it was examined how overconfident CEOs can affect firm's innovations after merger and acquisitions. The chapter starts by analysing descriptive statistics followed by an analysis on the regressions specified in the previous chapter.

### 5.1 | Descriptive statistics

**Table 1** shows the distribution of our sample by industry (classified according to the first two-digit of the NAICS level<sup>32</sup>).

**Table 1** Distribution of companies by industry

NAICS Level	Industry Description	Number
11	Agriculture, Forestry, Fishing and Hunting	5
21	Mining	77
23	Construction	27
31 - 33	Manufacturing	641
42	Wholesale Trade	45
44 - 45	Retail Trade	80
48 - 49	Transportation and Warehousing	45
51	Information	138
54	Professional, Scientific, and Technical Services	54
56	Administrative and Support and Waste Management and Remediation Services	32
61	Educational Services	11
62	Health Care and Social Assistance	31
71	Arts, Entertainment, and Recreation	6
72	Accommodation and Food Services	33
81	Other Services (except Public Administration)	6
99	Unclassified Establishments & Conglomerates	3
	<b>Total</b>	<b>1,234</b>

**Table 2** shows the frequency of overconfident CEOs in the analysed period. Our measure generates the following results<sup>33</sup>, excluding CEO-years missing data: 39.7% of CEO-years are classified as overconfident, while only 60.3% are classified as non-overconfident. Additionally, when considering CEO-years with missing data, 37.3% of CEO-years are

<sup>32</sup> It was excluded companies from the Utilities, Financials and Real Estate sector (NAICS 22, 52 and 53, respectively), due to their business specifications and financial accounting differences.

<sup>33</sup> Changes in the sample size across years does not represent a problem in the econometric software (Eviews) used.

classified as overconfidence , compared to 56.7% of CEO-years which are classified as non-overconfidence<sup>34</sup>.

**Table 2** Frequency of overconfident CEOs

The sample of CEOs is from ExecuComp for 2006-2016 period. It was excluded Financial, Utility and Real Estate firms. We included only firms from the US and European countries which were available on ExecuComp. The HOLDER67 measure defines a CEO as overconfidence if the CEO does not exercise options that are at least 67% in the money. For brevity, overconfident CEOs are labelled as “confident” in the tables.

Year	No. Of CEOs	Confident CEOs (#)	Confident CEOs (%)
2006	1,148	232	20.21
2007	1,178	299	25.38
2008	1,191	316	26.53
2009	1,200	357	29.75
2010	1,213	438	36.11
2011	1,210	477	39.42
2012	1,195	527	44.10
2013	1,164	612	52.58
2014	1,135	621	54.71
2015	1,089	607	55.74
2016	1,044	583	55.84
Total	12,767	5,069	39.70

Managers who are identified as overconfident in any year, remains so throughout the sample period. This method contributes to an increase in the number of overconfident managers over the sample period. This patent is visible in the earlier part of the sample period, however during the second half of the sample period, there is a decreasing tendency.

**Table 3** presents descriptive statistics on the variables defined in the previous chapters<sup>35</sup>. Panel A classifies the sample according to the *holder67* measure for overconfidence. Consistent with the existing literature and our first hypothesis, overconfident CEOs have a significantly higher number of merger and acquisitions deals than non-overconfident CEOs. They also have higher mean number of new patents publication but lower mean number of new forward citations. R&D investments have greater importance and size on companies with an overconfident CEO. Also, overconfident CEOs have, on average, higher probability of managing a more innovative company than its industry peers, than a non-overconfident

<sup>34</sup> More detail on overconfidence statistical frequency on Appendix A.

<sup>35</sup> The complete table is provided in Appendix C, alongside the Wilcoxon/Man-Whitney tests results.

CEO. Additionally, overconfident CEOs tend to manage firms which are associated to higher innovation intensity, according to all measures.

With respect to the controls, overconfident CEOs manage larger firms and with higher growth, stock return, Tobin-Q and ROA, and lower cash holdings. Moreover, overconfident CEOs have higher probability of having financials constrains, as they are associated to firms with lower KZindex and cash holdings. Regarding CEO characteristics, overconfident CEOs are mainly man and associated to higher age and time in the office, however CEO compensation has a higher variable component, even though they hold a lower percentage of their firm's stock. Overconfident CEOs are associated to higher CEO-chairman duality in the board, higher probability to be founder of the company, and higher mean number of inside and female directors in the boards. With respect to merger and acquisitions characteristics, and according to the existing literature, overconfident CEOs tend to pursue targets in different countries and industries.

**Table 3** Summary Statistics on Overconfidence

The table gives the means and medians of the variables used in this study, according to the classification given to CEO (non-confident or confident). The sample includes nonfinancial, nonutility and nonreal estate firms in ExecuComp from 2006 to 2016. US and European firms with options information available were included in the sample. HOLDER67 measure defines a CEO as overconfidence if the CEO does not exercise options that are at least 67% in the money. For brevity, overconfident CEOs are labelled as “confident” in the tables. Variable's definitions are provided on chapter 3 and *t*-tests (Wilcoxon/Man-Whitney tie-adj. tests) are conducted to test differences between the means (medians) for firms with overconfident CEO and non-overconfident CEOs. \*, \*\*, and \*\*\* measure significance at the 10%, 5%, and 1% level, respectively.

Variables	Non-Confident CEO (N = 7,698)			Confident CEO (N = 5,069)		
	Mean	Median	Std.Dev	Mean	Median	Std.Dev
<b><i>Dependent variables</i></b>						
Aquisitions	0.75	0.00	1.64	0.82**	0.00***	1.57
IntRD	0.30	0.00	0.42	0.31**	0.00	0.42
IntPatents	0.07	0.03	0.09	0.08***	0.04**	0.09
IntCitations	0.09	0.03	0.11	0.09	0.04	0.11
<b><i>Innovation Variables</i></b>						
R&D/Assets (%)	2.90	0.00	6.80	2.81*	0.00	6.64
Patent_Count <sup>36</sup>	36.86	1.00	125.36	43.52***	1.00***	137.51
Patent_Citations	127.96	1.00	1,077.52	100.70*	1.24	498.40
IndustryRD	0.46	0.00	0.50	0.48**	0.00**	0.50
IndustryPat	0.29	0.00	0.45	0.33***	0.00***	0.47
IndustryCit	0.38	0.00	0.49	0.40*	0.00*	0.49
IntRD1	0.30	0.00	0.42	0.32**	0.00*	0.42
IntRD2	0.30	0.00	0.42	0.32*	0.00	0.42
IntPatents1	0.07	0.03	0.09	0.08***	0.04***	0.09
IntPatents2	0.07	0.03	0.09	0.08***	0.04***	0.09

<sup>36</sup> PATENT\_COUNT and PATENT\_CITATIONS represent the raw number of new publishing patents and new forward citations for a given company-year, respectively. These variables won't be used in our hypothesis models; however, they were included in the descriptive statistics for analysis.

Variables	Non-Confident CEO (N = 7,698)			Confident CEO (N = 5,069)		
	Mean	Median	Std.Dev	Mean	Median	Std.Dev
IntCitations1	0.09	0.03	0.11	0.09	0.04	0.11
IntCitations2	0.09	0.03	0.11	0.09	0.04	0.11
<b>Control variables</b>						
Return	0.00	0.021	0.25	0.03***	0.05***	0.19
Sales (in millions)	6,612.34	1,384.17	17,113.55	7,630.90***	1,866.94***	24,743.94
Growth1y	0.091	0.05	0.77	0.12**	0.08***	0.78
Tobin-q	2.87	1.50	35.74	2.51	1.81***	4.31
Cashholdings (%)	17.33	10.84	18.54	16.80	10.31	17.94
ROA (%)	0.03	0.05	0.18	0.06***	0.06***	0.11
ROE (%)	-0.26	0.05	13.77	-0.49	0.05***	33.33
EPS	4.37	1.18	144.97	2.19	1.82***	5.41
KZindex	41.67	-2.25	3,804.23	-276.04***	-2.32*	6,485.62
Age	55.92	56,00	7.62	56.24**	56,00***	7.00
Gender	0.96	1.00	0.19	0.97***	1.00***	0.16
Tenure	14.18	12.21	8.69	14.54**	12.88***	8.17
Stockown	0.04	0.01	0.08	0.03***	0.01***	0.06
Compensation	0.31	0.23	0.24	0.21***	0.15***	0.19
Duality	0.50	1.00	0.50	0.55***	1.00***	0.50
Inside	0.39	0.00	0.49	0.42***	0.00***	0.49
Founder	0.08	0.00	0.27	0.11***	0.00***	0.32
Female	0.46	0.00	0.72	0.48*	0.00*	0.73
Diversify	0.19	0.00	0.58	0.21**	0.00***	0.61
Payment	0.36	0.00	0.82	0.38	0.00***	0.80
Crossborder	0.54	0.00	1.27	0.60**	0.00***	1.24

It was verified whether the variables are or not highly correlated. According to Pallant (2001) high correlation is defined as 0.70 or higher, thus it was reported a correlation matrix reporting pairwise correlations<sup>37</sup>. The correlation matrices show high correlation between AQUISITIONS and CROSSBORDER variables, as more than 50% of included transaction had a target and a buyer headquartered in different countries (Appendix D). It was not included the correlation between two variables were one of them is the multiplication of that variable with other. Additionally, innovation variables were also associated with high correlation among them, however as regressions will only use one variable for innovation at a time, this raises no multicollinearity problems. The remaining correlations are in general quite low, indication there is no multicollinearity in the datasets that could affect the regression coefficients.

