CEO Overconfidence and the Influence on Firm Innovation

A study about well-established multinationals during 2008-2016

David Vermaut

Nova School of Business & Economics

International Masters in Management

David Vermaut (27617)

Supervisor: Prof. Dr. Boris Lokshin

Co-supervisor: Prof. Dr. Miguel Muñoz Duarte

Maastricht, January 2018

Statement of Originality

I hereby declare that:

- The master thesis 'CEO Overconfidence and the Influence on Firm Innovation - a study about well-established multinationals during 2008-2016' is exclusively written by David Vermaut

- Literature quotations, research findings and thoughts of other authors, as well as any form of information source have been properly referenced according to standards set by the American Psychological Association (APA)

- This master thesis has only been presented to the board of examination of Maastricht University, SBE and Universidade NOVA de Lisboa.

- I am aware of the fraud sanctions as stated in the Education and Examination Regulations (EERs) of the SBE.

Maastricht, 03-01-2018

David Vermaut

Acknowledgements

I would like to thank several people who continuously supported me throughout my thesis. Without their feedback and continuous encouragement, the completion of this thesis would not have been possible.

First, I would like to express my sincere appreciation and gratitude to Prof. Dr. Boris Lokshin who gave me the opportunity to write this master's thesis at Maastricht University and who provided me with the required data to conduct my analysis. Furthermore, I am also very grateful to Prof. Dr. Miguel Muñoz Duarte for being my co-supervisor at Nova School of Business & Economics. They provided me with constructive and valuable feedback. Moreover, they were always prepared to guide me in the right direction when necessary.

In addition, I also want to express gratitude to André Matos, Tobias Büchsenschütz, Laura Smulders, and Floris Van Der Veer, for collaborating to gather the necessary annual reports and shareholder letters. This successful cooperation enabled me to gain timely access to the input data that was needed.

Subsequently, I would like to acknowledge my parents, my sister, and my family and friends for providing me with unconditional support throughout the writing of this master's thesis.

And lastly, I particularly thank Hugo Yu, Kayla Urbanowski, and Robert Pollock for proofreading my thesis.

David Vermaut

"Unbridled confidence and arrogance are characteristics of successful business visionaries."

Vinod Khosla – Co-founder of Sun Microsystems

Abstract

Previous research has mainly investigated the effect of CEO overconfidence on financial outcomes. However, only little research has been conducted about the influence of CEO overconfidence on firm innovation. Moreover, no studies have examined when CEO background characteristics such as tenure and power distance, influence the latter relationship. Consequently, the purpose of this master's thesis is to analyze the impact of CEO overconfidence on firm innovation, and to explore whether tenure and power distance influence this relationship.

Using shareholder letters to measure overconfidence, the results indicate that over the 2008-2016 period, CEO overconfidence positively influences firm innovation for well established-multinationals active in non-innovative industries. Nonetheless, for well-established multinationals in innovative industries, there exists no relationship between CEO overconfidence and innovation. Furthermore, in line with the theoretical research, the findings demonstrate a negative moderating impact of tenure in both innovative and non-innovative industries. Unlike CEO tenure, the influence of CEO power distance could not be investigated due to correlational issues with both CEO overconfidence and CEO tenure.

By highlighting the importance of CEO overconfidence in explaining a valuable organizational outcome such as firm innovation and by unveiling the moderating impact of CEO tenure, the thesis contributes to the existing upper-echelons and tone-at-the-top literature.

Keywords: CEO overconfidence, firm innovation, CEO tenure, CEO power distance, multinationals, industry innovativeness, upper-echelon theory, tone at the top

---

Table of Contents

List of Tables

List of Figures

1. Introduction

Apple is generally considered one of the world's most innovative companies. For eleven consecutive years, Apple remains at the top of Boston Consulting Group (BCG) Global Innovation List (Chandran, 2017). Moreover, during the last decade they successfully introduced several disruptive inventions such as iTunes, the iPod, the iPhone, and the iPad. Nonetheless, the Chief Executive Officer (CEO), Steve Jobs, who was responsible for this success, has always been considered a prime example of an overconfident CEO. Jobs always trusted his own revolutionary vision and was known for not being receptive to feedback and focus groups (Adams, 2012).

In line with this example, the purpose of this thesis is to investigate the effect of CEO overconfidence on a firm's innovation performance. Overconfidence is defined as the phenomenon whereby an individual's certainty about his/her predictions (Busenitz & Barney, 1994), abilities (Galasso & Simcoe, 2011; Gervais & Odean, 2001; Hirshleifer, Low, & Teoh, 2012a), and knowledge (Friedman, 2007) exceeds the accuracy of these (Klayman, Soll, González-Vallejo, & Barlas, 1999). Moreover, overconfidence is in conflict with standard economic models (Galasso & Simcoe, 2011) and rational decision making. Nonetheless, a large part of the literature divulges that most individuals are systematically overconfident about their abilities and 'beliefs' (Gervais & Odean, 2001). Exemplary, Deery (1999) indicates how young drivers tend to overestimate their own driving abilities compared to more experienced drivers. Additionally, when looking at it on an organizational level overconfidence appears to be omnipresent, as demonstrated in the 'Steve Jobs' example. Therefore, there exists a growing interest on the effect that CEO overconfidence has on several organizational outcomes.

Previous research mainly looked into the effect of CEO overconfidence on financial outcomes such as dividend policy (Deshmukh, Goel, & Howe, 2013), merger and acquisition activity (Brown &

Sarma, 2007; Ferris, Jayaraman, & Sabherwal, 2013; Malmendier & Tate, 2008), corporate investment (Malmendier & Tate, 2005), trading performance (Barber & Odean, 2001), and earnings management (Hribar & Yang, 2010; Schrand & Zechman, 2012). However, the effect of CEO overconfidence on innovation has received less attention. Nonetheless, in the current era of globalization, internationalization, and technological revolution, a corporate culture that fosters innovation has become crucial (Knight & Cavusgil, 2004; Tellis, Prabhu, & Chandy, 2009).

Previous research by Galasso and Simcoe (2011), Hirshleifer et al. (2012a), and Engelen, Neumann, and Schwens (2015) already demonstrated the existence of a positive relationship between both constructs. However, these studies measured overconfidence based on the 'in-the-money stock options' methodology by Malmendier and Tate (2005) or on how CEOs are portrayed in the news media. However, no prior research has used shareholder letters to explore the relationship between CEO overconfidence and innovation. Secondly, previous research also did not examine how a CEO's background affects this relationship. Nonetheless, the attitude that an overconfident CEO has towards innovation may be modified by several background variables, such as tenure in the CEO position (Musteen, Barker III, & Baeten, 2010) and cultural values (Geletkanycz, 1997; Jalbert, Chan, Jalbert, & Landry, 2007). CEOs tend to grow stale in the saddle (Miller, 1991) and establish fixed routines as their tenure increases (Musteen et al., 2010), producing a modifying influence on the relationship between CEO overconfidence and firm innovation. Furthermore, cultural values, such as the distribution of power between a CEO and his organizational members (Morrison & Milliken, 2000; Shane, 1993), influence a CEO's attitude towards change and innovation. Consequently, this thesis will also explore the moderating effect of CEO background variables – proxied by CEO tenure and CEO power distance – on the relationship between CEO overconfidence and innovation. And finally, the research by Galasso

and Simcoe (2011) and Hirshleifer et al. (2012a) empirically validated their hypotheses on data from before 2005. Hence, it is value-adding to reconfirm the relationship between CEO overconfidence and innovation, when considering that the financial crisis in 2008 affected the perception and acceptance about overconfidence,

Thus, this thesis aspires to cover current gaps in the literature by employing an uncommon tool, namely shareholder letters, to measure CEO overconfidence. Based on the importance of leadership as a language-based phenomenon, such a meaning-oriented method could be better suited when determining CEO overconfidence (Amernic, Craig, & Tourish, 2010; Pondy, McCall, & Lombardo, 1989). Moreover, by considering the moderating effect of a CEO's background – proxied by CEO tenure and CEO power distance, this research provides new insights about when CEO overconfidence impacts innovation. And lastly, by examining the period of 2008-2016, this thesis takes a present-day view on the subject. This is done in contrast to previous studies by Galasso and Simcoe (2011) and Hirshleifer et al. (2012a), who looked into the time periods 1980-1994 and 1993-2003, respectively.

To gain an understanding about the effect of CEO overconfidence on innovation, the remainder of this thesis proceeds as follows. Firstly, section 2 introduces the theoretical concepts of overconfidence and innovation, elaborates how CEO overconfidence impacts innovation and explores the impact of a CEO's background on the latter relationship. Next, section 3 outlines the research design that is employed during the thesis. Subsequently, section 4 summarizes the results and examines whether the results support the anticipated hypotheses. And finally, section 5 discusses the results and concludes this master's thesis.

2. Theoretical background

To lay the conceptual foundation for the thesis, this section firstly clarifies the overarching theory, namely upper echelons theory (UET). Subsequently, an introduction is given to the constructs of 'overconfidence' and 'firm innovation'. And lastly, this section develops the hypotheses that will be investigated throughout the thesis, being, the impact of CEO overconfidence on firm innovation, and how CEO background might moderate the latter relationship.

2.1 Upper Echelons Theory

The broader research domain in which this thesis is situated, is the Upper Echelons Theory (UET). UET argues that organizational outcomes are reflections of the cognitive biases and managerial beliefs of powerful actors within an organization. This is based on the idea that upper echelons inevitably manage an organization based on their personal values, beliefs, and characteristics. Accordingly, based on top executives' psychological characteristics it becomes possible to partially predict organizational outcomes (Hambrick & Mason, 1984) and culture (Berson, Oreg, & Dvir, 2008). In line with this outlook, the thesis explores whether an association exists between the cognitive bias 'overconfidence' and 'firm innovation'.

In general, UET employs observable characteristics (for instance age, functional tracks, experiences or education) to proxy managerial beliefs and biases of the top management team (TMT). Nonetheless, this thesis directly measures overconfidence by employing shareholder letters and linguistic software. Moreover, instead of looking at the entire top management team (TMT) to predict an organizational outcome, this thesis focusses on the CEO. Because the CEO is the most influential and powerful member within the TMT, this executive will also have the most fundamental role in shaping and guiding an organization (Barker III & Mueller, 2002; Berson et al., 2008).

2.2 Overconfidence

'Overconfidence' or the act of being exceedingly 'self-assured', is commonly defined as the appearance of extreme self-certainty about an individual's predictions, while this is not in line with the accuracy of these (Hirshleifer et al., 2012a; Klayman et al., 1999; Simon & Houghton, 2003). However, overconfidence is not just limited to predictions. Overconfidence also handles about an unjustifiable degree of confidence about an individual's abilities (Friedman, 2007; Galasso & Simcoe, 2011; Grinblatt & Keloharju, 2009) and knowledge (Hayward, Shepherd, & Griffin, 2006). Nonetheless, it is also important to highlight how overconfidence differs from extreme certainty. Whenever an individual is extremely confident in his beliefs, but is faultless, this is not considered overconfident (Simon & Houghton, 2003). Moreover, overconfident decision-makers are depicted as persons who are excessively optimistic during their initial assessment (Busenitz & Barney, 1994), avoid negative feedback (Ehrlinger, Mitchum, & Dweck, 2016), only slowly incorporate additional information (Busenitz & Barney, 1994), and overestimate the value created by undertaking a particular project (Malmendier & Tate, 2015; Wong, Lee, & Chang, 2017).

In addition, the psychology literature categorizes overconfidence as a cognitive or behavioral bias (Busenitz & Barney, 1994; Friedman, 2007; Staw, 1991). Such a cognitive bias influences the decision rules, opinions, and cognitive mechanisms during an individual's decision-making process. Consequently, as argued by the upper-echelons perspective, top management's cognitive biases shape organizational outcomes (Hambrick & Mason, 1984). Besides, Haley and Stumpf (1989) and Busenitz and Barney (1994) also recognize how cognitive biases, such as overconfidence, are vital in explaining differences in executives' strategic decisions.

When looking into the leading causes of overconfidence, Russo and Schoemaker (1992) acknowledge mainly two of them. Firstly, Russo and Schoemaker (1992) state how availability and

hindsight are important in explaining overconfidence. These principles stipulate how overconfident executives have difficulties in imagining all possible ways in which a project can unfold. Hence, overconfident individuals tend to present a project more predictable than it is. By doing so, they often oversee the possibility of non-success or even failure (Camerer & Lovallo, 1999). And secondly, Russo and Schoemaker (1992) also disclose how anchoring and confirmation biases foster overconfidence. These concepts indicate that overconfident executives anchor on one particular idea and additionally seek confirmation for this initial idea. Besides, other research by Ehrlinger et al. (2016) also focusses on the confirmation bias as an important trigger for overconfidence.

Throughout all studies that have been measuring executive overconfidence, extant methods were employed (Bollaert & Petit, 2010). Psychometric personality tests (Graham, Harvey, & Puri, 2013), in-the-money stock options (Malmendier & Tate, 2005, 2008), media coverage (Hirshleifer et al., 2012a), shareholder letters (Brennan & Conroy, 2013), and relative compensation (Hayward & Hambrick, 1997) are all examples of possible overconfidence measures. However, Hill, Kern, and White (2014) argue that some of these measures score low on content validity. Hence, some overconfidence measures do not adequately review for executive overconfidence. Nonetheless, shareholder letters achieve a good score for content validity. The strength of this approach is that it reflects the mindset of top executives (Rovenpor, 1993) while accounting for leadership as a language-based phenomenon (Fairhurst, 2008; Pondy et al., 1989). Besides, Malmendier and Tate (2015) also indicate the potential shareholder letters have in reflecting overconfidence because of the improving capabilities of text analysis software. In the research design section, this thesis will go into more detail about the methodology that is employed when consulting these shareholder letters.

2.3 Firm innovation

This thesis examines how CEO overconfidence, as defined in the previous section, impacts firm innovation. Accordingly, it is essential to briefly unfold why the research examines the particular organizational outcome of firm innovation.

Drucker (1998) describes innovation as the effort to create purposeful, focused change in an enterprise's economic or social potential. Moreover, Drucker (2014) also argues that because of increasing globalization, fast-changing markets, sustainability issues, and the emergence of digital technologies, innovation has never been as important as today in creating a competitive advantage. However, for many companies, the innovation process is a risky one as it is characterized by many complex, uncertain, but high-impact decisions. In other words, Miles, Snow, Meyer, and Coleman (1978) describe organizations that permanently pursue an innovative corporate culture as 'prospectors'. These prospectors focus on exploring new opportunities and on preserving close alignment with the external environment. Furthermore, there exist several types of innovation, ranging from radical to incremental ones. Papadakis and Bourantas (1998) divide innovation into four groups – namely the introduction of new products, the significant innovation in existing products, the incremental innovation in existing products, and the innovation in process technology.

2.4 The influence of CEO overconfidence on firm innovation

Firstly, several studies argue that overconfident CEOs are keener on accepting risk and undertaking risky projects (Barber & Odean, 2001; Goel & Thakor, 2008; Simon & Houghton, 2003). Li and Tang (2010) and Kahneman and Lovallo (1993) support this by acknowledging that overconfident CEOs largely underestimate uncertainty and the probability on failure. Hence, they do not perceive uncertainty in the same way as rational individuals would. Besides, Simon and Houghton (2003)

and Gervais, Heaton, and Odean (2011) also include 'diagnostic cues' in explaining why overconfident CEOs pursue riskier projects. It is proclaimed that overconfident CEOs overestimate positive cues, while ignoring negative or contradicting cues. The literature defines the latter phenomenon as a 'confirmation bias'. As explained in section 2.1, individuals that suffer from a confirmation bias only explore for confirming evidence, while ignoring contradicting arguments (Russo & Schoemaker, 1989). Consequently, by exaggerating just the positive cues, overconfident CEOs overlook the probability of failure and accept risky projects (Galasso & Simcoe, 2011; Goel & Thakor, 2008). Furthermore, Goel and Thakor (2008) also disclose that overconfident individuals manifest lower cut-off signals in accepting projects. Whereas rational CEOs require higher payoffs to cover for incurring risk, overconfident CEOs embrace the same risk at a lower payoff probability. Therefore, overconfident CEOs engage in value-adding projects that rational CEOs would decline. Taken together, it appears that, because of systematic unawareness of uncertainty, underestimation of the probability on failure, and biased interpretation of diagnostic cues, overconfident CEOs are keener on taking risks. Moreover, it is exactly this risk-taking attitude which positively influences the exploration and innovation process (Hirshleifer et al., 2012a; Levinthal & March, 1993).

Subsequently, overconfident CEOs are also more enthusiastic about their beliefs than other CEOs. By having this attitude, overconfident CEOs convey their enthusiasm on other members within their organization (Russo & Schoemaker, 1989). Additionally, Botelho, Powell, Kincaid, and Wang (2017) emphasize that skilled CEOs engage for organizational impact by instilling confidence that they will lead the team in a successful manner. By having this particular enthusiastic attitude, overconfident CEOs are more likely to instill this confidence among their followers (Engelen et al., 2015). Moreover, Simon and Shrader (2012) argue that it is through the

enthusiastic mindset that overconfident CEOs increase colleagues' motivation, enthusiasm, and perseverance in risk-taking. However, Engelen et al. (2015) also reveal how excessive overconfidence inhibits employee cooperation. When the overconfidence level becomes too high, CEOs tend to see new opportunities everywhere, and thus lose employees' understanding. Typically, employees utilize a conception-matching process when judging if CEO overconfidence is supported. This implies that an organizational member will check if their beliefs regarding feasibility match with the CEO's intentions (Carroll & Bandura, 1987). Nonetheless, this thesis argues that in general overconfident CEOs' enthusiasm fosters organizational acceptance to undertake innovative activities (Stenmark, Shipman, & Mumford, 2011). Consequently, it follows that overconfident CEOs, by having an enthusiastic attitude and mindset, are more beneficial in implementing innovative capacity into an organization.

Finally, Staw (1991), Levinthal and March (1993), and Engelen et al. (2015) also accentuate that overconfident CEOs are more action-oriented than other CEOs. Overconfident CEOs are more pro-active, quick, and decisive when pursuing innovative activities. Instead of extensively collecting, examining, and discussing information, overconfident CEOs exhibit the 'can do' attitude by pushing innovation projects more rapidly. Moreover, the 'herd-argument' by Bernardo and Welch (2001) helps explain why overconfident CEOs are more action-oriented. This argument acknowledges that overconfident individuals are less likely to imitate their peers, by down weighing their input, and thus are more likely to explore their own beliefs. Since the latter individuals do not follow the herd, a higher level of self-determination is unveiled in executing the aspired innovation projects. Consequently, Bernardo and Welch (2001) state that overconfidence encourages organizations not to follow the main path that a herd is taking. It is exactly by being

action-oriented that overconfident CEOs faster depart from proven organizational practices (Engelen et al., 2015).

Consequently, based on the above-mentioned ideas that overconfident CEOs are more risk-taking, have an enthusiastic mindset, and are action-oriented, this thesis hypothesizes the following:

H1: CEO overconfidence positively impacts firm innovation

2.5 CEO background as a moderator

Next to overconfidence, a psychological or cognitive characteristic, CEO background also seems to have a notable effect on firm innovation (Barker III & Mueller, 2002; Papadakis & Bourantas, 1998; Shane, 1992). Musteen et al. (2010) demonstrate that a different background may modify the decisions and beliefs that guide a CEO when making decisions regarding innovation. Consequently, it is vital to explore how a CEO's background affects the relationship between CEO overconfidence and firm innovation. However, since the range of potential CEO background characteristics is rather extensive, this thesis focusses on two of the most salient characteristics, namely CEO tenure (Hambrick & Fukutomi, 1991) and power distance (Geletkanycz, 1997).

2.5.1 CEO tenure

CEO tenure, or the period of time that a CEO occupies the particular position of CEO has been demonstrated to notably influence organizational outcomes (Finkelstein & Hambrick, 1990). Nonetheless, no previous studies have explored whether tenure influences the relationship between CEO overconfidence and firm innovation. Hence, arguments in favor of both a positive and a negative impact can be found.

Studies providing arguments in favor of a positive impact are issued by Musteen et al. (2010) and Brennan and Conroy (2013). These authors argue that CEO overconfidence grows over the time a

CEO is serving within an organization. Hence, respecting H1, it would be assumed that CEO tenure would reinforce the positive effect of CEO overconfidence on innovation capacity (Musteen et al., 2010). Nonetheless, following most of the existing research, this thesis also refutes this line of reasoning.

Firstly, Miller (1991) and McClelland, Liang, and Barker III (2010) argue that an increasing CEO tenure acts in favor of the status quo since longer-tenured CEOs grow stale, establish a known acceptance zone, and become stubborn in their management paradigms. As such, CEOs stick closer to proven organizational practices, and thus become less pro-active and action-oriented. Nonetheless, when a CEO becomes less action-oriented the positive impact of overconfidence on firm innovation decreases. Consequently, the longer a CEO's tenure, the weaker the match between the organizational structure and the external environment, and thus the smaller impact CEO overconfidence has on firm innovation.

Moreover, Hambrick and Fukutomi (1991) and Luo, Kanuri, and Andrews (2014) acknowledge that risk-appetite also evolves when observing the CEO's life cycle. These authors reveal that during initial tenure CEOs are taking more risks, are more open to learning, and are exploring new projects. However, during later stages, CEOs tend to turn risk-averse, depend on internal knowledge, and lose alignment with the external environment. In support of this idea, Bereskin and Hsu (2013) also reported that incumbent CEOs are often underinvesting as they are in favor of a quiet life, instead of incurring risks. However, having a risk-taking attitude is one of the reasons why overconfident CEOs positively impact firm innovation. Consequently, as risk-appetite declines over a CEO's life cycle, the impact of overconfident CEOs on firm innovation will be negatively moderated by tenure.

Consequently, bearing in mind that an increasing tenure reduces risk-appetite and action-orientation, this thesis hypothesizes the following concerning the impact of CEO tenure on the relationship between CEO overconfidence and firm innovation.

H2: The positive association between CEO overconfidence and firm innovation will be negatively influenced by CEO tenure

2.5.2 CEO power distance

The main presumption of this thesis, as elaborated above, posits that CEO overconfidence positively impacts firm innovation. However, differences in national culture[1] also play an important role in explaining the mindset of top executives, especially when considering the open-mindedness towards change (Geletkanycz, 1997). Previous research demonstrates how national culture influences beliefs (Ferris et al., 2013), organizational behavior (Shane, 1993), and interpretations and responses to strategic issues, such as innovation (Schneider & De Meyer, 1991). Moreover, Schneider and De Meyer (1991) reveal that national culture is not just affecting proactivity behavior, but also internally and externally oriented actions. Consequently, depending on their national background, overconfident CEOs will also interpret the same environmental occurrence, in a different way (Shane et al., 1995).

To quantitatively measure the effect of national culture on organizational values, Hofstede (2017) developed six dimensions which, together, comprise national culture. These dimensions consist of power distance, individualism, masculinity, uncertainty avoidance, long-term orientation, and indulgence. However, this thesis just focusses on the potential moderating effect power distance has on the relationship between CEO overconfidence and firm innovation. Power distance handles

[1] Shane, Venkataraman, and MacMillan (1995) define national culture as the set of common values and thoughts that differentiate people from diverse nationalities.

the acceptance and distribution of power between organizational members (Hofstede, 2017). Executives which are low in power distance, pursue equal power distribution, decentralized authority, and informal communication channels between organizational members. On the contrary, executives which unveil a considerable degree of power distance, are in favor of unequal power distribution, bureaucracy, and a hierarchical organizational structure (Geletkanycz, 1997; Zhao, 2005).

Because of the preference for a hierarchical organizational structure and unequal power distribution, power distant CEOs create weaker personal connections with their subordinates (Elenkov & Manev, 2005). For this reason, Shane (1993) also argues that power distant organizations lack informal communication channels between the different hierarchical levels. Moreover, Shane (1993) also indicates that subordinates in power distant organizations are overloaded with detailed tasks and tend to lose their creative freedom. Consequently, an overconfident CEO whose managerial beliefs are dominated by installing a high-power distance culture, discourages enthusiasm and endorses organizational silence (Morrison & Milliken, 2000).

Moreover, Van der Vegt, Van de Vliert, and Huang (2005) illustrate that demographic diversity[2], an environment in which many multinationals are embedded, is negatively associated with firm innovation when power distance is high. This is based on the idea that the input of subordinates, while diverse in outlook, may not be processed by overconfident managers as they consider these ideas as less competent. Again, subordinates feel underappreciated and unmotivated, lack trust, and generate significantly less follower performance (Avolio, Zhu, Koh, & Bhatia, 2004).

[2] This premise was partially supported for the task-oriented demographics (organizational tenure and functional background). However, no confirmation was found for the relations-oriented demographics (age and gender)

Taken together, by discouraging enthusiasm and motivation among subordinates (Simon & Shrader, 2012), and thus deteriorating one of the strengths of an overconfident CEO, it appears that power distance negatively impacts the positive relationship between CEO overconfidence and firm innovation. Furthermore, when taking into account that an individual's national culture cannot be changed over time (Hofstede, 2017) , the above mentioned arguments lead to the third hypothesis.

H3: The positive association between CEO overconfidence and firm innovation will be negatively influenced when a CEO originates from a high-power distance country

2.6 Conceptual model

In summary of the developed hypotheses, Figure 1 displays the conceptual model that will be employed throughout the analysis. This model graphically illustrates the investigated relationships and depicts the expected effect between the variables. In the research design, these variables will be operationalized to conduct the statistical analysis.