<sup>37</sup> The complete table is provided in Appendix D.

## 5.2 | Regression results

### 5.2.1 | Results from hypothesis 1

The first hypothesis was developed to test whether innovative firms are more likely to perform merger and acquisitions compared to its peers, in the same industry. **Table 4** represents the hypothesized effects of innovation on acquisitiveness.

The table shows the standard-errors as well as the significance level of our main variables. The full table can be found on **Appendix E**. For each of the innovation measures, we performed different regressions using three specifications. Our base specification, shown in **Table 4**, included clustered standard errors at the period level with industry and year fixed effects. We also estimated these regressions using a second specification, with clustered standard errors at the firm level, industry and year fixed effects, and a third specification, where it was only used clustered standard errors at the firm level<sup>38</sup>.

The table is divided in two panels. Panel A includes industry measures for innovation in models (1) to (3), and innovation intensity (at year  $t$ ) in models (4) to (6). Panel B includes models (7) to (12) which measure the impact of innovation intensity in 1 and 2 years forward (identified as  $1y$  and  $2y$ , respectively), to check the impact of innovation intensity in the next years (at year  $t+1$  and year  $t+2$ ) and whether the effect due to merger and acquisition in the year  $t$  holds in the next years and/or has a higher effect on the likelihood to conduct a merger and acquisition. This effect was measure by a binary variable (MA) valued 1 when there is at least one merger or acquisition for a company-year combination.

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<sup>38</sup>The results from our base specifications are more robust and with significancy, nevertheless we compare our results with the other two specifications, which were not included in this dissertation as there wasn't significance, however, when there is significance, the conclusions remain the same.

**Table 4** Effect of innovation on acquisitiveness

The table presents the results of regression of the likelihood of conducting successful M&A deals in more innovative or noninnovative firms, within its industry, and in firms with higher innovation intensity in year  $t$ ,  $t+1$  and  $t+2$ . MA is a binary variable valued 1 when there is occurred at least one successful merger and acquisition deal for each company-year, and zero otherwise. Standard errors are corrected for clustering of observations at the period level with period and industry fixed effects, in all regressions (standard errors are in parentheses). Industry fixed effects are defined based on two-digit NAICS codes. \*, \*\*, and \*\*\* measure significance at the 10%, 5%, and 1% level, respectively.

<b>Panel A: Dependent Variable = MA (binary variable)</b>						
	(1)	(2)	(3)	(4)	(5)	(6)
IndustryCit	0.008*** (0.004)					
IndustryPat		0.039*** (0.011)				
IndustryRD			0.044*** (0.007)			
IntCitations				0.120*** (0.023)		
IntPatents					0.319*** (0.051)	
IntRD						0.067*** (0.006)
Intercept	-0.432*** (0.063)	-0.350 (0.076)***	-0.493 (0.058)***	-0.425 (0.063)***	-0.326 (0.063)***	-0.457 (0.061)***
Firm fixed effects	No	No	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,045	12,045	12,045	12,045	12,045	12,045
R <sup>2</sup>	0.289	0.290	0.290	0.289	0.291	0.291
<b>Panel B: Dependent Variable = MA (binary variable)</b>						
	(7) - $1y$	(8) - $2y$	(9) - $1y$	(10) - $2y$	(11) - $1y$	(12) - $2y$
IntCitations	0.140*** (0.042)	0.150*** (0.035)				
IntPatents			0.316*** (0.048)	0.318*** (0.048)		
IntRD					0.070*** (0.007)	0.078*** (0.007)
Intercept	-0.419*** (0.061)	-0.413*** (0.063)	-0.328*** (0.064)	-0.326*** (0.065)	-0.458*** (0.061)	-0.464*** (0.061)
Firm fixed effects	No	No	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,045	12,045	12,045	12,045	12,045	12,045
R <sup>2</sup>	0.289	0.289	0.291	0.291	0.291	0.292

First of all, our regressions indicate that firms which are considered as more innovative within their industry are also associated to a higher probability of concluding merger and acquisitions deals.

The coefficients, on Panel A, from models (1) to (3) show that more innovative firms, compared with its industry peers, significantly increase the likelihood of occurring a merger or acquisition transaction. Model (1) indicates that firms that receive more citations from its patents, than the industry average, have a positive effect on acquisitiveness. Additionally, model (2) shows that firms which publish patents above the industry mean also increase the probability of a merger or acquisition to take place. Moreover, model (3) predicts that firms with higher size of R&D investments, than the average size from its industry competitors, increase the likelihood of a M&A deal to take place by 4.4%.

Models (4) to (6) show innovation intensity of firms have a positive effect on acquisitiveness as well. Measured by forward citations received, model (4) reveals that increasing the intensity of forward citations received in that year have a significant positive impact on the prospect of occurring a M&A deal in the same year by 12%. Moreover, such impact substantially increases when considering the intensity level of new publishing patents, according to model (5). Furthermore, firms with higher size on R&D spending's also significantly increase the likelihood of concluding a merger and acquisition transaction. The impact of patents on the probability of occurring a merger or acquisition has a higher economic significance, as higher levels of publishing patents, compared to its industry peers, tends to impact firm's acquisitiveness by 31.9%. The economic and statistical significance of the remaining coefficients in models (1) to (6) are also higher and the errors associated are lower.

The results from Panel B show similar conclusions. The coefficient on model (7) for firm's innovation intensity in one year forward, measure by forward citations received, indicates that an increase on the degree of citation intensity in the next year has a positive and more significant impact on firm acquisitiveness in the year before. When considering a 2-year period in model (8), this effect slightly increases. New publishing patents have the same economic significancy when considering a 1 and 2-year forward period. However, higher size of R&D spending's in 1 or 2-years forward contribute to a positive impact on the probability of occurring a merger and acquisition transaction as well. All models have high significancy and lower standard errors.

Based on our results, on both panels, there is enough evidence to support our hypothesis 1.1 and therefore, we may conclude that firms which are more innovative than its industry peers are more likely to conduct merger and acquisitions. Furthermore, our results show enough evidence to support our hypothesis 1.2 as well, and thus higher innovation intensity has a positive effect on the likelihood of concluding a merger and acquisitions transactions likewise.

## 5.2.2 | Results from hypothesis 2

The second hypothesis was developed to test whether innovative firms with an overconfident CEO are more likely to conduct merger and acquisitions compared to its peers in the same industry.

**Table 5** represents the hypothesized effects of overconfidence and innovation on firm's acquisitiveness, including the *holder67* proxy for overconfidence. The full table can be found on **Appendix F**. Our results won't be compared to the studies from Malmendier and Tate (2005a, 2008) and Hirshleifer et al. (2012), as there is no significance on our overconfidence variable. To test whether firm's innovation causes overconfident CEOs to conduct more merger and acquisitions deals, we will analyse our variables defined as *HOLDER67\*InnoVar*.

**Table 5** The effect of overconfidence & innovation on acquisitiveness

ACQUISITION is the number of merger and acquisitions occurred in a particular company-year. HOLDER67 measure defines a CEO as overconfidence if the CEO does not exercise options that are at least 67% in the money. Innovation Variables were defined in the previous chapters. Standard errors are corrected for clustering of observations at the period level with period and industry fixed effects, in all regressions (standard errors are in parentheses). Industry fixed effects are defined based on two-digit NAICS codes. \*, \*\*, and \*\*\* measure significance at the 10%, 5%, and 1% level, respectively.

Panel A: Dependent Variable = AQUISITION						
	Innovation Variable					
	IndustryCit	IndustryPat	IndustryRD	IntCitations	IntPatents	IntRD
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Innovation Variable</i>	0.079*** (0.029)	0.057 (0.054)	0.087*** (0.020)	0.464*** (0.142)	0.580** (0.286)	0.156*** (0.020)
Holder67	0.042* (0.022)	0.009 (0.034)	-0.001 (0.031)	0.034 (0.026)	0.011 (0.038)	0.013 (0.031)
Holder67* <i>InnoVar</i>	-0.106*** (0.039)	-0.027 (0.064)	-0.002 (0.031)	-0.382*** (0.123)	-0.160 (0.294)	-0.051 (0.038)
Intercept	-2.962** (0.197)	-2.900** (0.249)	-3.132** (0.194)	-2.955** (0.199)	-2.836** (0.231)	-3.065** (0.204)
Firm fixed effects	No	No	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,705	7,705	7,705	7,705	7,705	7,705
R <sup>2</sup>	0.490	0.490	0.490	0.490	0.490	0.490

<b>Panel B: Dependent Variable = AQUISITION</b>						
	<b>Innovation Variable</b>					
	<b>IntCitations</b>		<b>IntPatents</b>		<b>IntRD</b>	
	<b>(7) - 1y</b>	<b>(8) - 2y</b>	<b>(9) - 1y</b>	<b>(10) - 2y</b>	<b>(11) - 1y</b>	<b>(12) - 2y</b>
<i>Innovation Variable</i>	0.335*** (0.123)	0.526*** (0.144)	0.539* (0.281)	0.520* (0.271)	0.165*** (0.024)	0.168*** (0.023)
Holder67	0.031 (0.032)	0.035 (0.038)	0.008 (0.039)	0.011 (0.041)	0.017 (0.031)	0.019 (0.031)
Holder67* <i>InnovVar</i>	-0.344*** (0.108)	-0.413** (0.196)	-0.118 (0.281)	-0.166 (0.290)	-0.061 (0.040)	-0.067* (0.041)
Intercept	-2.961** (0.195)	-2.934** (0.197)	-2.845** (0.229)	-2.859** (0.223)	-3.070** (0.203)	-3.070** (0.208)
Firm fixed effects	No	No	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,705	7,705	7,705	7,705	7,705	7,705
R <sup>2</sup>	0.490	0.490	0.490	0.490	0.490	0.490

Innovation variables in models (1) to (12) show a positive effect on the number of acquisitions concluded. On the one side, coefficients from model (1) to (3) indicate that more innovative firms, compared to its peers in the industry, are more likely to conclude merger and acquisitions transactions, however such impact is of low economic significance. On the other side, coefficients from models (4) to (6) indicate a higher impact on firm's acquisitiveness, as firms with more intensive R&D spending's, compared to their competitors in the industry, are associated to higher numbers of merger and acquisitions deals. Such impact is even higher when considering firms innovation strategies outcomes, implying that patent publication and the number of citations received from those patents impact positively firm's acquisitiveness level. Moreover, if patent publication intensity doubles it impacts the firm's acquisitiveness levels by 58%. However, standard error from this variable is higher which doesn't endure our conclusions. The impact of citations received, which refers to all patents published for that firm, is lower, however with the same effect, a higher significance level and a lower standard error.