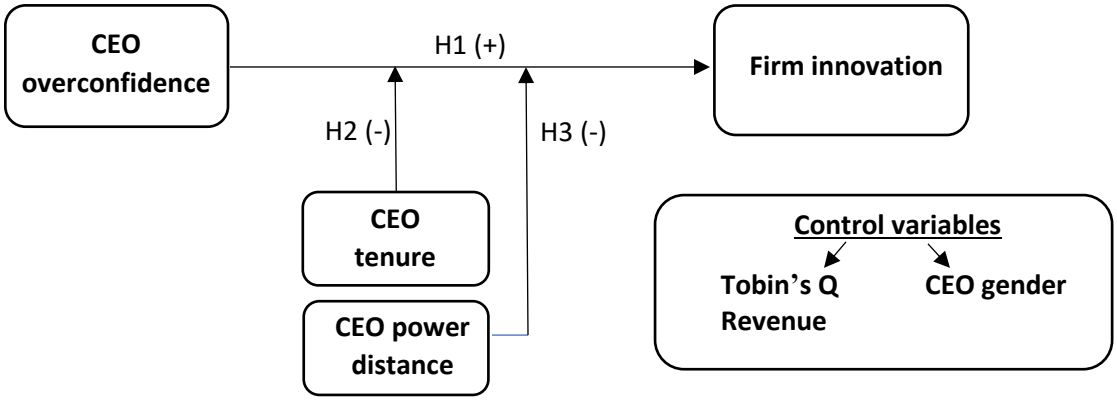


Figure 1 - Conceptual model

3 Research design

3.1 Context

To empirically investigate if higher levels of CEO overconfidence could be associated with a significantly higher amount of firm innovation this thesis took a firm-level perspective. Moreover, as firms are competing in an increasingly globalized and digitalized environment (Drucker, 2014), with innovation as a crucial component to survive, it would be scope-limiting to constrain the context to just one specific country. Therefore, differing from studies by Galasso and Simcoe (2011), Hirshleifer et al. (2012a), and Li and Tang (2010), this thesis does not just take either an American or Chinese perspective, but a global perspective. Moreover, a wide span of industries – ranging from the automotive, the FMCG, and the healthcare industry to the financial or technological industry - is examined in this research.

Furthermore, a rather undervalued approach to measure CEO overconfidence, namely shareholder letters, is employed. These shareholder letters are an opportunity to take a language- and leadership based approach in quantifying overconfidence (Amernic et al., 2010; Fairhurst, 2008; Pondy et al., 1989). However, as shareholder letters are often only issued by listed firms, this master's thesis solely includes firms which are stock market listed and thus well-established. Moreover, by incorporating merely listed companies, more accurate CEO and innovation data can be employed.

And finally, this research is situated in the recent past. By employing innovation and CEO data from the period 2008-2016, the drawn results and interpretations are valuable in the current time perspective. As overconfidence was often denounced as an important trigger of several speculative bubbles in the last decades[3] and the global financial crisis in 2007-2008, it is interesting to examine

[3] The dotcom bubble in the United States (1995-2000), the housing bubble in the United States (2002-2006), the Irish and Spanish property bubbles (the 2000s), and the Chinese stock bubbles (2003-2007).

if CEO overconfidence is still as explicit as before (Gladwell, 2009). Studies which employed datasets that handled the time periods before the global financial crisis, might be outdated and offer irrelevant insights into today's environment. Hence, by taking a fresh point of view, enriching insights and implications can be obtained.

In summary, this research considers well-established multinationals from diverse continents, countries, and industries during the period 2008-2016, to get an accurate and up-to-date understanding about the relationship between CEO overconfidence and firm innovation.

3.2 Sample and procedure

To study the impact of CEO overconfidence on firm innovation we examine a large sample of 155 firms[4], drawn from a wide range of industries, during the period 2008-2016. To obtain the thesis-relevant information for all these firms, diverse data sources were consulted. Annual reports were used to obtain the CEO-related data, while the corresponding shareholder letters were employed to measure CEO overconfidence. And subsequently, this dataset was amplified with firm-related information from the Worldscope database.

Practically, this implies that annual reports were collected for all 155 companies during the period 2008-2016. However, during this period, some firms became delisted or even went bankrupt. Therefore, it was not possible to acquire all the annual reports over the entire period 2008-2016. Subsequently, CEO shareholder letters were extracted from the corresponding annual reports. This procedure yielded approximately 1255 different shareholder letters. Next, these letters were scanned by LIWC[5] - a linguistic and computerized text analysis program – to reveal the expressed

[4] The included firms cannot be released due to confidentiality issues.
[5] Linguistic Inquiry and Word Count. More information about this text analysis program can be found on https://liwc.wpengine.com/

level of CEO overconfidence. However, not all of these shareholder letters could be taken into further analysis as corresponding innovation data appeared unavailable.

The final sample, for which complete information was available for all variables, consists of 1041 entries. Moreover, this sample contains firms from over 19 different countries and having notably different magnitudes (ranging from minimally 1500 to over half a million employees). Besides, when considering the appointed CEOs, these have 26 different nationalities and an incumbency ranging from one to thirty-one years. Also, it is remarkable that of the 273 unique CEOs, only six are female. Consequently, it is concluded that the sample is large and diverse enough to gain statistically correct insights on the effect of CEO overconfidence on firm innovation.

3.3 Measures

3.3.1 CEO overconfidence

To determine CEO overconfidence, this thesis employs shareholder letters. When using shareholder letters, the most interesting insights about the tone, attitude, and mindset of the top management are revealed. Moreover, this methodology is in line with the growing importance of leadership as a language-based phenomenon (Amernic et al., 2010; Conaway & Wardrope, 2010; Yadav, Prabhu, & Chandy, 2007). In support, previous studies by Brennan and Conroy (2013) and McClelland et al. (2010) have already proven that shareholder letters are a valuable medium through which particular CEO values can be measured.

Subsequently, LIWC, a computerized text analysis program, is used to measure the level of CEO overconfidence within the shareholder letters. LIWC enables one to analyze texts and subsequently reflect the expressed emotions, thinking styles, concerns, and psychological states (LIWC, 2017). Based on linguistic and psychological algorithms, LIWC compares each word in the shareholder letters against a user-defined dictionary to obtain a score for CEO overconfidence. Following the

methodology of Malmendier and Tate (2008), Hribar and Yang (2010), and Hirshleifer et al. (2012a), different word categories are constructed in the LIWC dictionary for both 'confident' and 'cautious'. The word category 'confident' contains the terms "confident", "confidence", "optimistic", "optimism" and other related synonyms. Moreover, the word category 'cautious' consists of the terms "pessimistic", "pessimism", "reliable", "steady", "practical", "conservative", "frugal", "cautious", "gloomy" and other related synonyms[6]. Next, by using Equation 1, the overconfidence level can be measured for each CEO *i* in year *t*. Hence, when CEO_i expresses a higher score on 'confident' than on 'cautious' at time *t*, the latter will be categorized as an overconfident CEO, and vice versa.

$$CEO\ overconfidence_{i,t} = \begin{cases} 1\ if\ x_{i,t} > y_{i,t} \\ 0\ if\ x_{i,t} \leq y_{i,t} \end{cases}$$

$$\text{where } x_i =' Confident' score,$$
$$and\ y_i =' Cautious' score$$

Equation 1 - CEO overconfidence measure

By operationalizing CEO overconfidence through a dichotomous variable, the research eventually contains 656 overconfident (±63%) and 385 non-overconfident (±37%) data points. Furthermore, this frequency of overconfident CEOs is in line with the 61% as argued by the option-based measure by Hirshleifer et al. (2012a).

3.3.2 Firm innovation

Previous studies by Griffith, Huergo, Mairesse, and Peters (2006) and Griffith et al. (2006) mention the wide-spread use of R&D to measure innovation. Hence, this thesis also proposes R&D expenditure as a robust proxy for firm innovation. R&D expenditure reflects the amount of input

[6] An exact list of the words that were assigned to each word category is added in Appendix A.I.

spent on innovation. Thus, it shows if a company and its CEO value innovation. When a CEO is not spending capital on the initial phase, no future innovation can be expected either (Barker III & Mueller, 2002). Furthermore, R&D expenditure also has a positive association with patents (Artz, Norman, Hatfield, & Cardinal, 2010) and other innovation outputs (Mairesse & Mohnen, 2005). Consequently, by considering a firm's R&D expenditure, one gets a good overview on the capital that a CEO intends to invest on innovation. In addition, R&D also appears to be positively related to innovation outputs.

Besides, it is remarked that, in line with the R&D literature (Barker III & Mueller, 2002), R&D expenditure is not normally distributed. This is caused by variations in R&D expenditures when examining a broad range of industries. However, approximately normal distributions are required for the dependent variable when employing statistical tests. Hence, to improve the skewness and kurtosis, a natural log-transformation was applied as it deals best with a substantial positive skew (Burns & Burns, 2008). Subsequently, a more normal R&D expenditure distribution was obtained[7].

Finally, following research by Barker III and Mueller (2002), this thesis assumes a direct link between a CEO's characteristics and firm innovation. This implies that no significant time lag is expected between the installation of a CEO and the effect on R&D expenditure. Nonetheless, when one would consider an innovation output like patents, a one year lag should be taken into consideration before CEO characteristics have an impact (Hirshleifer et al., 2012a).

3.3.3 CEO tenure

The tenure or time span that a CEO has been managing an organization is most commonly expressed in years (Hambrick & Fukutomi, 1991). To obtain this data, the thesis employed the

[7] Skewness and kurtosis decreased notably. Besides, also the Kolmogorov-Smirnov and Shapiro-Wilk tests and the QQ-plots exhibit improved normality. The precise normality outcomes can be found in Appendix B.I.1

annual reports. Subsequently, at each time *t*, the CEO tenure was adjusted to have a fit with the corresponding year. Otherwise, it would be fallacious to draw conclusions about the longitudinal effect of CEO tenure on firm innovation. Furthermore, by having a dataset that encompasses CEOs with a wide range of experience in their role – ranging from one year to thirty-one years – useful insights about the moderating effect of CEO tenure can be obtained.

3.3.4 CEO power distance

When examining the influence of a CEO's national culture on the relationship between CEO overconfidence and firm innovation, this thesis just focusses on the influence of power distance. Accordingly, only Hofstede's power distance scores were retrieved[8] and linked to the CEOs, based on their nationalities. By doing so, each CEO_i has during time *t* a fitting national power distance score. Hence, it is assumed that a CEO has approximately the same value set as an average individual of his/her country. However, since the Hofstede measures repeatedly have shown their robustness and reliability, this assumption is valid (Shane et al., 1995).

3.3.5 Control variables

To regulate for external variables that might influence the relationship between CEO overconfidence and firm innovation, several control variables are employed. These can be divided into two categories: the CEO and firm level control variables.

First, in terms of the CEO level, 'gender' was taken into consideration by including a dummy variable (0=female, 1=male). It appears that male executives are more action-oriented, take more significant actions and perform more acquisitions, when compared to female executives (Barber &

[8] The consulted Hofstede scores can be found on the following website: http://geerthofstede.com/research-and-vsm/dimension-data-matrix/

Odean, 2001; Huang & Kisgen, 2013). Consequently, it is necessary to control the gender variable to rid its effect on the relationship between CEO overconfidence and firm innovation.

Furthermore, control variables also were added on the firm level. The most important one is 'revenue'. Since the absolute amount of R&D expenditure is inherently related to firm size and revenue, it would be inaccurate not to control for this magnitude-related factor (Hirshleifer et al., 2012a). Otherwise, results would be biased by bigger firms that are generating a higher amount of revenues, but are not necessarily being more innovative. Moreover, Tobin's Q (market value/asset value) was also added as a control variable, since a higher Tobin's Q might be associated with higher R&D expenditures (Hirshleifer et al., 2012a). Accordingly, by including Tobin's Q, financial and valuation effects are filtered out and the focus remains on innovation. Moreover, as both firm level control variables were suffering from a notable positive skew[9], natural logarithm transformations were employed to normalize the data. And finally, following the approach of Galasso and Simcoe (2011), all the firm-level control variables were lagged by one year, for obvious reasons of simultaneity.

3.4 Analytical strategy

To investigate the relationships, as expressed in the hypotheses and conceptual model in Figure 1, an appropriate analytical strategy must be developed.

Firstly, correlations are examined as they provide a first insight in how pairs of variables relate. It allows one to measure a first degree of correspondence between variables. Nonetheless, when incorporating more than one independent variable, a multiple regression is better in estimating the relationship between several variables. It allows for interpretation about the co-occurrence of

[9] Appendix B.I.2-3 shows these skews in more detail and demonstrates the impact of the natural logarithm transformations.

several variables. Hence, in this way, it is possible to statistically gauge the association between CEO overconfidence and firm innovation, and to examine when CEO tenure and CEO power distance are influencing the latter relationship. Furthermore, a multiple regression also quantifies which amount of overall variance in R&D expenditure is explained by the independent variables (Burns & Burns, 2008). The precise multiple regression model that is employed to conduct the statistical analysis is depicted in Equation 2.

$$Ln(R\&D\ expenditure) =$$
$$= \beta_0 + \beta_1 * Overconfidence + \beta_2 * Tenure + \beta_3 * Power\ Distance + \beta_4$$
$$* Overconfidence * \text{Tenure} + \beta_5 * Overconfidence * Power\ distance + \beta_6$$
$$* Ln(Revenue) + \beta_7 * Ln(Tobin's\ Q) + \beta_8 * CEO\ Gender + \beta_9 * \text{Time effect} + \varepsilon$$

Equation 2 - Moderation Model

This equation reflects the anticipated relationship between the dependent variable on the left hand-side, and the independent, moderation, and control variables on the right hand-side. Moreover, the variable 'time effect' is also incorporated into the regression model. This time variable consists of eight dummy variables, and thus reflecting the period 2008-2016. By including this variable, the influence of systematic time-effects is prevented. Furthermore, it is also noted that all further statistical analyses and estimations are conducted in SPSS, a software program specialized in performing these.

4 Results

4.1 Descriptive statistics

Means, standard deviations, and correlations for all model variables (including the control variables) are exhibited in Table 1 to describe the basic characteristics of the data. Regarding the dependent variable, our average firm was spending approximately 5.68 million dollars on ln(R&D Expenditure). However, due to the log transformation, accurate interpretation of this number is complicated. When looking back at the original R&D data, it is realized that the average firm spent 1200 million dollars on research and development with a standard deviation of more than 1700 million dollars. Hence, it was exactly due to this skewness, that a log transformation was exercised. Furthermore, in terms of the principal independent variable, CEO overconfidence, it is noticed that this thesis is dealing with a rather overconfident set of CEOs. More than half (63%) of the included shareholder letters conveyed overconfident beliefs.

	Mean	SD	1	2	3	4	5	6	7
R&D expenditure (ln)	5.68	2.04	-						
Overconfidence	0.63	0.48	-0.055	-					
CEO Tenure	1.48	0.81	-0.194	0.015	-				
CEO Power	43.53	14.64	0.025	-0.07	0.158	-			
Revenue (ln)	9.56	1.25	0.740	-0.061	-0.173	0.093	-		
Tobin's Q (ln)	0.36	0.37	0.166	0.070	0.039	-0.069	0.042	-	
CEO Gender	0.97	0.16	-0.041	-0.001	0.079	0.460	-0.107	-0.039	-

Note: N=1041.
All correlations with an absolute value > 0.06 are significant at $p \leq 0.05$

Table 1 - Means, Standard Deviations, and Correlations

An inspection of the correlation matrix indicates no significant correlation between CEO overconfidence and R&D expenditure. Additionally, Table 1 also suggests a strong correlation between the independent variables CEO power and CEO Tenure.

To further investigate this disclosure, Figure 2 graphically presents the mean CEO power score for several levels of CEO tenure. Again, it appears that a longer CEO tenure is positively associated with a higher CEO power score. This could imply multicollinearity, a phenomenon that destabilizes and complicates the interpretation of coefficient estimates during a regression. Furthermore, since CEO power also correlates significantly with another independent variable, namely CEO overconfidence, it is decided to exclude CEO power from further analysis.

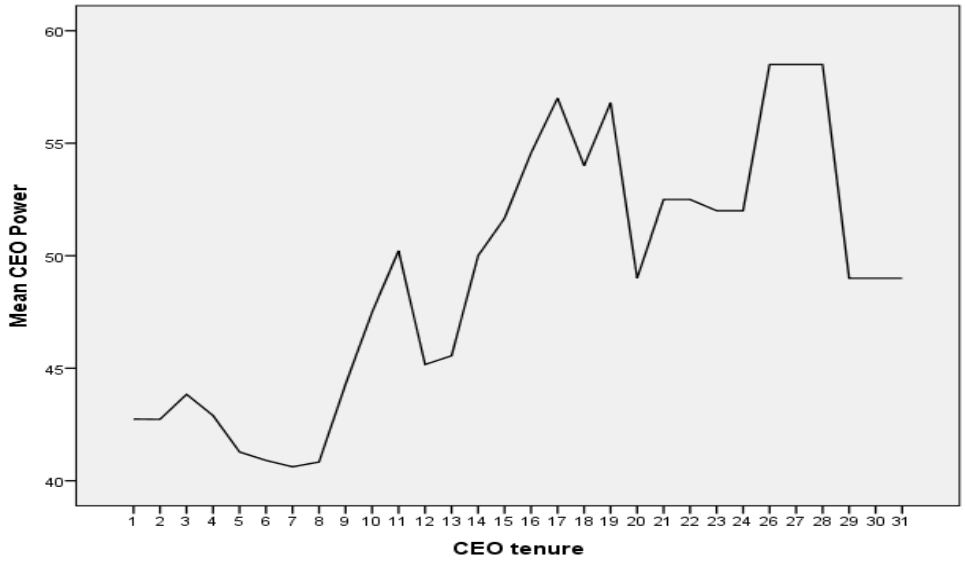


Figure 2 - Mean CEO power for each level of CEO tenure

Consequently, due to significant correlation with the other independent variables, no support will be found for H3, which predicted that the positive association between CEO overconfidence and firm innovation would be negatively influenced when a CEO originates from a high-power distance country.

4.2 Hypotheses testing

Correlations are useful in gaining a first indication about the relationships between two variables, but they do not indicate the precise effect, nor the impact of multiple independent variables working together (Burns & Burns, 2008). Rather, correlations measure the impact of a single variable.

Hence, to understand the effect of multiple independent variables on R&D expenditure, a multiple regression is necessary.

To execute a linear multiple regression, several conditions must be fulfilled. Most importantly, multicollinearity between independent variables must be avoided. The Variance Inflation Factor (VIF) is the most accurate measure to control for multicollinearity. Generally, when a VIF is exceeding a value of 10, multicollinearity concerns should be raised. Hence, Appendix B.II shows that, after leaving out CEO power, all VIF scores are well below 5. Furthermore, it is also preferred to comprise a big enough sample size and to have approximately normal distributions (Burns & Burns, 2008). Hence, the assumptions for performing a multiple regression are respected.

Table 2 presents the results for the multiple regression that are performed. In model (1) only the control variables are considered. Afterwards, in model (2), the focal variables are also inserted. And eventually, in model (3) the moderation term between CEO overconfidence and CEO tenure is added. In this way, it is ensured that the regression firstly restrains for the control variables. Furthermore, by adding the focal and moderation variables just in the second and third block, it is possible to examine how much these variables explain – on top of the control variables - R&D expenditure. Furthermore, it is also noteworthy that all three models include year fixed effects by incorporating 8 dummy variables for the period 2008-2016. Consequently, it can be assured that the results are not influenced by systematic year effects.

All the variables in model (1) have a significant impact on R&D Expenditure, manifesting their importance as control variables. Taken together, they explain 57.3% of the variance in R&D expenditure. Subsequently, model (3) represents the multiple regression between R&D expenditure as the dependent variable, CEO overconfidence and CEO tenure as the focal variables, and CEO overconfidence*CEO tenure as the moderation variable, while control variables are still included.

CEO tenure is included as a focal variable, although not directly related to a hypothesis, as it needed to construct the moderation variable. Model (3) attains a F-value of 104.09 ($p<0.001$), implying that the overall regression model is strongly significant.

Nonetheless, CEO overconfidence does not significantly contribute to the interpretation of R&D expenditure. CEO overconfidence was found to have an insignificantly positive impact on R&D expenditure (β=0.168, t= 1.244, p=0.214). This is not in line with the expectations and consequently provides no support for H1. Furthermore, in terms of the moderation variable CEO overconfidence*CEO tenure, a strongly significantly negative coefficient was found (β =-0.044, t=-2.497, p=0.013). Based on this result, it is deduced that the moderation variable significantly influences the relationship between CEO overconfidence and R&D expenditure in a negative manner. And consequently, support is provided for H2.

Furthermore, Table 2 indicates that, after incorporation of the independent variables, model (3) has an adjusted R-squared of 58.1%. Hence, on top of the control variables, the independent variables explain an additional 0.8% of the variance in R&D expenditure. The focal variables explain 0.6%, while the moderation variable clarifies 0.2% of the variance in R&D expenditure. On first sight, these percentages may seem minor. But, bearing in mind that R&D expenditure totals hundreds of millions, understanding each percentage point is essential. For the average firm in this sample, the included independent variables thus explain around ten million of expenditures.

Dependent variable: R&D expenditure (ln)						
Independent variables	**Model (1)** Control variables		**Model (2)** Focal variables (H1)		**Model (3)** CEO Tenure (H2)	
	β	**S.E**	**β**	**S.E**	**β**	**S.E**
Constant	-6.888***	0.446	-6.498***	0.456	-6.633***	0.458
Control variables						
Revenue (ln)	1.205***	0.033	1.179***	0.034	1.176***	0.033
Tobin's Q (ln)	0.786***	0.116	0.811***	0.116	0.808***	0.116
CEO gender	0.581**	0.261	0.653**	0.260	0.650**	0.260
Focal variables						
CEO overconfidence			-0.093	0.085	0.168	0.135
CEO tenure			-0.034***	0.009	-0.006	0.014
Moderating variables						
CEO overconfidence * CEO tenure					-0.044**	0.018
Observations	1041		1041		1041	
F-value	128.03		111.05		104.09	
R	0.760		0.764		0.766	
Adjusted R-squared	0.573		0.579		0.581	

Note: Results from multiple linear regression model. All models include year fixed effects by incorporating 8 time dummies (2008 as reference year). Confidence levels: *p<0.1, **p<0.05, ***p<0.01 Complete SPSS-output is added in Appendix B.II

Table 2 - Results from multiple regression.

4.3 Effect of industry innovativeness

As the obtained results do not provide support for the main hypothesis (H1), the thesis explores whether industry innovativeness might have an influence on the obtained results. This is based on research by Hirshleifer et al. (2012a) which indicates that the relationship between CEO overconfidence and innovation might depend on the considered industry. Consequently, the original sample was divided into one sample containing firms active in innovative industries, and

one sample containing firms active in non-innovative industries. To define whether an industry is considered innovative or not, the thesis employed the research by Hirshleifer, Low, and Teoh (2012b). These authors calculated the proportion of innovative years for all industries (based on the SIC[10] codes). Whenever an industry crossed the cutoff value of 75% innovative years, the industry was labeled as innovative[11]. Subsequently, two new regression models were run in SPPS for both the innovative and non-innovative industries. The results from these regressions are reported in Table 3.

When interpreting Table 3, it appears that industry innovativeness has a significant impact on the obtained results. In terms of the effect of CEO overconfidence on R&D expenditure, it follows that CEO overconfidence has no significant influence (β=0.030, t=0.174, p= 0.862) when dealing with an innovative industry. However, for non-innovative industries, CEO overconfidence significantly affects the amount of R&D expenditures (β=0.393, t= 2.105, p= 0.036). Consequently, partial support is provided for H1. Depending on the innovativeness of the industry, the relationship between CEO overconfidence and firm innovation holds.

Furthermore, it also follows that the effect of CEO overconfidence*CEO tenure, the moderating variable, on the relationship between CEO overconfidence and R&D expenditure depends on the industry innovativeness. When considering non-innovative industries, H2 is supported as tenure is strongly significant (β= -0.054, t= -2.456, p= 0.014). Nonetheless, for non-innovative industries, Table 3 only presents support for H2 (β= -0.045, t= -1.765, p= 0.078) when taking a significance level of 0.1. When taking a significance level of 0.05, no support is provided for H2. Consequently, depending on the innovativeness of the industry, there again exist differences. However, in general,

[10] Standard Industrial Classification

[11] Appendix A.II demonstrates the proportion of innovative years (%) for each industry and whether an industry is labelled as innovative or non-innovative

the regressions indicate a strongly negative influence of the moderating variable on the relationship between CEO overconfidence and firm innovation.

Dependent variable: R&D expenditure (ln)				
Independent variables	**Model 4** Innovative Industry		**Model 5** Non-innovative Industry	
	β	**S.E**	**β**	**S.E**
Constant	-5.665***	0.518	-10.767***	0.784
Control variables				
Revenue (ln)	1.131***	0.036	1.353***	0.058
Tobin's Q (ln)	1.055***	0.172	1.172***	0.150
CEO gender	0.293	0.277	2.372***	0.485
Focal variables				
CEO overconfidence	0.030	0.171	0.393**	0.187
CEO tenure	0.018	0.021	0.011	0.017
Moderating variables				
CEO overconfidence * CEO tenure	-0.045*	0.025	-0.054**	0.022
Observations	563		477	
F-value	77.80		56.13	
R	0.815		0.793	
Adjusted R-squared	0.656		0.618	

Note: Results from multiple linear regression model when splitting the data by 'Innovative Industry'. All models include year fixed effects by incorporating 8 time dummies (2008 as reference year). Confidence levels: *p<0.1, **p<0.05, ***p<0.01. Complete SPSS-output is added in Appendix B.III

Table 3- Results from multiple regression, divided by industry innovativeness

And finally, as shown in Table 3, incorporating the innovativeness of the industry increases the explanatory power (adjusted R-squared) to respectively 65.6% and 61.8%. Together with the strong significance of 'innovative industry' ($t=14.638$, $p<0.001$), this implies that the innovativeness of the corresponding industry is important in elucidating R&D expenditure.