When considering the impact of R&D spending's in 1 or 2 years forward, the impact is slightly higher, indicating that the impact of R&D spending on firm's acquisitiveness increases gradually over time. Moreover, the intensity of received citations in 1-year forward has a lower impact on firm's acquisitiveness, while in 2-year forwards the impact almost doubles. This implies that, even though the intensity of citations received in 1 and 2-years forward contributes positively to merger and acquisition to take place, such impacts are different. Even more, these impact increases overtime as market recognition on firm's innovation may take longer to access and, thus citations intensity can have higher increases in the next 2 years.

Firms with overconfident CEOs have a probability of 4.2% to be considered as an innovative firm, compared to its industry peers, thereby we can access that overconfidence has a positive effect on firm's innovation recognition. However, relatively to our variables *HOLDER67\*Innovation*, the coefficient in model (1) indicates a negative additional impact from existing an overconfident CEO in such innovative firms on the level of merger or acquisitions concluded. This implies there is no additional positive impact brought by an overconfident CEO, which is associated to higher risk-taking investment strategies', in an innovative firm. Furthermore, the existence of CEO overconfidence in an innovative firm, simultaneously, eliminates the positive impact brought by both variables in merger and acquisitions as overconfidence is associated to lower wealth effects on merger and acquisitions deals (Billett & Qian, 2008; Doukas & Petmezas, 2007) and potential synergies from these strategies might be overestimated (Malmendier & Tate, 2004).

According to models (4), (7), (8) and (12), the effect of firm's intensity on innovation, with an overconfident CEO, has a higher and more negative impact. There is a loss of value on the level of acquisitiveness of firms when they have higher intensity on citations received and are managed by overconfident CEOs. In fact, this effect almost eliminates the positive impact of innovation on firm's acquisitiveness, as well. The effect is stronger when considering innovation intensity in a 2-year forward period rather than 1-year forward.

Based on our results, on both panels, there is enough evidence to reject our hypothesis 2.1 and therefore, it can be inferred that more innovative firms with an overconfident CEO are less likely to conduct a successful merger and acquisitions, compared to its industry competition. Moreover, our hypothesis 2.2 can be rejected as well, as higher innovation intensity in firm's which are managed by overconfident CEOs, with more risk-taking profiles, has a negative effect on the level of concluded merger and acquisitions transactions likewise.

### 5.2.3 | Results from hypothesis 3

Finally, the third hypothesis was developed to test whether overconfidence and firms' acquisitiveness impacts their ability to innovate. **Table 6** represents the hypothesized effects of overconfidence and acquisitiveness on innovation, including the *holder67* proxy for overconfidence. The full table can be found on **Appendix G**. Our regressions tested the impact of overconfidence CEO and their acquisitiveness level on firm's innovation.

**Table 6** The effect of overconfidence and acquisitiveness on innovation

Innovation intensity variables – defined as citations, patents, and R&D - were defined in previous chapters. ACQUISITION is the number of merger and acquisitions occurred in a particular company-year. HOLDER67 measure defines a CEO as overconfidence if the CEO does not exercise options that are at least 67% in the money. Standard errors are corrected for clustering of observations at the period level with period and industry fixed effects, in all regressions (standard errors are in parentheses). Industry fixed effects are defined based on two-digit NAICS codes. \*, \*\*, and \*\*\* measure significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable = Innovation Variables						
	IntCitations		IntPatents		IntRD	
	(1)	(2)	(3)	(4)	(5)	(6)
Holder67	0.0072*** (0.0016)	0.0076*** (0.0010)	0.0043*** (0.0011)	0.0048*** (0.0006)	0.0264*** (0.0063)	0.0306*** (0.0050)
Aquisitions_1y	0.0021*** (0.0007)		0.0017 (0.0011)		0.0235*** (0.0031)	
Aquisitions_2y		0.0022*** (0.0006)		0.0019* (0.0011)		0.0232*** (0.0029)
Holder67* Aquisitions_1y	-0.0007 (0.0010)		-0.0001 (0.0013)		0.0002 (0.0036)	
Holder67* Aquisitions_2y		-0.0002 (0.0009)		-0.0000 (0.0012)		-0.0005 (0.0036)
Intercept	-0.0875** (0.0176)	-0.0928** (0.0134)	-0.2858** (0.0101)	-0.2903** (0.0077)	0.7382** (0.0934)	0.7542** (0.0977)
Firm fixed effects	No	No	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,376	6,894	7,376	6,894	7,376	6,894
R <sup>2</sup>	0.256	0.256	0.417	0.416	0.369	0.366

Models (1) to (6) show that overconfident CEO have a positive impact on firm's innovation intensity, which is comparable to the results from Hirshleifer et al. (2012). Model (5) and (6) indicate higher economic significance as the impact of CEO overconfidence on the intensity of R&D spending's is stronger, compared to the other measures for innovation. These results are consistent with the idea that overconfident CEOs tend to accept greater risk and feel particularly enthusiasm about challenging projects, as is the case of projects associated to R&D spending. Another explanation is that overconfident CEOs<sup>39</sup> may be expecting for "the next big thing", thus believe investing significantly on innovative projects will produce greater results.

The intensity of patents publication and citations received are correlated to firms' capability to innovate and markets acceptance toward that specific innovation. Studies have shown that boards may hire overconfident CEOs due to their leadership talent and vision

<sup>39</sup> Hirshleifer et al. (2012) defined overconfident CEOs according to 3 levels: low, moderate, and high overconfident CEOs. Their results show that higher overconfident CEOs spend levels of R&D similar to non-overconfident CEOs and that moderate overconfident CEOs are associated to higher spending's and increases on R&D. The authors reported that higher levels of overconfidence might expect for greater results coming from "the next big thing" and not from existing projects.

(Phua et al., 2018), which might also be associated to their perception and screening capability to determine which patents are worthwhile to publish and will bring more recognition to the company. Our results have low economic significance, however it is important to highlight that such traces from overconfident managers have been identify in recent literature and thus our results should be taken in consideration and further explore in future research.

Models (1) to (2) indicate a positive impact of merger or acquisition conducted 1-year earlier on firm's innovation intensity, measure as citation intensity. This effect holds when considering the impact of merger and acquisitions conducted 2-years prior to the period at issue. Models (5) and (6) show a stronger effect when considering the intensity of R&D spending's. Such results suggest that the level of merger and acquisitions in prior years impacts positively firm's spending's on R&D projects. One possible explanation is that these increases on R&D spending's might not arrive from real increases on R&D but rather from merged spending's after those deals. However, these increases on R&D intensity may also derive from new strategies from the company's management team.

Our variables which would indicate the additional value of having an overconfident CEO and merger and acquisition prior to the period at issue, show no significance, and thus no conclusion may be taken from them.

Based on our results, there is not enough evidence to support or reject our hypothesis 3. Nevertheless, we can conclude that overconfident CEO's and the level of prior merger and acquisitions impact positively firm's innovation intensity. However, we cannot conclude that overconfident CEOs increases firm's innovation after successfully concluded merger and acquisitions transactions.

## Chapter 6 | Conclusion and future research

Overconfident CEOs believe their firms are “better than average” and overestimate their ability to generate future returns and their leadership impact (Malmendier & Tate, 2004, 2008). Individuals tend to be overconfident to those outcomes where they believe are under their control and which they are highly committed, as is the case of R&D projects. In contrast to many studies on the topic, CEO overconfidence is associated to greater innovation in more innovative industries and higher effectiveness at pursuing growth opportunities while translating them into firm’s value (Hirshleifer et al., 2012). Our study supports these findings.

The sample used in this research includes 1,234 firms and thus more than 10,000 observations. This study relies on the presumption that overconfidence is not a negative trace as projects on innovation tend to be of higher risk and challenging for managers. By merging or acquiring other companies, firms might be in fact acquiring existing innovation from targets rather than investing in innovation products/services.

Using proxies for innovation based on R&D scaled on assets, forward citations, and number of patents, over the 2006-2016 period, more innovative firms are associated to higher probability of conducting mergers and acquisitions. Furthermore, innovation intensity associated to market recognition, firm’s capability to innovate and R&D spending’s also contribute positively to the likelihood of merger and acquisitions to take place. The effect is stronger when considering firm’s innovation in the next 2 years.