5 Discussion

In this thesis, the impact of CEO overconfidence, a cognitive bias contrasting standard economic models and rational decision making, on firm innovation was studied. Particularly, it was hypothesized that overconfident CEOs are more risk-taking, have a more enthusiastic mindset, and are more action-oriented, which in turn will lead to a higher level of firm innovation. Moreover, it was also predicted that CEO background would have an influence on the latter relationship. Both CEO tenure and CEO power distance were expected to negatively affect the relationship between CEO overconfidence and firm innovation.

5.1 Summary of findings

Employing shareholder letters to measure CEO overconfidence, this thesis demonstrates that over the 2008-2016 period, overconfident CEOs, managing established multinationals active in non-innovative industries, spend significantly more on research & development, an initial step towards successful firm innovation, than non-overconfident CEOs do. However, for overconfident CEOs running multinationals in innovative industries, this relationship does not hold. For these multinationals there exists a positive, but non-significant relationship between CEO overconfidence and firm innovation. Furthermore, this thesis also revealed that CEO tenure negatively influences the relationship between CEO overconfidence and firm innovation for both innovative ($p<0.1$) and non-innovative industries ($p<0.05$). Consequently, there exists a decreasing effect of CEO overconfidence over time. Overconfident and shortly-tenured CEOs more significantly impact firm innovation than longer-tenured overconfident CEOs do.

5.2 Theoretical contributions

This thesis has contributed to the existing tone at the top and UET literature by exploring the influence of CEO overconfidence – a cognitive bias that influences the managerial beliefs of the

most important executive in the top management team – on firm innovation. Previous studies by Galasso and Simcoe (2011) and Hirshleifer et al. (2012a) also looked into this relationship, but did not consider the impact of CEO tenure. Moreover, by employing the yearly shareholder letters to measure CEO overconfidence, this thesis also commits to the growing importance of leadership as a language- and meaning-based construct (Amernic et al., 2010; Pondy et al., 1989).

Subsequently, the next paragraphs will further elaborate on the theoretical contributions that have been realized based on the results. The insight that there only exists a positively significant relationship between CEO overconfidence and firm innovation in non-innovative industries, is remarkable. On the one hand, the positive relationship between CEO overconfidence and innovation, was hypothesized and in line with previous research (Engelen et al., 2015; Galasso & Simcoe, 2011). Nonetheless, on the other hand, this result contradicts the finding of Hirshleifer et al. (2012a) that overconfident managers only obtain more innovation in innovative industries. A possible explanation is that, since multinationals in innovative industries are already aggressively pursuing innovation opportunities (Miller, 1991), employees do not perceive added value in an overconfident CEO. When CEOs dominate other organizational members, who are already innovation-oriented, it may reduce their enthusiasm and inhibit full cooperation (Engelen et al., 2015). However, for multinationals active in non-innovative industries, overconfident CEOs who dominate and take on challenging opportunities might turn out beneficial for firm innovation. When having a CEO who is risk-taking and action-oriented, the reluctance towards innovation might be overcome (Miller & Friesen, 1982).

A second conceivable explanation might be that multinationals in non-innovative industries actively pursue overconfident CEOs to compensate for innovation-aversion in the industry. By realizing that overconfident CEOs are effective in engaging in difficult tasks and in building

awareness and enthusiasm for new opportunities, these multinationals can outweigh the non-innovativeness of their industry. Hence, hiring overconfident CEOs might more significantly impact firm innovation in non-innovative industries. Besides, as the thesis only considers well-established and successful multinationals, the incorporated firms might also be more innovative than one would expect when considering their non-innovative industry. Nonetheless, future research remains necessary to investigate why industry innovativeness impacts the relationship between CEO overconfidence and firm innovation.

Besides, the outcome that CEO tenure negatively influences the relationship between CEO overconfidence and firm innovation is in conformance with research by Luo et al. (2014), McClelland et al. (2010), and Barker III and Mueller (2002). Accordingly, when tenure increases, overconfident CEOs grow stale in the saddle and commit to fewer strategic changes such as firm innovation. The risk-taking and action-oriented attitude of a new and overconfident CEO disappears and transforms into a more 'conservative' one. Incumbent CEOs prefer a quiet life and start cutting R&D costs to maximize short-term earnings (Bereskin & Hsu, 2013). Nonetheless, when combining this with an overconfident and dominant attitude, firm innovation will decline.

Finally, and contrary to the expectations, CEO power distance, could not be incorporated into the analysis due to its strong correlation with both CEO overconfidence and CEO tenure. Hence, it appears that CEOs with a longer tenure also install a more power distant corporate culture. This finding is consistent with the theory that executives' personality strengthens over tenure (Barker III & Mueller, 2002). Furthermore, the analysis also reveals that power distant CEOs are strongly associated with overconfident CEOs. Power distance could reflect the dominance and action-orientation that overconfident CEO exhibit. Accordingly, it is an interesting element for future

research to examine whether power distant CEOs tend to be longer-tenured and demonstrate higher levels of overconfidence.

5.3 Practical implications

Apart from the theoretical implications, this thesis also specifies several practical implications for multinationals and their corresponding board of directors when contracting CEOs.

Firstly, it is inferred that not all well-established multinationals benefit from hiring an overconfident CEO. Multinationals active in non-innovative industries could significantly improve their innovation potential by hiring an overconfident CEO. Nonetheless, in innovative industries, an overconfident CEO does not significantly improve firm innovation. Consequently, this is an important insight for a board of directors when considering their contracting practices. Since overconfidence improves firm innovation in non-innovative industries, it is important to screen potential CEOs on this criterion.

Moreover, another practical implication is related to the insight that CEO tenure negatively impacts the influence of CEO overconfidence on firm innovation. To maximize the impact of CEO overconfidence on firm innovation, this type of CEOs should have been recently appointed. When an overconfident CEO has a longer tenure, the negative effects of overconfidence will start outweighing the positive ones. Consequently, it is concluded that overconfident CEOs have a decreasing impact over time. On the short-term, overconfidence will boost firm innovation. Nonetheless, on the longer-term, the risk-taking, action-oriented, and enthusiastic mindset of an overconfident CEO will vanish and turn into a stubborn and stale one. Thus, when hiring an overconfident CEO, this time aspect should always be taken into consideration. If a multinational aspires to establish an ever-growing innovative corporate culture, overconfident CEOs cannot govern for long periods and will even have to be replaced frequently.

5.4 Limitations & Future Research

This thesis also contains some noteworthy limitations and subjects for future research, which are illuminated in this section.

A first limitation consists in working with shareholder letters. Although shareholder letters more accurately assess the construct 'overconfidence' and reflect the speaker's characteristics, there are also some drawbacks (Hill et al., 2014). Shareholder letters can suffer from impression management when it, instead of objectively informing shareholders about the status of the firm, turns into public relations collaboration. Furthermore, it can also be argued whether it solely represents the beliefs and thought processes of a CEO (Yadav et al., 2007). However, Amernic et al. (2010) contradict this by arguing that CEOs take shareholder letters seriously, as it carries a personal claim through their name and signature.

Furthermore, a second limitation concerns the use of R&D to measure innovation. As mentioned in the 'research design', R&D is a wide-spread proxy for innovation output since both constructs are positively related and since R&D data is easier to obtain. However, R&D only handles the capital that is spent to initiate innovation. And whether it eventually leads to successful innovation is not assured. For instance, some multinationals could have spent a substantial amount on R&D, but not realized noteworthy improvements or innovation. Consequently, to further validate the obtained insights in this thesis, future research should explore whether the insights still hold when innovation is measured by innovation outputs, such as patents or citations.

Subsequently, based on the obtained outcomes, some other ideas for future research are provided. A first topic for future research is why industry innovativeness has an impact on the significance of the relationship between CEO overconfidence and firm innovation. Since it has been shown that CEO overconfidence only has a positive impact on innovation in non-innovative industries, gaining

a deeper understanding in the overall rationale would be value-adding for future CEO-contracting practices. Two possible explanations were provided in the theoretical contributions, but future research should indicate whether these are valid.

Furthermore, since it is demonstrated that CEO tenure has a negative impact on the relationship between CEO overconfidence and innovation, it would be interesting to examine at which tenure overconfident CEOs in non-innovative industries, and thus intrinsically more innovative CEOs, turn conservative. To find out, subgroups of CEO tenure (low-medium-high) could be constructed and compared. In this manner, additional insights about during which tenure-cycle overconfidence positively impact firm innovation could be achieved. Furthermore, it could also be a subject for future research to explore whether tenure would still have a negative impact when one considers non-profit organizations. In contrast with the incorporated profit-oriented multinationals, CEOs of non-profit organizations might take more risks closer to their departure or retirement as they pursue an ideal, rather than optimizing firm profitability (Luo et al., 2014). Consequently, for these cases, it could be that CEO tenure positively impacts the relationship between CEO overconfidence and firm innovation. To investigate this theory, another sample should be constructed. The current sample only includes well-established and profit-oriented multinationals and accordingly results cannot be generalized for the non-profit industry.

And lastly, based on the reported correlations in Table 1, it could be insightful to examine whether power distant CEOs systematically demonstrate higher levels of overconfidence. If this appears to be the case, power distance is a useful tool to recognize overconfident CEOs.

5.5 Conclusion

In a rapidly changing and globalizing environment innovation became a priority. If a firm is not able to innovate, it faces decline and even extinction (Drucker, 2014). As such, it is important to understand which factors foster or hamper an innovative corporate culture. Therefore, following upper-echelons theory (Hambrick & Mason, 1984), this thesis investigated how CEO overconfidence, an omnipresent cognitive bias, influences the amount of firm innovation. At first glance, overconfidence is in contrast with rational decision-making and standard economic models. But, exactly because overconfident CEOs have a more risk-taking, action-oriented, and enthusiastic mindset, this type of managers might be better suited to perform challenging tasks, such as innovation.

In the context of well-established multinationals over the period 2008-2016, this thesis provides empirical evidence that CEO overconfidence does positively stimulate firm innovation. Nonetheless, this relationship only holds for non-innovative industries. Consequently, in these industries, CEO overconfidence is an important element to foster innovation. It is therefore important that future leadership development and hiring practices in non-innovative industries understand the importance of overconfidence in promoting innovation. Meanwhile, in innovative industries, overconfident CEOs do not have an impact on innovation.

Moreover, it is also discovered that CEO tenure negatively influences the relationship between CEO overconfidence and firm innovation for both innovative and non-innovative industries. Nonetheless, in non-innovative industries the impact of CEO tenure is more significant. In other words, it is concluded that if an overconfident CEO remains in charge for a longer time, a known acceptance zone is established, and risk appetite diminishes. However, it is mainly by having a risk-taking attitude that overconfident CEOs are able to spur innovation (Levinthal & March,

1993). To maintain innovation, organizations with overconfident CEOs must ensure that their CEO is not governing for too long. Otherwise, the influence of CEO overconfidence might disappear (in non-innovative industries) or even turn negative (in innovative industries). By gaining the insight that there exists a decreasing effect of CEO overconfidence over the period that a CEO is managing an organization, the thesis elaborates on the existing research by Galasso and Simcoe (2011) and Hirshleifer et al. (2012a).

And lastly, it was not possible to explore whether CEO power distance influences the relationship between CEO overconfidence and firm innovation. The correlations between CEO power distance and both CEO tenure and CEO overconfidence were too strong, and would erratically impact the regression model. Nonetheless, it is a valuable insight that an increase in CEO power strongly coincides with an increase in CEO overconfidence.

Taken together, by unveiling the positive impact that CEO overconfidence has on firm innovation for well-established multinationals in non-innovative industries, and by indicating the negative impact of CEO tenure on the relationship between CEO overconfidence and firm innovation, this thesis contributed notably to the existing management literature.

6 References

Adams, S. (2012). Overconfident CEOs Are Better Innovators. Retrieved from https://www.forbes.com/sites/susanadams/2012/04/10/overconfident-ceos-are-better-innovators/#739566dc1927

Amernic, J., Craig, R., & Tourish, D. (2010). *Measuring and assessing tone at the top using annual report CEO letters*: The Institute of Chartered Accountants of Scotland.

Artz, K. W., Norman, P. M., Hatfield, D. E., & Cardinal, L. B. (2010). A longitudinal study of the impact of R&D, patents, and product innovation on firm performance. *Journal of Product Innovation Management, 27*(5), 725-740.

Avolio, B. J., Zhu, W., Koh, W., & Bhatia, P. (2004). Transformational leadership and organizational commitment: Mediating role of psychological empowerment and moderating role of structural distance. *Journal of Organizational Behavior, 25*(8), 951-968.