CEO overconfidence, which is based on *holder67* measure developed by Malmendier and Tate (2008), show less significancy results in our models. Nevertheless, our findings indicate that the additional effect of overconfidence in more innovative firms, compared to their industry peers, in firm’s acquisitiveness is positive. Thus, overconfident CEOs, in firms where innovation recognition and spending’s on R&D are above the industry average, don’t need to accommodate innovation from the merged/acquired firms as their innovation projects are considered as “better than average”. Overconfident CEOs risk taking profile may allow them to effectively select projects which will be accepted by the market.

Merger and acquisitions concluded 2-years before have a positive impact on firm’s level of R&D spending’s, which could be offset by the presence of an overconfident CEO in that firm. Additionally, overconfidence and the level of prior merger and acquisitions positively impact firm’s innovation intensity.

The present study has a few limitations. First, our data on the number of publishing patents and forward citations may have deviations as the same company may have patents associated to employees or subsidiaries, which could not be fully represented in our sample. Second, only one option-based measure for CEO overconfident was used, while many studies have used press-based and at least two overconfidence measures. Due to time and resources limitations the other proxies developed by Malmendier and Tate (2005a, 2005b) were not used in this thesis, which could further strengthen, or offset, our results.

Furthermore, it wasn't determined whether merger or acquisitions were successful or not and therefore, the average Cumulative Abnormal Returns (CAR) could have been used to determine the value-creation (value-destruction) in these transactions.

Lastly, this thesis included data on companies listed, mainly, in the USA which is similar to the previous studies. However, differences between countries could impact managers decisions on innovation and thus, future research should focus on European or Asian companies.

## Chapter 7 | References

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## Chapter 8 | Appendix

### Appendix A Frequency on overconfidence CEOs

**Table 7** Frequency Summary on Overconfidence

The HOLDER67 measure defines a CEO as overconfidence if the CEO does not exercise options that are at least 67% in the money. For brevity, overconfident CEOs are labelled as “confident” in the tables. The first column does not consider CEO-years with missing data, while the second column does consider CEO-years with missing data.

<b>Holder67</b>	Non-Confident CEO	<b>60.30</b>	<b>56.71</b>
	Confident CEO	<b>39.70</b>	<b>37.34</b>
	NA	-	<b>5.95</b>

### Appendix B Frequency on M&A and innovation inputs

**Table 8** Distribution of total acquisitions, new patents, and forward citations per industry (2006-2016)

NAICS Level	Total Acquisitions	Total New Patents	Total Forward Citations
11	25	8,177	400
21	501	13,332	9,746
23	415	1,900	11,807
31 - 33	5,049	447,221	1,196,615
42	450	2,205	9,864
44 - 45	518	2,459	6,613
48 - 49	113	296	3,781
51	1,435	36,924	190,371
54	460	9,451	97,965
56	275	320	6,405
61	25	49	713
62	516	760	5,071
71	65	108	2,735
72	100	149	1,941
81	36	17	120
99	30	39	392
<b>Total</b>	<b>10,013</b>	<b>523,407</b>	<b>1,544,540</b>

**Table 9** The relationship between cross border and total acquisitions deals

CROSSBORDER was defined as the number of successful cross border deals for each company-year which is established when the headquarter of the target and buyer of the transaction are from different countries. ACQUISITIONS is defined as the total number of successful deals for each company-year.

NAICS	Total Crossborder	%	Total Acquisit.	Crossborder (Mean)	Crossborder (Std. Dev.)	Acquisitions (Mean)	Acquisitions (Std. Dev.)
11	19	76.0%	25	0.3455	0.6446	0.4545	0.7654
21	426	85.0%	501	0.5030	1.1648	0.5915	1.2812
23	388	93.5%	415	1.3064	2.2324	1.3973	2.2788
31	285	64.9%	439	0.3501	0.7483	0.5393	1.0558
32	875	66.6%	1,314	0.4371	1.0197	0.6563	1.4828
33	2134	64.7%	3,296	0.5039	1.0846	0.7783	1.5436
42	357	79.3%	450	0.7212	1.2911	0.9091	1.4819
44	335	91.5%	366	0.5537	1.3468	0.6050	1.4652
45	132	86.8%	152	0.4800	1.0156	0.5527	1.1494
48	77	85.6%	90	0.1667	0.4708	0.1948	0.5238
49	7	30.4%	23	0.2121	0.5453	0.6970	0.9515
51	1,060	73.9%	1,435	0.6983	1.6631	0.9453	2.1405
54	316	68.7%	460	0.5320	1.1439	0.7744	1.7236
56	201	73.1%	275	0.5710	0.9611	0.7813	1.2056
61	23	92.0%	25	0.1901	0.4711	0.2066	0.4816
62	494	95.7%	516	1.4487	2.2896	1.5132	2.3746
71	49	75.4%	65	0.7424	1.2808	0.9848	1.7497
72	80	80.0%	100	0.2204	0.5621	0.2755	0.6822
81	29	80.6%	36	0.4394	0.7260	0.5455	0.8261
99	16	53.3%	30	0.4848	0.8704	0.9091	1.5076
<b>All</b>	<b>7,303</b>	<b>72.9%</b>	<b>10,013</b>	<b>0.5380</b>	<b>1.2306</b>	<b>0.7377</b>	<b>1.5750</b>
Average	-	75.9%	-	54.5%	107.7%	71.6%	133.4%

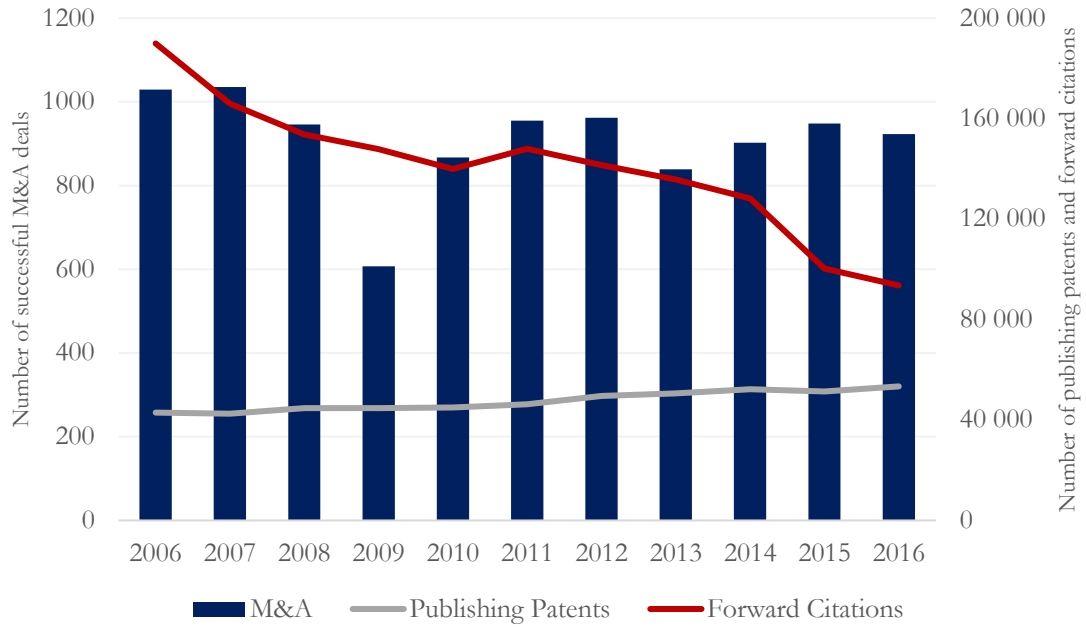
**Table 10** The relationship between diversify and total acquisitions deals

DIVERSIFY was defined as the number of successful diversified deals for each company-year which is established when the target and buyers NAICS are different. ACQUISITIONS is defined as the total number of successful deals for each company-year.

NAICS	Total Diversify	%	Total Acquisitions	Diversify (Mean)	Diversify (Std. Dev.)	Acquisitions (Mean)	Acquisitions (Std. Dev.)
11	4	16.0%	25	0.0727	0.2621	0.4545	0.7654
21	89	17.8%	501	0.1051	0.4034	0.5915	1.2812
23	41	9.9%	415	0.1380	0.3737	1.3973	2.2788
31	157	35.8%	439	0.1929	0.5373	0.5393	1.0558
32	348	26.5%	1,314	0.1738	0.5483	0.6563	1.4828
33	732	22.2%	3,296	0.1728	0.4993	0.7783	1.5436
42	124	27.6%	450	0.2505	0.5848	0.9091	1.4819
44	119	32.5%	366	0.1967	0.7387	0.6050	1.4652
45	19	12.5%	152	0.0691	0.2813	0.5527	1.1494
48	32	35.6%	90	0.0693	0.2786	0.1948	0.5238
49	4	17.4%	23	0.1212	0.3314	0.6970	0.9515
51	456	31.8%	1,435	0.3004	0.9088	0.9453	2.1405
54	151	32.8%	460	0.2542	0.6680	0.7744	1.7236
56	78	28.4%	275	0.2216	0.5027	0.7813	1.2056
61	7	28.0%	25	0.0579	0.2344	0.2066	0.4816
62	144	27.9%	516	0.4223	0.8029	1.5132	2.3746
71	15	23.1%	65	0.2273	0.6024	0.9848	1.7497
72	24	24.0%	100	0.0661	0.2992	0.2755	0.6822
81	10	27.8%	36	0.1515	0.3613	0.5455	0.8261
99	1	3.3%	30	0.0303	0.1741	0.9091	1.5076
<b>All</b>	<b>2,555</b>	<b>25.5%</b>	<b>10,013</b>	<b>0.1882</b>	<b>0.5823</b>	<b>0.7377</b>	<b>1.5750</b>
Average	-	24.0%	-	0.165	0.470	0.716	1.334

**Graph 1** M&A deals, number of published patents and forward citations through time

The years of 2009 and 2013 have less deals concluded, as the financial crisis of 2008 hit heavily the economies in US and Europe, which further amplified its impact by the sovereign debt crisis of 2013 in European's economies. The total number of publishing patents had a slow and positive evolution through time, while the total number of forward citations has decreased over time, as patents can continuously receive citations from other patents around the world.