Barber, B. M., & Odean, T. (2001). Boys will be boys: Gender, overconfidence, and common stock investment. *The quarterly journal of economics, 116*(1), 261-292.

Barker III, V. L., & Mueller, G. C. (2002). CEO characteristics and firm R&D spending. *Management Science, 48*(6), 782-801.

Bereskin, F. L., & Hsu, P.-H. (2013). Bringing in changes: the effect of new CEOs on innovation.

Bernardo, A. E., & Welch, I. (2001). On the evolution of overconfidence and entrepreneurs. *Journal of Economics & Management Strategy, 10*(3), 301-330.

Berson, Y., Oreg, S., & Dvir, T. (2008). CEO values, organizational culture and firm outcomes. *Journal of Organizational Behavior, 29*(5), 615-633.

Bollaert, H., & Petit, V. (2010). Beyond the dark side of executive psychology: Current research and new directions. *European Management Journal, 28*(5), 362-376.

Botelho, E. L., Powell, K. R., Kincaid, S., & Wang, D. (2017). What Sets Successful CEOs Apart. *Harvard business review*.

Brennan, N. M., & Conroy, J. P. (2013). Executive hubris: The case of a bank CEO. *Accounting, Auditing & Accountability Journal, 26*(2), 172-195.

Brown, R., & Sarma, N. (2007). CEO overconfidence, CEO dominance and corporate acquisitions. *Journal of Economics and business, 59*(5), 358-379.

Burns, R. P., & Burns, R. (2008). *Business research methods and statistics using SPSS*: Sage.

Busenitz, L. W., & Barney, J. B. (1994). *Biases and heuristics in strategic decision making: differences between entrepreneurs and managers in large organizations.* Paper presented at the Academy of Management Proceedings.

Camerer, C., & Lovallo, D. (1999). Overconfidence and excess entry: An experimental approach. *The American Economic Review, 89*(1), 306-318.

Carroll, W. R., & Bandura, A. (1987). Translating cognition into action: The role of visual guidance in observational learning. *Journal of Motor Behavior, 19*(3), 385-398.

Chandran, N. (2017). Apple, Google, Tesla ranked world's most innovative companies: BCG. Retrieved from https://www.cnbc.com/2017/01/11/apple-google-tesla-ranked-worlds-most-innovative-companies-bcg.html

Conaway, R. N., & Wardrope, W. J. (2010). Do their words really matter? Thematic analysis of US and Latin American CEO letters. *The Journal of Business Communication (1973), 47*(2), 141-168.

Deery, H. A. (1999). Hazard and risk perception among young novice drivers. *Journal of safety research, 30*(4), 225-236.

Deshmukh, S., Goel, A. M., & Howe, K. M. (2013). CEO overconfidence and dividend policy. *Journal of Financial Intermediation, 22*(3), 440-463.

Drucker, P. (1998). The discipline of innovation. *Harvard business review, 76*(6), 149-157.

Drucker, P. (2014). *Innovation and entrepreneurship*: Routledge.

Ehrlinger, J., Mitchum, A. L., & Dweck, C. S. (2016). Understanding overconfidence: Theories of intelligence, preferential attention, and distorted self-assessment. *Journal of Experimental Social Psychology, 63*, 94-100.

Elenkov, D. S., & Manev, I. M. (2005). Top management leadership and influence on innovation: The role of sociocultural context. *Journal of Management, 31*(3), 381-402.

Engelen, A., Neumann, C., & Schwens, C. (2015). "Of course I can": The effect of CEO overconfidence on entrepreneurially oriented firms. *Entrepreneurship Theory and Practice, 39*(5), 1137-1160.

Fairhurst, G. T. (2008). Discursive leadership: A communication alternative to leadership psychology. *Management Communication Quarterly, 21*(4), 510-521.

Ferris, S. P., Jayaraman, N., & Sabherwal, S. (2013). CEO overconfidence and international merger and acquisition activity. *Journal of Financial and Quantitative Analysis, 48*(1), 137-164.

Finkelstein, S., & Hambrick, D. C. (1990). Top-management-team tenure and organizational outcomes: The moderating role of managerial discretion. *Administrative Science Quarterly*, 484-503.

Friedman, H. (2007). Does overconfidence affect entrepreneurial investment? *Wharton Research Scholars Journal*, 42.

Galasso, A., & Simcoe, T. S. (2011). CEO overconfidence and innovation. *Management Science, 57*(8), 1469-1484.

Geletkanycz, M. A. (1997). The salience of 'culture's consequences': The effects of cultural values on top executive commitment to the status quo. *Strategic management journal*, 615-634.

Gervais, S., Heaton, J. B., & Odean, T. (2011). Overconfidence, compensation contracts, and capital budgeting. *The Journal of Finance*, *66*(5), 1735-1777.

Gervais, S., & Odean, T. (2001). Learning to be overconfident. *the Review of financial studies*, *14*(1), 1-27.

Gladwell, M. (2009). Overconfidence and the financial crisis. Retrieved from http://blogs.reuters.com/felix-salmon/2009/05/05/overconfidence-and-the-financial-crisis/

Goel, A. M., & Thakor, A. V. (2008). Overconfidence, CEO selection, and corporate governance. *The Journal of Finance*, *63*(6), 2737-2784.

Graham, J. R., Harvey, C. R., & Puri, M. (2013). Managerial attitudes and corporate actions. *Journal of financial Economics*, *109*(1), 103-121.

Griffith, R., Huergo, E., Mairesse, J., & Peters, B. (2006). Innovation and productivity across four European countries. *Oxford review of economic policy*, *22*(4), 483-498.

Grinblatt, M., & Keloharju, M. (2009). Sensation seeking, overconfidence, and trading activity. *The Journal of Finance*, *64*(2), 549-578.

Haley, U. C., & Stumpf, S. A. (1989). Cognitive trails in strategic decision-making: linking theories of personalities and cognitions. *Journal of Management Studies*, *26*(5), 477-497.

Hambrick, D. C., & Fukutomi, G. D. (1991). The seasons of a CEO's tenure. *Academy of management review*, *16*(4), 719-742.

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of management review*, *9*(2), 193-206.

Hayward, M. L., & Hambrick, D. C. (1997). Explaining the premiums paid for large acquisitions: Evidence of CEO hubris. *Administrative Science Quarterly*, 103-127.

Hayward, M. L., Shepherd, D. A., & Griffin, D. (2006). A hubris theory of entrepreneurship. *Management Science*, *52*(2), 160-172.

Hill, A. D., Kern, D. A., & White, M. A. (2014). Are we overconfident in executive overconfidence research? An examination of the convergent and content validity of extant unobtrusive measures. *Journal of Business Research, 67*(7), 1414-1420.

Hirshleifer, D., Low, A., & Teoh, S. H. (2012a). Are overconfident CEOs better innovators? *The Journal of Finance, 67*(4), 1457-1498.

Hirshleifer, D., Low, A., & Teoh, S. H. (2012b). Internet Appendix for "Are Overconfident CEOs Better Innovators?". *The Journal of Finance*.

Hofstede, G. (2017). National Culture. Retrieved from https://www.hofstede-insights.com/models/national-culture/

Hribar, P., & Yang, H. (2010). Does CEO overconfidence affect management forecasting and subsequent earnings management. *Unpublished working paper*.

Huang, J., & Kisgen, D. J. (2013). Gender and corporate finance: Are male executives overconfident relative to female executives? *Journal of financial Economics, 108*(3), 822-839.

Jalbert, T., Chan, C., Jalbert, M., & Landry, S. P. (2007). The Interrelationship of CEO Nationality with Financial Management, Firm Performance, and CEO Compensation.

Kahneman, D., & Lovallo, D. (1993). Timid choices and bold forecasts: A cognitive perspective on risk taking. *Management Science, 39*(1), 17-31.

Klayman, J., Soll, J. B., González-Vallejo, C., & Barlas, S. (1999). Overconfidence: It depends on how, what, and whom you ask. *Organizational behavior and human decision processes, 79*(3), 216-247.

Knight, G. A., & Cavusgil, S. T. (2004). Innovation, organizational capabilities, and the born-global firm. *Journal of international business studies, 35*(2), 124-141.

Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic management journal, 14*(S2), 95-112.

Li, J., & Tang, Y. (2010). CEO hubris and firm risk taking in China: The moderating role of managerial discretion. *Academy of Management Journal, 53*(1), 45-68.

LIWC. (2017). How it works. Retrieved from https://liwc.wpengine.com/how-it-works/

Luo, X., Kanuri, V. K., & Andrews, M. (2014). How does CEO tenure matter? The mediating role of firm-employee and firm-customer relationships. *Strategic management journal, 35*(4), 492-511.

Mairesse, J., & Mohnen, P. (2005). The importance of R&D for innovation: a reassessment using French survey data *Essays in Honor of Edwin Mansfield* (pp. 129-143): Springer.

Malmendier, U., & Tate, G. (2005). CEO overconfidence and corporate investment. *The Journal of Finance, 60*(6), 2661-2700.

Malmendier, U., & Tate, G. (2008). Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of financial Economics, 89*(1), 20-43.

Malmendier, U., & Tate, G. (2015). Behavioral CEOs: The role of managerial overconfidence. *The Journal of Economic Perspectives, 29*(4), 37-60.

McClelland, P. L., Liang, X., & Barker III, V. L. (2010). CEO commitment to the status quo: Replication and extension using content analysis. *Journal of Management, 36*(5), 1251-1277.

Miles, R. E., Snow, C. C., Meyer, A. D., & Coleman, H. J. (1978). Organizational strategy, structure, and process. *Academy of management review, 3*(3), 546-562.

Miller, D. (1991). Stale in the saddle: CEO tenure and the match between organization and environment. *Management Science, 37*(1), 34-52.

Miller, D., & Friesen, P. H. (1982). Innovation in conservative and entrepreneurial firms: Two models of strategic momentum. *Strategic management journal, 3*(1), 1-25.

Morrison, E. W., & Milliken, F. J. (2000). Organizational silence: A barrier to change and development in a pluralistic world. *Academy of management review, 25*(4), 706-725.

Musteen, M., Barker III, V. L., & Baeten, V. L. (2010). The influence of CEO tenure and attitude toward change on organizational approaches to innovation. *The Journal of Applied Behavioral Science, 46*(3), 360-387.

Papadakis, V., & Bourantas, D. (1998). The chief executive officer as corporate champion of technological innovation: aii empirical investigation. *Technology Analysis & Strategic Management, 10*(1), 89-110.

Pondy, L. R., McCall, M., & Lombardo, M. (1989). Leadership is a language game. *Readings in managerial psychology*, 224-233.

Rovenpor, J. L. (1993). The relationship between four personal characteristics of chief executive officers (ceos) and company merger and acquisition activity (maa). *Journal of Business and psychology, 8*(1), 27-55.

Russo, J. E., & Schoemaker, P. J. (1989). *Decision traps: Ten barriers to brilliant decision-making and how to overcome them*: Doubleday/Currency New York, NY.

Russo, J. E., & Schoemaker, P. J. (1992). Managing overconfidence. *Sloan management review, 33*(2), 7.

Schneider, S. C., & De Meyer, A. (1991). Interpreting and responding to strategic issues: The impact of national culture. *Strategic management journal, 12*(4), 307-320.

Schrand, C. M., & Zechman, S. L. (2012). Executive overconfidence and the slippery slope to financial misreporting. *Journal of Accounting and Economics, 53*(1), 311-329.

Shane, S. (1992). Why do some societies invent more than others? *Journal of Business Venturing, 7*(1), 29-46.

Shane, S. (1993). Cultural influences on national rates of innovation. *Journal of Business Venturing, 8*(1), 59-73.

Shane, S., Venkataraman, S., & MacMillan, I. (1995). Cultural differences in innovation championing strategies. *Journal of Management, 21*(5), 931-952.

Simon, M., & Houghton, S. M. (2003). The relationship between overconfidence and the introduction of risky products: Evidence from a field study. *Academy of Management Journal, 46*(2), 139-149.

Simon, M., & Shrader, R. C. (2012). Entrepreneurial actions and optimistic overconfidence: The role of motivated reasoning in new product introductions. *Journal of Business Venturing, 27*(3), 291-309.

Staw, B. M. (1991). Dressing up like an organization: When psychological theories can explain organizational action. *Journal of Management, 17*(4), 805-819.

Stenmark, C. K., Shipman, A. S., & Mumford, M. D. (2011). Managing the innovative process: The dynamic role of leaders. *Psychology of aesthetics, creativity, and the arts, 5*(1), 67.

Tellis, G. J., Prabhu, J. C., & Chandy, R. K. (2009). Radical innovation across nations: The preeminence of corporate culture. *Journal of marketing, 73*(1), 3-23.

Van der Vegt, G. S., Van de Vliert, E., & Huang, X. (2005). Location-level links between diversity and innovative climate depend on national power distance. *Academy of Management Journal, 48*(6), 1171-1182.