## Appendix C Descriptive statistics

**Table 11** Wilcozon/Man-Whitney for Holder67 measure on overconfidence

The HOLDER67 measure defines a CEO as overconfidence if the CEO does not exercise options that are at least 67% in the money. Wilcozon/Man-Whitney test (or Wilcozon rank sum test) is a nonparametric test use to match two sample groups according to the values of the classification variables – HOLDER67 dummy – rather than the value of the observations relative to the median. The test also provides other statistical measures, namely the medium value of each variable according to the value of the classification variables.

Variables	Wilcozon/Man-whitney (tie-adj.) <i>Value</i>	Wilcozon/Man-whitney (tie-adj.) <i>Probability</i>	Wilcozon/Man-whitney <i>Value</i>	Wilcozon/Man-whitney <i>Probability</i>	t-test <i>Value</i>	t-test <i>Probability</i>
<b><i>Dependent variables</i></b>						
Aquisitions	5.501989	0.0000	4.648077	0.0000	-2.298871	0.0215
IntRD	1.478761	0.1392	1.257677	0.2085	-2.289200	0.0221
IntPatents	2.385267	0.0171	2.275483	0.0229	-2.958529	0.0031
IntCitations	0.641335	0.5213	0.603531	0.5462	0.236122	0.8133
<b><i>Innovation Variables</i></b>						
R&D/Assets	1.721598	0.0851	1.482129	0.1383	0.725647	0.4681
Patent_Count	2.582094	0.0098	2.463186	0.0138	-2.825014	0.0047
Patent_Citations	0.855015	0.3925	0.804840	0.4209	1.686296	0.0918
IndustryRD	2.300890	0.0214	1.988404	0.0468	-2.301280	0.0214
IndustryPat	4.508661	0.0000	3.593628	0.0003	-4.512082	0.0000
IndustryCit	1.830509	0.0672	1.547367	0.1218	-1.830681	0.0672
IntRD1	1.721711	0.0851	1.468019	0.1421	-2.218108	0.0266
IntRD2	1.610116	0.1074	1.374358	0.1693	-1.822712	0.0684
IntPatents1	2.813226	0.0049	2.687394	0.0072	-3.412292	0.0006
IntPatents2	3.177101	0.0015	3.037290	0.0024	-3.693106	0.0002
IntCitations1	0.825870	0.4089	0.777237	0.4370	0.150460	0.8804
IntCitations2	1.111146	0.2665	1.044894	0.2961	-0.117002	0.9069
<b><i>Control variables</i></b>						
Return	9.478096	0.0000	9.478096	0.0000	-7.477618	0.0000
Sales	6.709126	0.0000	6.709126	0.0000	-2.745035	0.0061
Growth1y	11.43681	0.0000	11.43681	0.0000	-2.333640	0.0196
Tobin-q	19.49918	0.0000	19.49918	0.0000	0.714690	0.4748
Cashholdings	1.256727	0.2089	1.256727	0.2089	1.577710	0.1147
ROA	17.08749	0.0000	17.08749	0.0000	-11.68362	0.0000

ROE	4.776831	0.0000	4.776831	0.0000	0.563962	0.5728
EPS	19.84471	0.0000	19.84468	0.0000	1.070228	0.2845
KZindex	1.827272	0.0677	1.827272	0.0677	3.400271	0.0007
Age	3.327179	0.0009	3.324022	0.0009	-2.408582	0.0160
Gender	3.958537	0.0001	1.232702	0.2177	-3.960865	0.0001
Tenure	4.269912	0.0000	4.269908	0.0000	-2.313092	0.0207
Stockown	6.911997	0.0000	6.911993	0.0000	8.092470	0.0000
Compensation	25.94343	0.0000	25.94343	0.0000	23.44776	0.0000
Duality	4.588431	0.0000	3.970364	0.0001	-4.593004	0.0000
Inside	3.211610	0.0013	2.725770	0.0064	-3.212799	0.0013
Founder	5.369968	0.0000	2.727114	0.0064	-5.377403	0.0000
Female	1.771188	0.0765	1.498875	0.1339	-1.679464	0.0931
Diversify	2.578218	0.0099	1.554025	0.1202	-2.351365	0.0187
Payment	2.784722	0.0054	2.068527	0.0386	-1.157876	0.2469
Crossborder	5.312012	0.0000	4.238982	0.0000	-2.419593	0.0156

**Table 12** Summary Statistics on Holder67 measure for overconfidence

The HOLDER67 measure defines a CEO as overconfidence if the CEO does not exercise options that are at least 67% in the money. For brevity, overconfident CEOs are labelled as “confident” in the tables.

Variables	Non-Confident CEO						Confident CEO					
	Mean	Median	Max.	Min	Std.Dev	Obs	Mean	Median	Max.	Min	Std.Dev	Obs
<b><i>Dependent variables</i></b>												
Aquisitions	0.75149	0.00000	19.0000	0.00000	1.63523	7,698	0.81851	0.00000	19.0000	0.00000	1.57483	5,069
IntRD	0.29556	0.00000	1.52749	0.00000	0.41536	7,698	0.31277	0.00000	1.60417	0.00000	0.41585	5,069
IntPatents	0.07373	0.03344	0.32960	0.00000	0.08608	7,698	0.07839	0.03540	0.33086	0.00000	0.08901	5,069
IntCitations	0.09127	0.03267	0.45618	0.00000	0.11304	7,698	0.09079	0.03832	0.43728	0.00000	0.10903	5,069
<b><i>Innovation Variables</i></b>												
R&D/Assets	0.02896	0.00000	2.10402	-0.10122	0.06799	7,398	0.02806	0.00000	1.78926	0.00000	0.06636	4,874
Patent_Count	36.85737	1.00000	2654.00000	0.00000	125.359	7,698	43.5167	1.00000	2930.000	0.00000	137.5147	5,069
Patent_Citations	127.95850	1.00000	53222.0000	0.00000	1077.52	7,698	100.699	1.24000	15914.00	0.00000	498.3988	5,069
IndustryRD	0.45921	0.00000	1.00000	0.00000	0.49837	7,698	0.47998	0.00000	1.00000	0.00000	0.49965	5,069
IndustryPat	0.28956	0.00000	1.00000	0.00000	0.45359	7,698	0.32709	0.00000	1.00000	0.00000	0.46919	5,069

IndustryCit	0.38491	0.00000	1.00000	0.00000	0.48660	7,698	0.40107	0.00000	1.00000	0.00000	0.49016	5,069
IntRD1	0.29927	0.00000	1.52749	0.00000	0.41729	7,698	0.31604	0.00000	1.63087	0.00000	0.41863	5,069
IntRD2	0.30245	0.00000	1.51288	0.00000	0.41887	7,698	0.31629	0.00000	1.64088	0.00000	0.42045	5,069
IntPatents1	0.07424	0.03382	0.33049	0.00000	0.08641	7,698	0.07966	0.03597	0.33110	0.00000	0.08962	5,069
IntPatents2	0.07467	0.03382	0.32745	0.00000	0.08683	7,698	0.08056	0.03766	0.33102	0.00000	0.09004	5,069
IntCitations1	0.09044	0.03224	0.468320	0.00000	0.11189	7,698	0.09014	0.03833	0.42022	0.00000	0.10776	5,069
IntCitations2	0.08885	0.03127	0.44230	0.00000	0.11029	7,698	0.08908	0.03729	0.43122	0.00000	0.10641	5,069
<b>Control variables</b>												
Return	0.00204	0.02061	3.35139	-3.09283	0.24632	7,609	0.03275	0.04866	1.89806	-2.18132	0.191686	5,037
Sales (in millions)	6612.3442	1384.1740	233715.000	0.100000	17113.547	7,670	7630.901	1866.944	433526.000	0.02900	24743.939	5,062
Growth1y	0.09076	0.05228	58.0939	-0.98947	0.76869	7,585	0.12366	0.07770	45.23941	-0.96495	0.78498	5,028
Tobin-q	2.86832	1.49817	2719.84	0.34527	35.73653	7,682	2.50769	1.80596	141.1700	0.50932	4.30789	5,064
Cashholdings	0.17333	0.10836	0.9991	-0.01038	0.18544	7,398	0.16800	0.10315	0.99962	-0.01438	0.17942	4,874
ROA	0.02571	0.04676	4.82621	-3.15043	0.17876	7,682	0.05852	0.06355	1.24721	-1.99655	0.10989	5,063
ROE	-0.25388	0.04531	100.146	-1100.05	13.77283	7,686	-0.49443	0.04727	1.43893	-2363.637	33.3253	5,066
EPS	4.36712	1.18000	8548.00000	-196.120	144.96690	7,691	2.18588	1.82000	110.5300	-136.8600	5.41022	5,064
KZindex	41.6721	-2.24992	257701.200	-21081.87	3804.2340	7,321	-276.041	-2.32058	4195.841	-338137.7	6485.620	4,848
Age	55.9180	56,00000	96.00000	30.0000	7.61994	7,430	56.24208	56,00000	88.0000	34.00000	7.00146	5,048
Gender	0.96133	1.00000	1.00000	0.00000	0.19283	7,473	0.97429	1.00000	1.00000	0.00000	0.15829	5,056
Tenure	14.1823	12.2082	61.45753	-0.66575	8.68862	7,296	14.5442	12.87671	57.40548	-0.66575	8.16719	4,923
Stockown	0.03831	0.01188	0.87600	1.00E-05	0.07685	6,092	0.02729	0.00998	0.68637	1.00E-05	0.05949	4,632
Compensation	0.30683	0.22926	1.00000	0.00000	0.24128	7,430	0.21169	0.15038	1.00000	0.00000	0.19133	5,047
Duality	0.50151	1.00000	1.00000	0.00000	0.50004	5,966	0.54795	1.00000	1.00000	0.00000	0.49776	4,119
Inside	0.38923	0.00000	1.00000	0.00000	0.48761	7,633	0.41789	0.00000	1.00000	0.00000	0.49326	4,987
Founder	0.08196	0.00000	1.00000	0.00000	0.27433	5,966	0.11386	0.00000	1.00000	0.00000	0.31768	4,119
Female	0.45923	0.00000	5.00000	0.00000	0.71679	7,506	0.48132	0.00000	5.00000	0.00000	0.73211	5,059
Diversify	0.18849	0.00000	10.0000	0.00000	0.58404	7,698	0.21385	0.00000	8.00000	0.00000	0.61425	5,059
Payment	0.36269	0.00000	9.00000	0.00000	0.82363	7,698	0.37976	0.00000	9.00000	0.00000	0.80153	5,059
Crossborder	0.54482	0.00000	15.0000	0.00000	1.27432	7,698	0.59992	0.00000	14.0000	0.00000	1.23554	5,059