Wong, Y.-J., Lee, C.-Y., & Chang, S.-C. (2017). CEO Overconfidence and Ambidextrous Innovation. *Journal of Leadership & Organizational Studies*, 1548051817692329.

Yadav, M. S., Prabhu, J. C., & Chandy, R. K. (2007). Managing the future: CEO attention and innovation outcomes. *Journal of marketing*, *71*(4), 84-101.

Zhao, F. (2005). Exploring the synergy between entrepreneurship and innovation. *International Journal of Entrepreneurial Behavior & Research, 11*(1), 25-41.

Appendices

Appendix A. Lists

I. LIWC dictionary

Overconfident: adventuresome, adventurous, assured, audacious, bold, brash, bright, certain, clear, confidence, confident, daring, decisive, doubtless, encouraging, fair, hopeful, hope, hubris, likely, optimism, optimistic, overconfidence, overconfident, overoptimism, overoptimistic, positive, promising, rosy, stout, sure, uphesitating, upbeat, venturesome, venturous

Cautious: adverse, alert, bearish, careful, cautious, circumspect, chary, conservative, considerate, defeatist, despairing, disadvantage, downbeat, drawback, frugal, gingerly, gloomy, guarded, heedful, hopeless, negative, observant, overpessimistic, pessimism, pessimist, pessimistic, practical, reliable, safe, secure, solid, steady, thoughtful, unfavorable, watchful

II. Innovative and non-innovative industries[12]

Industry	SIC	Proportion of innovative years (%)	Innovative?[13]
Food & drink products	20	0	No
Tobacco products	21	0	No
Apparel & other finished products	23	9	No
Lumber & wood products, excl. furniture	24	64	No
Paper & allied products	26	91	Yes
Printing & publishing	27	82	Yes
Chemicals & pharmaceutical products	28	18	No
Rubber & plastic products	30	64	No
Stone, clay, glass, concrete products	32	91	Yes
Primary metal	33	18	No
Commercial mach & computer hardware	35	100	Yes
Electric equip & electronic equipment	36	100	Yes
Transportation equipment	37	91	Yes
Measuring, control & medical equipment	38	100	Yes
Consumer goods	39	100	Yes
Communications	48	100	Yes
Wholesale - durable goods	50	9	No
Business services	73	100	Yes
Services - health	80	91	Yes

[12] Based on the research by Hirshleifer et al. (2012b)

[13] Cutoff level has been set at a proportion of innovative years of 75%. In this way, only industries with a notable proportion of innovative years are labeled as innovative.

Appendix B. SPSS Output

I. Normality tests & plots

Considering the given dataset, several variables are suffering from a strong skew and kurtosis. To normalize these variables natural log-transformation were applied. Hence, the following subsections present the skewness, kurtosis[14], Kolmogorov-Smirnov test, Shapiro-Wilk test[15], and QQ-plots[16], before and after a natural log-transformation was applied, for each of these variables.

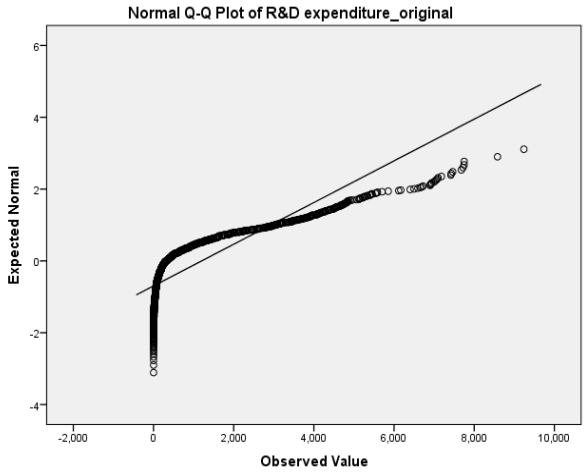
1. R&D Expenditure

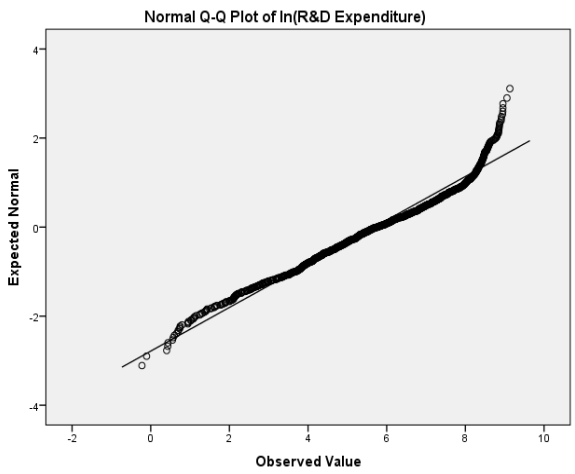
Descriptives

		Statistic	Std. Error
R&D Expenditure	Skewness	1.788	.075
	Kurtosis	2.664	.149
ln(R&D Expenditure)	Skewness	-.408	.075
	Kurtosis	-.555	.149

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
R&D expenditure	.243	1069	.000	.720	1069	.000
ln(R&D Expenditure)	.061	1069	.000	.968	1069	.000





[14] The absolute value for both skew and kurtosis should be as low as possible

[15] Both the Kolmogorov-Smirnov and Shapiro-Wilk test are insignificant when the distribution is not differing from a normal one. Hence, a lower statistic value is preferred.

[16] QQ-plots graph the observed value and the expected normal value for a variable. Consequently, the observed values should approximate the line of expected normal values.

2. Tobin's Q

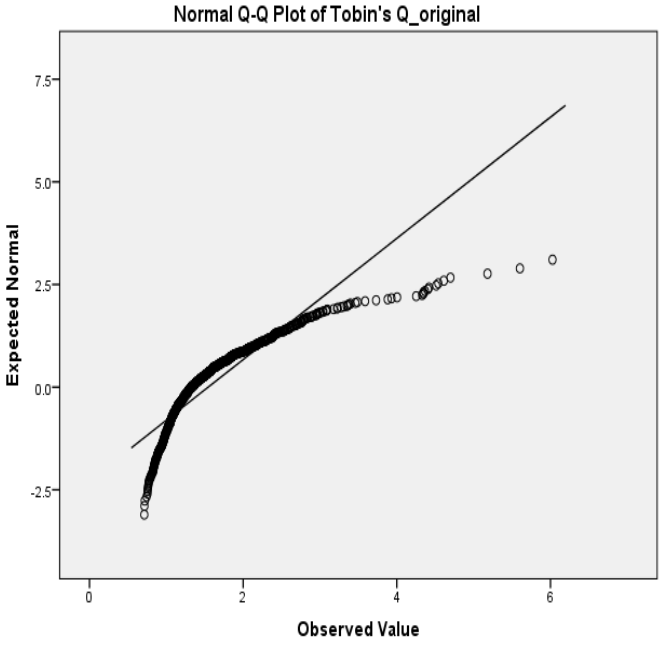
Descriptives

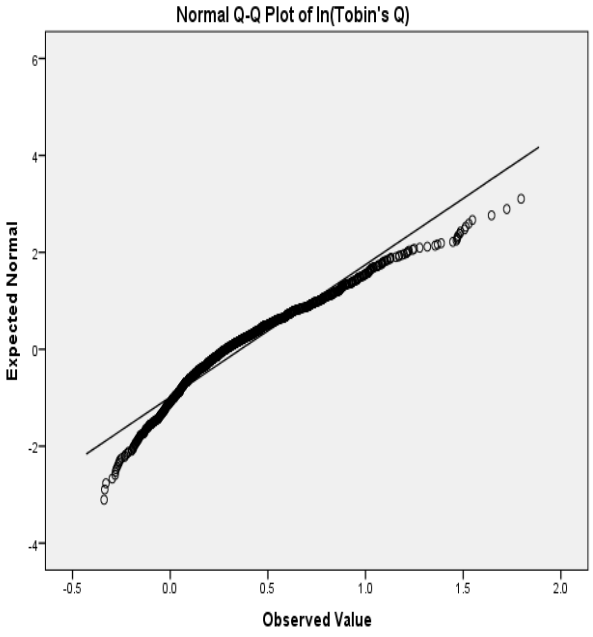
		Statistic	Std. Error
Tobin's Q	Skewness	2.113	.076
	Kurtosis	6.554	.151
ln(Tobin's Q)	Skewness	.819	.076
	Kurtosis	.461	.151

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Tobin's Q_original	.144	1048	.000	.812	1048	.000
ln(Tobin's Q)	.086	1048	.000	.953	1048	.000

a. Lilliefors Significance Correction





3. Revenue

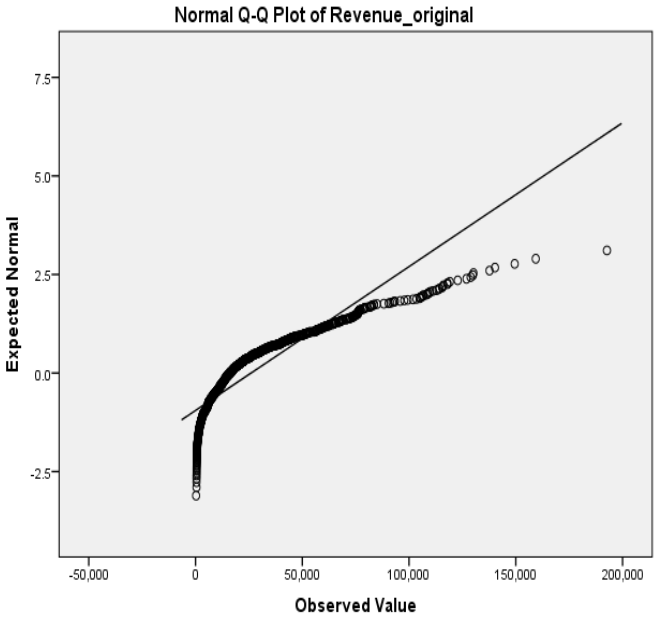
Descriptives

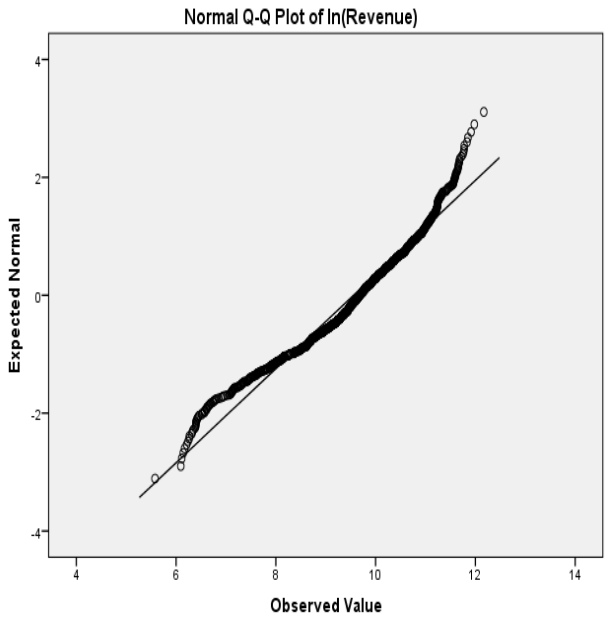
		Statistic	Std. Error
Revenue	Skewness	1.831	.075
	Kurtosis	3.886	.150
ln(Revenue)	Skewness	-.612	.075
	Kurtosis	.004	.150

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Revenue_original	.177	1068	.000	.803	1068	.000
ln(Revenue)	.069	1068	.000	.968	1068	.000

a. Lilliefors Significance Correction





II. Hierarchical multiple regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	2016, CEO gender (0=female, 1=male), ln(Tobin's Q), ln(Revenue), 2011, 2013, 2015, 2012, 2014, 2010, 2009[b]	.	Enter
2	Overconfidence (0=No,1=Yes), CEO tenure_original[b]	.	Enter
3	Moderator[b]	.	Enter

a. Dependent Variable: ln(R&D Expenditure)

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.760[a]	.578	.573	1.32864
2	.764[b]	.584	.579	1.31964
3	.766[c]	.587	.581	1.31630

a. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Tobin's Q), ln(Revenue), 2011, 2013, 2015, 2012, 2014, 2010, 2009

b. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Tobin's Q), ln(Revenue), 2011, 2013, 2015, 2012, 2014, 2010, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original

c. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Tobin's Q), ln(Revenue), 2011, 2013, 2015, 2012, 2014, 2010, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original, Moderator

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2486.138	11	226.013	128.032	.000[b]
	Residual	1818.239	1030	1.765		
	Total	4304.377	1041			
2	Regression	2514.158	13	193.397	111.054	.000[c]
	Residual	1790.219	1028	1.741		
	Total	4304.377	1041			
3	Regression	2524.959	14	180.354	104.092	.000[d]
	Residual	1779.418	1027	1.733		
	Total	4304.377	1041			

a. Dependent Variable: ln(R&D Expenditure)

b. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Tobin's Q), ln(Revenue), 2011, 2013, 2015, 2012, 2014, 2010, 2009

c. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Tobin's Q), ln(Revenue), 2011, 2013, 2015, 2012, 2014, 2010, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original

d. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Tobin's Q), ln(Revenue), 2011, 2013, 2015, 2012, 2014, 2010, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original, Moderator