## Appendix D Correlation matrix and variables

Table 13 Correlation Matrix for all variables

	AGE	AQUISITIONS	AQUISITIONS_1	AQUISITIONS_2	CASHHOLDINGS	COMPENSATION	CROSSBOARD	DIVERSIFY	DUALITY	EPS	FEMALE	FOUNDER	GENDER	GROWTH1Y	HOLDER67	NETBUYER	INDUSTRYCIT	INDUSTRYPAT	INDUSTRYRD	INSIDE	
AGE	1.00																				
AQUISITIONS	-0.03	1.00																			
AQUISITIONS_1	-0.02	0.64	1.00																		
AQUISITIONS_2	-0.01	0.57	0.66	1.00																	
CASHHOLDINGS	-0.11	-0.09	-0.11	-0.11	1.00																
COMPENSATION	0.01	-0.17	-0.16	-0.15	0.15	1.00															
CROSSBOARD	-0.03	<b>0.91</b>	0.59	0.52	-0.08	-0.15	1.00														
DIVERSIFY	0.00	0.62	0.40	0.35	-0.06	-0.12	0.55	1.00													
DUALITY	0.27	-0.01	-0.01	0.01	-0.10	-0.04	-0.01	0.00	1.00												
EPS	0.05	0.00	-0.01	-0.01	-0.01	-0.02	0.00	0.00	0.02	1.00											
FEMALE	0.00	-0.05	-0.05	-0.05	0.03	0.01	-0.04	-0.04	-0.04	-0.01	1.00										
FOUNDER	0.07	0.00	0.00	0.00	0.18	0.10	0.03	-0.01	0.14	-0.01	-0.01	1.00									
GENDER	0.05	0.05	0.05	0.05	0.01	-0.05	0.05	0.04	0.01	0.00	-0.33	0.05	1.00								
GROWTH1Y	-0.03	0.00	0.00	-0.01	0.05	-0.03	0.01	0.00	-0.03	0.00	-0.02	0.03	0.01	1.00							
HOLDER67	0.02	0.04	0.04	0.03	-0.04	-0.24	0.04	0.04	0.00	-0.01	0.03	0.05	0.06	0.01	1.00						
NETBUYER	-0.06	0.00	0.00	0.00	-0.07	-0.13	-0.02	0.01	-0.10	-0.04	0.06	-0.20	-0.05	0.01	0.06	1.00					
INDUSTRYCIT	-0.04	0.00	0.00	0.01	0.05	-0.04	-0.02	0.01	0.00	-0.01	0.05	-0.01	-0.06	0.00	0.04	0.00	1.00				
INDUSTRYPAT	0.01	0.05	0.06	0.06	0.00	-0.16	0.00	0.03	0.07	-0.01	0.04	-0.02	-0.04	-0.02	0.06	0.05	0.39	1.00			

(continued)

	AGE	AQUISITIONS	AQUISITIONS_1	AQUISITIONS_2	CASHHOLDINGS	COMPENSATION	CROSSBOAR1	DIVSERSIF1	DUALITY	EPS	FEMALE	FOUNDER	GENDER	GROWTH1Y	HOLDER67	NETBUYER	INDUSTRYCIT	INDUSTRYPAT	INDUSTRYRD	INSIDE
INDUSTRYRD	-0.07	-0.02	-0.02	-0.01	0.25	0.05	-0.05	0.01	-0.03	0.02	0.00	0.10	0.00	0.00	0.07	-0.03	0.25	0.27	<b>1.00</b>	
INSIDE	0.17	0.03	0.02	0.04	-0.06	-0.02	0.02	0.02	0.06	0.02	-0.02	0.04	0.03	-0.02	0.04	-0.02	-0.03	-0.01	-0.03	<b>1.00</b>
INTCITATIONS	-0.07	0.06	0.06	0.07	0.19	-0.04	0.02	0.04	-0.02	-0.01	-0.03	0.03	-0.01	0.00	0.02	0.02	<b>0.71</b>	0.21	0.24	-0.06
INTCITATIONS1	-0.07	0.06	0.07	0.08	0.18	-0.04	0.01	0.04	-0.02	-0.01	-0.03	0.03	-0.01	0.00	0.03	0.01	0.58	0.23	0.24	-0.06
INTCITATIONS2	-0.07	0.07	0.08	0.08	0.19	-0.06	0.01	0.05	-0.02	-0.01	-0.03	0.04	0.00	0.00	0.03	0.01	0.54	0.26	0.24	-0.05
INTPATENTS	-0.06	0.11	0.12	0.13	0.19	-0.14	0.04	0.07	0.01	-0.01	-0.05	0.02	0.02	0.00	0.04	0.07	0.31	0.57	0.28	-0.05
INTPATENTS1	-0.06	0.11	0.11	0.12	0.19	-0.15	0.03	0.07	0.01	-0.01	-0.05	0.03	0.02	0.00	0.05	0.07	0.30	0.56	0.28	-0.05
INTPATENTS2	-0.06	0.10	0.11	0.12	0.20	-0.15	0.03	0.07	0.01	-0.01	-0.05	0.03	0.02	0.00	0.06	0.07	0.31	0.55	0.28	-0.05
INTRD	-0.09	0.06	0.06	0.06	0.35	0.04	0.02	0.06	-0.05	-0.01	-0.05	0.14	0.05	0.02	0.05	-0.03	0.15	0.16	<b>0.77</b>	-0.02
INTRD1	-0.09	0.05	0.06	0.06	0.35	0.04	0.02	0.06	-0.05	-0.01	-0.05	0.14	0.04	0.02	0.05	-0.03	0.15	0.16	<b>0.75</b>	-0.02
INTRD2	-0.09	0.05	0.06	0.07	0.35	0.04	0.02	0.06	-0.06	-0.01	-0.05	0.14	0.05	0.02	0.05	-0.02	0.15	0.15	<b>0.74</b>	-0.02
KZINDEX	-0.01	0.02	0.02	0.02	-0.06	0.01	0.02	0.01	0.04	0.00	0.00	0.01	-0.01	0.00	-0.03	-0.01	0.00	0.02	0.03	0.03
MA	-0.04	0.67	0.42	0.38	-0.13	-0.17	0.62	0.47	0.02	-0.01	-0.05	-0.02	0.07	0.00	0.08	0.03	0.00	0.05	-0.01	0.01
PAYMENT	-0.01	0.39	0.69	0.40	-0.11	-0.12	0.37	0.27	0.01	0.00	-0.04	-0.03	0.05	0.00	0.04	0.02	0.01	0.04	-0.01	0.03
RETURN	-0.01	0.00	-0.01	0.00	0.06	-0.11	0.00	0.00	0.00	0.00	-0.03	0.03	0.02	0.05	0.08	-0.02	-0.01	0.01	0.04	0.05
ROA	0.00	0.08	0.06	0.05	-0.07	-0.25	0.07	0.06	0.03	0.02	0.03	-0.04	0.01	0.03	0.13	-0.02	-0.03	0.08	0.02	0.06
ROE	0.01	0.00	0.01	0.01	0.01	-0.05	0.00	0.01	-0.01	0.24	0.00	0.00	0.00	0.01	0.02	-0.01	-0.02	0.01	0.02	0.02
SIZE	0.10	0.26	0.27	0.28	-0.42	-0.45	0.22	0.20	0.14	0.06	0.01	-0.18	-0.03	-0.07	0.06	0.10	0.05	0.24	-0.16	0.08
TENURE	0.31	-0.06	-0.05	-0.04	0.08	0.17	-0.03	-0.02	0.24	0.07	-0.04	0.36	0.07	0.01	-0.01	-0.18	-0.06	-0.05	-0.01	0.06
TOBIN_Q	-0.01	-0.01	-0.01	-0.01	0.09	0.01	0.00	-0.01	-0.02	-0.01	-0.01	0.03	0.01	0.01	0.01	-0.01	0.01	0.01	0.05	-0.02

(continued)

	INTCITATIONS	INTCITATIONS1	INTCITATIONS2	INTPATENTS	INTPATENTS1	INTPATENTS2	INTRD	INTRD1	INTRD2	KZINDEX	MA01	PAYMENT	RETURN	ROA	ROE	SIZE	TENURE	TOBIN_Q	
INTCITATIONS	1.00																		
INTCITATIONS1	<b>0.85</b>	1.00																	
INTCITATIONS2	<b>0.82</b>	<b>0.86</b>	1.00																
INTPATENTS	0.65	0.65	0.67	1.00															
INTPATENTS1	0.64	0.67	0.68	<b>0.98</b>	1.00														
INTPATENTS2	0.64	0.66	<b>0.70</b>	<b>0.97</b>	<b>0.98</b>	1.00													
INTRD	0.42	0.42	0.43	0.49	0.49	0.49	1.00												
INTRD1	0.42	0.42	0.43	0.49	0.49	0.49	<b>0.98</b>	1.00											
INTRD2	0.42	0.43	0.43	0.49	0.49	0.49	<b>0.96</b>	<b>0.98</b>	1.00										
KZINDEX	-0.02	-0.01	0.00	0.00	0.00	-0.01	0.02	0.01	0.00	1.00									
MA	0.08	0.08	0.08	0.13	0.13	0.12	0.07	0.07	0.07	0.03	1.00								
PAYMENT	0.07	0.08	0.09	0.10	0.09	0.10	0.07	0.07	0.07	0.02	0.34	1.00							
RETURN	0.01	0.00	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.01	0.00	0.00	1.00						
ROA	-0.07	-0.06	-0.04	-0.01	-0.01	0.00	-0.05	-0.05	-0.05	-0.08	0.08	0.04	0.24	1.00					
ROE	-0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.00	-0.01	0.01	0.13	0.33	1.00				
SIZE	-0.03	-0.02	-0.01	0.11	0.11	0.10	-0.23	-0.24	-0.24	0.03	0.24	0.18	-0.03	0.26	0.03	1.00			
TENURE	-0.08	-0.08	-0.07	-0.10	-0.10	-0.10	0.00	0.00	-0.01	0.02	-0.07	-0.03	-0.01	-0.01	0.01	-0.16	1.00		
TOBIN_Q	-0.01	0.00	-0.01	-0.01	-0.01	-0.01	0.04	0.04	0.04	0.00	-0.03	-0.02	-0.01	-0.08	0.00	-0.08	0.01	1.00	

## Appendix E Results from hypothesis 1 (full table)

Panel A: Dependent Variable = MA (binary variable)						
	(1)	(2)	(3)	(4)	(5)	(6)
IndustryCit	0.008*** (0.004)					
IndustryPat		0.039*** (0.011)				
IndustryRD			0.044*** (0.007)			
IntCitations				0.120*** (0.023)		
IntPatents					0.319*** (0.051)	
IntRD						0.067*** (0.006)
Tobin_Q	0.000** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000** (0.000)	0.000*** (0.000)
Cashholdings	-0.134*** (0.025)	(0.146) *** (0.026)	-0.159*** (0.025)	-0.142*** (0.025)	-0.165*** (0.027)	-0.173*** (0.026)
Size	0.033*** (0.003)	0.030*** (0.003)	0.035*** (0.003)	0.033*** (0.003)	0.029*** (0.003)	0.035*** (0.003)
ROA	0.086*** (0.029)	0.087*** (0.028)	0.083*** (0.029)	0.089*** (0.029)	0.094*** (0.028)	0.085*** (0.029)
ROE	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Growth1y	0.006 (0.005)	0.006 (0.005)	0.006 (0.005)	0.006 (0.005)	0.006 (0.005)	0.006 (0.005)
EPS	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Return	-0.005 (0.031)	-0.007 (0.031)	-0.006 (0.031)	-0.006 (0.031)	-0.008 (0.031)	-0.006 (0.031)
KZindex	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Diversify	0.295*** (0.010)	0.295*** (0.010)	0.293*** (0.010)	0.294*** (0.010)	0.294*** (0.010)	0.292*** (0.010)
Payment	0.113*** (0.009)	0.113*** (0.009)	0.112*** (0.009)	0.113*** (0.009)	0.113*** (0.009)	0.111*** (0.009)
Intercept	-0.432*** (0.063)	-0.350*** (0.076)	-0.493*** (0.058)	-0.425*** (0.063)	-0.326*** (0.063)	-0.457*** (0.061)
Firm fixed effects	No	No	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,045	12,045	12,045	12,045	12,045	12,045
R <sup>2</sup>	0.289	0.290	0.290	0.289	0.291	0.291

<b>Panel B: Dependent Variable = MA (binary variable)</b>						
	(7) - 1y	(8) - 2y	(9) - 1y	(10) - 2y	(11) - 1y	(12) - 2y
IntCitations	0.140*** (0.042)	0.150*** (0.035)				
IntPatents			0.316*** (0.048)	0.318*** (0.048)		
IntRD					0.070*** (0.007)	0.078*** (0.007)
Tobin_Q	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)	0.000*** (0.000)
Cashholdings	-0.144*** (0.026)	-0.146*** (0.026)	-0.165*** (0.026)	-0.166*** (0.027)	-0.174*** (0.027)	-0.180*** (0.027)
Size	0.033*** (0.003)	0.033*** (0.003)	0.029*** (0.003)	0.029*** (0.003)	0.035*** (0.003)	0.035*** (0.003)
ROA	0.090*** (0.028)	0.089*** (0.028)	0.093*** (0.028)	0.093*** (0.028)	0.085*** (0.029)	0.084*** (0.029)
ROE	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Growth1y	0.006 (0.005)	0.006 (0.005)	0.006 (0.005)	0.006 (0.005)	0.006 (0.005)	0.006 (0.005)
EPS	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Return	-0.006 (0.031)	-0.006 (0.031)	-0.008 (0.031)	-0.008 (0.031)	-0.006 (0.031)	-0.006 (0.031)
KZindex	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Diversify	0.294*** (0.010)	0.294*** (0.010)	0.294*** (0.010)	0.294*** (0.010)	0.292*** (0.010)	0.291*** (0.010)
Payment	0.112*** (0.009)	0.112*** (0.009)	0.113*** (0.009)	0.113*** (0.009)	0.111*** (0.009)	0.111*** (0.009)
Intercept	-0.419*** (0.061)	-0.413*** (0.063)	-0.328*** (0.064)	-0.326*** (0.065)	-0.458*** (0.061)	-0.464*** (0.061)
Firm fixed effects	No	No	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,045	12,045	12,045	12,045	12,045	12,045
R <sup>2</sup>	0.289	0.289	0.291	0.291	0.291	0.292

## Appendix F Results from hypothesis 2 (full table)

Panel A: Dependent Variable = AQUISITION						
	Innovation Variable					
	IndustryCit	IndustryPat	IndustryRD	IntCitations	IntPatents	IntRD
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Innovation Variable</i>	0.079*** (0.029)	0.057 (0.054)	0.087*** (0.020)	0.464*** (0.142)	0.580** (0.286)	0.156*** (0.020)
Holder67	0.042* (0.022)	0.009 (0.034)	-0.001 (0.031)	0.034 (0.026)	0.011 (0.038)	0.013 (0.031)
Holder67* <i>InnovVar</i>	-0.106*** (0.039)	-0.027 (0.064)	-0.002 (0.031)	-0.382*** (0.123)	-0.160 (0.294)	-0.051 (0.038)
Age	-0.004* (0.002)	-0.004* (0.002)	-0.004* (0.002)	-0.004* (0.002)	-0.004* (0.002)	-0.004* (0.002)
Gender	0.138** (0.052)	0.140** (0.052)	0.140** (0.052)	0.140** (0.051)	0.138** (0.052)	0.137** (0.052)
Stockown	0.422** (0.120)	0.415** (0.127)	0.424** (0.116)	0.431** (0.121)	0.436** (0.129)	0.431** (0.116)
Compensation	0.004 (0.057)	0.010 (0.054)	0.007 (0.055)	0.009 (0.056)	0.018 (0.054)	0.007 (0.056)
Tenure	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)
Duality	-0.065* (0.029)	-0.067* (0.029)	-0.065* (0.029)	-0.063* (0.029)	-0.066* (0.029)	-0.065* (0.029)
Inside	-0.010 (0.024)	-0.009 (0.024)	-0.011 (0.024)	-0.009 (0.025)	-0.007 (0.024)	-0.010 (0.023)
Female	-0.021 (0.013)	-0.020 (0.012)	-0.020 (0.012)	-0.021 (0.013)	-0.020 (0.012)	-0.020 (0.012)
Founder	0.193** (0.056)	0.194** (0.057)	0.187** (0.058)	0.191** (0.056)	0.189** (0.057)	0.187** (0.058)
Tobin_Q	0.006 (0.003)	0.005 (0.003)	0.005 (0.003)	0.006 (0.003)	0.005 (0.003)	0.005 (0.003)
Cashholdings	0.039 (0.065)	0.031 (0.076)	-0.001 (0.069)	0.022 (0.067)	-0.004 (0.081)	-0.028 (0.069)
Size	0.136** (0.007)	0.134** (0.009)	0.139** (0.007)	0.136** (0.007)	0.131** (0.008)	0.140** (0.007)
ROA	0.254** (0.092)	0.248** (0.089)	0.238** (0.092)	0.269** (0.089)	0.267** (0.087)	0.246** (0.092)
ROE	-0.003** (0.001)	-0.003** (0.001)	-0.003** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)
Growthly	0.012 (0.013)	0.013 (0.013)	0.014 (0.013)	0.013 (0.013)	0.013 (0.013)	0.014 (0.013)
EPS	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)
Return	0.000 (0.068)	0.000 (0.068)	-0.002 (0.070)	0.000 (0.069)	-0.001 (0.069)	-0.001 (0.069)
KZindex	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)
Diversify	1.451** (0.061)	1.451** (0.061)	1.446** (0.061)	1.450** (0.061)	1.450** (0.061)	1.445** (0.061)
Payment	0.381** (0.036)	0.381** (0.037)	0.380** (0.037)	0.380** (0.036)	0.381** (0.037)	0.379** (0.037)
Intercept	-2.962** (0.197)	-2.900** (0.249)	-3.132** (0.194)	-2.955** (0.199)	-2.836** (0.231)	-3.065** (0.204)
Firm fixed effects	No	No	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,705	7,705	7,705	7,705	7,705	7,705
R <sup>2</sup>	0.490	0.490	0.490	0.490	0.490	0.490