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-6.888	.446		-15.441	.000		
	ln(Revenue)	1.205	.033	.742	36.326	.000	.982	1.019
	ln(Tobin's Q)	.786	.116	.142	6.763	.000	.934	1.071
	CEO gender (0=female, 1=male)	.581	.261	.045	2.223	.026	.982	1.018
	2009	.179	.173	.028	1.034	.301	.550	1.818
	2010	.266	.172	.042	1.547	.122	.558	1.791
	2011	.192	.173	.030	1.112	.267	.570	1.755
	2012	.325	.173	.051	1.878	.061	.562	1.778
	2013	.152	.174	.023	.875	.382	.571	1.751
	2014	.215	.175	.033	1.230	.219	.583	1.714
	2015	.277	.175	.042	1.586	.113	.587	1.704
	2016	.270	.176	.040	1.532	.126	.592	1.690
2	(Constant)	-6.498	.456		-14.256	.000		
	ln(Revenue)	1.179	.034	.727	35.161	.000	.947	1.056
	ln(Tobin's Q)	.811	.116	.146	7.002	.000	.927	1.079
	CEO gender (0=female, 1=male)	.653	.260	.051	2.508	.012	.977	1.024
	2009	.193	.172	.030	1.121	.262	.549	1.820
	2010	.281	.171	.044	1.646	.100	.557	1.795
	2011	.217	.172	.034	1.261	.208	.569	1.758
	2012	.358	.172	.056	2.081	.038	.561	1.783
	2013	.201	.173	.031	1.161	.246	.567	1.762
	2014	.279	.174	.042	1.602	.110	.578	1.730
	2015	.325	.174	.049	1.868	.062	.584	1.712
	2016	.322	.176	.048	1.833	.067	.588	1.701

	Overconfidence (0=No,1=Yes)	-.093	.085	-.022	-1.089	.276	.986	1.014
	CEO tenure_original	-.034	.009	-.080	-3.858	.000	.946	1.057
3	(Constant)	-6.633	.458		-14.488	.000		
	ln(Revenue)	1.176	.033	.725	35.106	.000	.945	1.058
	ln(Tobin's Q)	.808	.116	.146	6.989	.000	.927	1.079
	CEO gender (0=female, 1=male)	.649	.260	.051	2.499	.013	.977	1.024
	2009	.199	.172	.031	1.157	.248	.549	1.820
	2010	.301	.171	.047	1.763	.078	.556	1.799
	2011	.242	.172	.038	1.409	.159	.567	1.764
	2012	.366	.172	.057	2.130	.033	.561	1.783
	2013	.212	.173	.033	1.228	.220	.567	1.763
	2014	.289	.174	.044	1.664	.097	.578	1.731
	2015	.350	.174	.053	2.011	.045	.582	1.717
	2016	.348	.175	.052	1.982	.048	.586	1.707
	Overconfidence (0=No,1=Yes)	.168	.135	.040	1.244	.214	.394	2.535
	CEO tenure_original	-.006	.014	-.015	-.451	.652	.366	2.732
	Moderator	-.044	.018	-.104	-2.497	.013	.234	4.277

a. Dependent Variable: ln(R&D Expenditure)

III. Hierarchical multiple regression when dividing by 'Industry Innovativeness'

1. Innovative Industries

Variables Entered/Removed[a,b]

Model	Variables Entered	Variables Removed	Method
1	2016, ln(Revenue), ln(Tobin's Q), 2011, 2013, CEO gender (0=female, 1=male), 2014, 2010, 2015, 2012, 2009[c]	.	Enter
2	Overconfidence (0=No,1=Yes), CEO tenure_original[c]	.	Enter
3	Moderator[c]	.	Enter

a. Dependent Variable: ln(R&D Expenditure)

b. Models are based only on cases for which Innovative Industry = 1

c. All requested variables entered.

Model Summary

Model	R Innovative Industry = 1 (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	.812[a]	.660	.653	1.16871
2	.814[b]	.663	.655	1.16545
3	.815[c]	.665	.656	1.16322

a. Predictors: (Constant), 2016, ln(Revenue), ln(Tobin's Q), 2011, 2013, CEO gender (0=female, 1=male), 2014, 2010, 2015, 2012, 2009

b. Predictors: (Constant), 2016, ln(Revenue), ln(Tobin's Q), 2011, 2013, CEO gender (0=female, 1=male), 2014, 2010, 2015, 2012, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original

c. Predictors: (Constant), 2016, ln(Revenue), ln(Tobin's Q), 2011, 2013, CEO gender (0=female, 1=male), 2014, 2010, 2015, 2012, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original, Moderator

ANOVA[a,b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1462.651	11	132.968	97.349	.000[c]
	Residual	753.970	552	1.366		
	Total	2216.621	563			
2	Regression	1469.568	13	113.044	83.226	.000[d]
	Residual	747.053	550	1.358		
	Total	2216.621	563			

3	Regression	1473.784	14	105.270	77.801	.000[e]
	Residual	742.837	549	1.353		
	Total	2216.621	563			

a. Dependent Variable: ln(R&D Expenditure)

b. Selecting only cases for which Innovative Industry = 1

c. Predictors: (Constant), 2016, ln(Revenue), ln(Tobin's Q), 2011, 2013, CEO gender (0=female, 1=male), 2014, 2010, 2015, 2012, 2009

d. Predictors: (Constant), 2016, ln(Revenue), ln(Tobin's Q), 2011, 2013, CEO gender (0=female, 1=male), 2014, 2010, 2015, 2012, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original

e. Predictors: (Constant), 2016, ln(Revenue), ln(Tobin's Q), 2011, 2013, CEO gender (0=female, 1=male), 2014, 2010, 2015, 2012, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original, Moderator

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-5.838	.506		-11.544	.000
	ln(Revenue)	1.150	.036	.807	31.995	.000
	ln(Tobin's Q)	1.027	.172	.158	5.967	.000
	CEO gender (0=female, 1=male)	.280	.276	.026	1.013	.311
	2009	.301	.211	.048	1.430	.153
	2010	.341	.209	.055	1.635	.103
	2011	.315	.207	.050	1.521	.129
	2012	.563	.209	.091	2.694	.007
	2013	.361	.211	.057	1.715	.087
	2014	.357	.211	.056	1.694	.091
	2015	.462	.210	.072	2.199	.028
	2016	.426	.211	.066	2.018	.044
2	(Constant)	-5.585	.517		-10.805	.000
	ln(Revenue)	1.138	.036	.799	31.369	.000
	ln(Tobin's Q)	1.064	.172	.164	6.169	.000
	CEO gender (0=female, 1=male)	.312	.277	.029	1.126	.261
	2009	.319	.210	.051	1.517	.130
	2010	.367	.208	.059	1.758	.079
	2011	.309	.207	.050	1.495	.135

	2012	.587	.209	.095	2.808	.005
	2013	.378	.212	.060	1.789	.074
	2014	.367	.212	.057	1.734	.083
	2015	.483	.210	.075	2.300	.022
	2016	.423	.211	.065	2.002	.046
	Overconfidence (0=No,1=Yes)	-.212	.103	-.052	-2.054	.040
	CEO tenure_original	-.011	.012	-.024	-.941	.347
3	(Constant)	-5.665	.518		-10.938	.000
	ln(Revenue)	1.131	.036	.793	31.030	.000
	ln(Tobin's Q)	1.055	.172	.162	6.126	.000
	CEO gender (0=female, 1=male)	.293	.277	.027	1.059	.290
	2009	.317	.210	.051	1.511	.131
	2010	.379	.208	.061	1.822	.069
	2011	.329	.207	.053	1.591	.112
	2012	.604	.209	.097	2.892	.004
	2013	.384	.211	.061	1.817	.070
	2014	.360	.211	.056	1.705	.089
	2015	.523	.211	.081	2.479	.013
	2016	.438	.211	.068	2.076	.038
	Overconfidence (0=No,1=Yes)	.030	.171	.007	.174	.862
	CEO tenure_original	.018	.021	.038	.874	.383
	Moderator	-.045	.025	-.097	-1.765	.078

a. Dependent Variable: ln(R&D Expenditure)

b. Selecting only cases for which Innovative Industry = 1

2. Non-innovative Industries

Variables Entered/Removed[a,b]

Model	Variables Entered	Variables Removed	Method
1	2016, CEO gender (0=female, 1=male), ln(Revenue), 2011, 2014, ln(Tobin's Q), 2013, 2012, 2015, 2010, 2009[c]	.	Enter
2	Overconfidence (0=No,1=Yes), CEO tenure_original[c]	.	Enter
3	Moderator[c]	.	Enter

a. Dependent Variable: ln(R&D Expenditure)

b. Models are based only on cases for which Innovative Industry = 0

c. All requested variables entered.

Model Summary

Model	R Innovative Industry = 0 (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	.788[a]	.621	.613	1.27032
2	.790[b]	.624	.614	1.26802
3	.793[c]	.629	.618	1.26120

a. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Revenue), 2011, 2014, ln(Tobin's Q), 2013, 2012, 2015, 2010, 2009

b. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Revenue), 2011, 2014, ln(Tobin's Q), 2013, 2012, 2015, 2010, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original

c. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Revenue), 2011, 2014, ln(Tobin's Q), 2013, 2012, 2015, 2010, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original, Moderator

ANOVA[a,b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1234.520	11	112.229	69.548	.000[c]
	Residual	751.986	466	1.614		
	Total	1986.506	477			
2	Regression	1240.454	13	95.420	59.345	.000[d]
	Residual	746.052	464	1.608		
	Total	1986.506	477			
3	Regression	1250.050	14	89.289	56.135	.000[e]

Residual	736.456	463	1.591		
Total	1986.506	477			

a. Dependent Variable: ln(R&D Expenditure)

b. Selecting only cases for which Innovative Industry = 0

c. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Revenue), 2011, 2014, ln(Tobin's Q), 2013, 2012, 2015, 2010, 2009

d. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Revenue), 2011, 2014, ln(Tobin's Q), 2013, 2012, 2015, 2010, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original

e. Predictors: (Constant), 2016, CEO gender (0=female, 1=male), ln(Revenue), 2011, 2014, ln(Tobin's Q), 2013, 2012, 2015, 2010, 2009, Overconfidence (0=No,1=Yes), CEO tenure_original, Moderator

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-10.901	.749		-14.547	.000
	ln(Revenue)	1.385	.056	.721	24.851	.000
	ln(Tobin's Q)	1.174	.151	.232	7.757	.000
	CEO gender (0=female, 1=male)	2.330	.489	.137	4.770	.000
	2009	.188	.242	.030	.775	.439
	2010	.303	.240	.048	1.265	.206
	2011	.062	.244	.010	.255	.799
	2012	.083	.244	.013	.340	.734
	2013	-.064	.243	-.010	-.264	.792
	2014	-.009	.245	-.001	-.037	.971
	2015	-.073	.247	-.011	-.296	.767
	2016	-.070	.250	-.010	-.282	.778
2	(Constant)	-10.516	.782		-13.452	.000
	ln(Revenue)	1.352	.058	.704	23.279	.000
	ln(Tobin's Q)	1.178	.151	.233	7.792	.000
	CEO gender (0=female, 1=male)	2.347	.488	.138	4.812	.000
	2009	.195	.242	.031	.808	.420
	2010	.300	.239	.048	1.255	.210
	2011	.074	.244	.011	.303	.762
	2012	.093	.244	.014	.380	.704
	2013	-.040	.243	-.006	-.166	.869
	2014	.027	.246	.004	.109	.914
	2015	-.041	.247	-.006	-.165	.869

	2016	-.026	.251	-.004	-.105	.917
	Overconfidence (0=No,1=Yes)	.044	.122	.010	.363	.717
	CEO tenure_original	-.021	.011	-.057	-1.893	.059
3	(Constant)	-10.767	.784		-13.729	.000
	ln(Revenue)	1.353	.058	.705	23.418	.000
	ln(Tobin's Q)	1.172	.150	.232	7.791	.000
	CEO gender (0=female, 1=male)	2.372	.485	.140	4.887	.000
	2009	.210	.240	.033	.875	.382
	2010	.331	.238	.053	1.387	.166
	2011	.103	.243	.016	.424	.672
	2012	.082	.242	.013	.339	.735
	2013	-.025	.242	-.004	-.104	.917
	2014	.053	.245	.008	.215	.830
	2015	-.038	.246	-.006	-.155	.877
	2016	.012	.250	.002	.049	.961
	Overconfidence (0=No,1=Yes)	.393	.187	.092	2.105	.036
	CEO tenure_original	.011	.017	.029	.634	.526
	Moderator	-.054	.022	-.139	-2.456	.014

a. Dependent Variable: ln(R&D Expenditure)

b. Selecting only cases for which Innovative Industry = 0