**Panel B: Dependent Variable = AQUISITION**

<i>Innovation Variable</i>	<b>Innovation Variable</b>					
	IntCitations		IntPatents		IntRD	
	(7) - 1y	(8) - 2y	(9) - 1y	(10) - 2y	(11) - 1y	(12) - 2y
	0.335*** (0.123)	0.526*** (0.144)	0.539* (0.281)	0.520* (0.271)	0.165*** (0.024)	0.168*** (0.023)
Holder67	0.031 (0.032)	0.035 (0.038)	0.008 (0.039)	0.011 (0.041)	0.017 (0.031)	0.019 (0.031)
Holder67* <i>InnovVar</i>	-0.344*** (0.108)	-0.413** (0.196)	-0.118 (0.281)	-0.166 (0.290)	-0.061 (0.040)	-0.067* (0.041)
Age	-0.004* (0.002)	-0.004* (0.002)	-0.004* (0.002)	-0.004* (0.002)	-0.004* (0.002)	-0.004* (0.002)
Gender	0.140** (0.052)	0.140** (0.052)	0.138** (0.052)	0.139** (0.052)	0.137** (0.052)	0.137** (0.052)
Stockown	0.425** (0.123)	0.426** (0.122)	0.433** (0.128)	0.430** (0.127)	0.435** (0.117)	0.439** (0.118)
Compensation	0.008 (0.057)	0.013 (0.057)	0.018 (0.054)	0.018 (0.054)	0.006 (0.056)	0.005 (0.056)
Tenure	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)
Duality	-0.063* (0.029)	-0.063* (0.029)	-0.066* (0.029)	-0.066* (0.029)	-0.065* (0.029)	-0.065* (0.029)
Inside	-0.009 (0.025)	-0.009 (0.025)	-0.008 (0.024)	-0.008 (0.024)	-0.010 (0.023)	-0.010 (0.023)
Female	-0.021 (0.012)	-0.021 (0.012)	-0.020 (0.012)	-0.020 (0.012)	-0.020 (0.012)	-0.020 (0.012)
Founder	0.193** (0.057)	0.192** (0.057)	0.189** (0.057)	0.190** (0.057)	0.187** (0.058)	0.187** (0.058)
Tobin_Q	0.006 (0.003)	0.006 (0.003)	0.005 (0.003)	0.005 (0.003)	0.005 (0.003)	0.005 (0.003)
Cashholdings	0.031 (0.066)	0.017 (0.069)	-0.003 (0.081)	0.002 (0.079)	-0.031 (0.070)	-0.033 (0.069)
Size	0.136** (0.007)	0.135** (0.007)	0.131** (0.008)	0.132** (0.008)	0.140** (0.007)	0.140** (0.008)
ROA	0.261** (0.090)	0.267** (0.090)	0.264** (0.087)	0.263** (0.088)	0.245** (0.091)	0.246** (0.093)
ROE	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)
Growth1y	0.013 (0.013)	0.013 (0.013)	0.013 (0.013)	0.013 (0.013)	0.014 (0.013)	0.014 (0.013)
EPS	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)
Return	0.001 (0.069)	0.002 (0.068)	-0.001 (0.069)	-0.001 (0.068)	-0.002 (0.069)	-0.003 (0.069)
KZindex	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)	0.000* (0.000)
Diversify	1.450** (0.061)	1.450** (0.061)	1.450** (0.061)	1.450** (0.061)	1.445** (0.062)	1.445** (0.061)
Payment	0.380** (0.036)	0.380** (0.037)	0.381** (0.037)	0.381** (0.037)	0.379** (0.037)	0.378** (0.037)
Intercept	-2.961** (0.195)	-2.934** (0.197)	-2.845** (0.2291)	-2.859** (0.223)	-3.070** (0.203)	-3.070** (0.208)
Firm fixed effects	No	No	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,705	7,705	7,705	7,705	7,705	7,705
R <sup>2</sup>	0.490	0.490	0.490	0.490	0.490	0.490

## Appendix G Results form hypothesis 3 (full table)

Dependent Variable = Innovation Variables						
	IntCitations		IntPatents		IntRD	
	(1)	(2)	(3)	(4)	(5)	(6)
Holder67	0.0072*** (0.0016)	0.0076*** (0.0010)	0.0043*** (0.0011)	0.0048*** (0.0006)	0.0264*** (0.0063)	0.0306*** (0.0050)
Aquisitions_1y	0.0021*** (0.0007)		0.0017 (0.0011)		0.0235*** (0.0031)	
Aquisitions_2y		0.0022*** (0.0006)		0.0019* (0.0011)		0.0232*** (0.0029)
Holder67* Aquisitions_1y	-0.0007 (0.0010)		-0.0001 (0.0013)		0.0002 (0.0036)	
Holder67* Aquisitions_2y		-0.0002 (0.0009)		-0.0000 (0.0012)		-0.0005 (0.0036)
Age	-0.0004 (0.0001)	-0.0003** (0.0001)	-0.0003** (0.0000)	-0.0003** (0.0000)	-0.0032** (0.0004)	-0.0032** (0.0004)
Gender	-0.0103** (0.0029)	-0.0106** (0.0031)	0.0030 (0.0017)	0.0032 (0.0020)	0.0017 (0.0122)	-0.0044 (0.0096)
Stockown	-0.0200* (0.0085)	-0.0199* (0.0099)	-0.0523** (0.0050)	-0.0526** (0.0059)	-0.1755** (0.0452)	-0.1701** (0.0514)
Compensation	-0.0162** (0.0058)	-0.0143* (0.0060)	-0.0267** (0.0028)	-0.0269** (0.0032)	-0.0431* (0.0212)	-0.0470* (0.0233)
Tenure	-0.0004** (0.0001)	-0.0004** (0.0001)	-0.0001 (0.0000)	-0.0001 (0.0000)	0.0006 (0.0004)	0.0005 (0.0004)
Duality	-0.0008 (0.0018)	-0.0011 (0.0019)	0.0030* (0.0012)	0.0032** (0.0012)	0.0041 (0.0069)	0.0056 (0.0068)
Inside	-0.0048** (0.0016)	-0.0045** (0.0017)	-0.0045** (0.0009)	-0.0042** (0.0009)	0.0066 (0.0063)	0.0082 (0.0055)
Female	0.0013 (0.0009)	0.0015 (0.0010)	0.0001 (0.0007)	0.0003 (0.0007)	0.0005 (0.0032)	-0.0001 (0.0034)
Founder	0.0074* (0.0037)	0.0072 (0.0040)	0.0129** (0.0011)	0.0127** (0.0012)	0.0775** (0.0033)	0.0784** (0.0031)
Tobin_Q	-0.0003 (0.0001)	-0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0002)	0.0024** (0.0006)	0.0027** (0.0008)
Cashholdings	0.0798** (0.0055)	0.0832** (0.0051)	0.0965** (0.0023)	0.0969** (0.0022)	0.5238** (0.0152)	0.5195** (0.0154)
Size	0.0052** (0.0006)	0.0053** (0.0005)	0.0126** (0.0004)	0.0127** (0.0003)	-0.0234** (0.0022)	-0.0237** (0.0022)
ROA	-0.0633** (0.0115)	-0.0644** (0.0120)	-0.0414** (0.0063)	-0.0428** (0.0064)	-0.0032 (0.0312)	-0.0065 (0.0319)
ROE	0.0003** (0.0001)	0.0003** (0.0001)	0.0002** (0.0001)	0.0002** (0.0001)	0.0003 (0.0003)	0.0003 (0.0003)
Growth1y	-0.0006 (0.0005)	-0.0008 (0.0005)	-0.0010* (0.0004)	-0.0010** (0.0004)	-0.0108** (0.0029)	-0.0101** (0.0029)
EPS	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)	0.0000* (0.0000)
Return	-0.0047 (0.0056)	-0.0036 (0.0059)	0.0017 (0.0041)	0.0021 (0.0043)	0.0132 (0.0186)	0.0113 (0.0196)
KZindex	-0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000* (0.0000)	0.0000* (0.0000)
Intercept	-0.0875** (0.0176)	-0.0928** (0.0134)	-0.2858** (0.0101)	-0.2903** (0.0077)	0.7382** (0.0934)	0.7542** (0.0977)
Firm fixed effects	No	No	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,376	6,894	7,376	6,894	7,376	6,894
R <sup>2</sup>	0.256	0.256	0.417	0.416	0.369	0.366