



UNIVERSIDADE CATÓLICA PORTUGUESA

# Enterprise Risk Management and Value:

Evidence from the Utility sector

Daniel Francisco Coelho Ferreira dos Santos



UNIVERSIDADE CATÓLICA PORTUGUESA

# Enterprise Risk Management and Value: Evidence from the Utility sector

Master Final Assignment on the category of Dissertation presented to  
Católica Porto Business School, Universidade Católica Portuguesa for the  
attainment of the Master degree in Finance

by

Daniel Francisco Coelho Ferreira dos Santos

under supervision of  
Professor Ricardo Cunha

Católica Porto Business School  
March 2021

# Agradecimentos

Gostava de agradecer a todas as pessoas que me apoiaram e foram imprescindíveis para a realização do meu Trabalho Final de Mestrado e para o sucesso do meu percurso académico. Sinto-me afortunado por ter um sistema de apoio tão forte na minha vida que me leva a ter a motivação e atitude para alcançar os meus objetivos.

Agradeço aos meus irmãos, Eduardo e Andreia, por sempre estarem disponíveis para me ajudar e aconselhar nas minhas decisões académicas e pessoais. Aos meus pais, Elísio e Emília, por todo o sacrifício que fizeram para que eu tenha o maior sucesso a nível pessoal e académico. Aos meus amigos que me acompanharam em todos os momentos do meu percurso.

Ao professor Ricardo Cunha pela supervisão e orientação na realização do Trabalho Final de Mestrado, essenciais para que os objetivos do mesmo fossem alcançados com o maior rigor.

# Resumo

Na última década, a importância de Gestão de Risco Empresarial tem aumentado e vindo a ser um ponto essencial de discussão e foco para as empresas, devido à incerteza e crises económicas e financeiras que estas têm vindo a enfrentar. A literatura e a teoria económica relacionam a implementação de Gestão de Risco Empresarial com a criação de valor da empresa e a boa performance financeira.

O objetivo deste trabalho de investigação é analisar a relação entre a implementação de Gestão de Risco Empresarial e o valor das empresas do setor *Utility*, um setor em constante mudança e inovação devido às estratégias contra as alterações climáticas, objetivos de descarbonização definidos e preferências dos consumidores. De forma a responder à questão de investigação, realizei uma regressão na qual a variável explicada é o *Tobin Q*, enquanto o *proxy* para o valor de empresa, e a variável explicativa é um *Score ERM* como *proxy* para o nível de implementação de Gestão de Risco Empresarial das empresas, assumindo como variáveis de controlo diversas variáveis contabilísticas e de *corporate governance* usadas também na literatura, tais como, dimensão, alavancagem, *Return on Assets*, crescimento das vendas, dimensão, independência do Conselho Administração e dividendos. Recolhi informação sobre 10 empresas do mesmo setor (2 portuguesas e 8 europeias) relativamente aos anos 2017, 2018 e 2019, um total de 30 observações.

Os resultados obtidos demonstram que a implementação de Gestão de Risco Empresarial, neste momento, não tem impacto significativo no valor das empresas. O mercado ainda não reage nem reconhece diferentes níveis de implementação de Gestão de Risco Empresarial como um fator diferenciador para a criação do valor da empresa. Os resultados demonstram ainda que a

implementação de Gestão de Risco Empresarial não tem impacto significativo na performance financeira das empresas. Este resultado é influenciado pelo facto de as empresas analisadas terem um elevado grau de implementação de Gestão de Risco Empresarial.

Palavras-chave: Gestão de Risco Empresarial, Criação de valor, Valor da empresa, setor *Utility*

# Abstract

In the last decade, the importance of Enterprise Risk Management (ERM) is emerging and becoming a critical point of discussion and focus on firms due to high uncertainty environments and the economic and financial crisis. The literature and economic theory relate ERM implementation to an increase in firm value and better firms' performance.

This research objective is to analyze the relationship between ERM implementation and firm value in firms from the Utility sector, which is a sector that is constantly changing and innovating due to climate change strategies, decarbonization goals and consumer preferences. To respond to the research question I build a regression, where the explained variable is Tobin's Q as a proxy to firm value and the explanatory variable is an ERM Score as proxy to firms ERM implementation level. As control variables, I added accounting variables and corporate governance variables that are generally proposed in the literature and other researches like company size, financial leverage, Return on Assets, sales growth, Board size and independence, and dividends. As a sample, I collected data from 10 firms (2 Portuguese and 8 European) from 2017, 2018, 2019, a total of 30 observations.

The result demonstrates that Enterprise Risk Management implementation has no significant impact on firms' value, at the moment. In other words, the market still does not react and recognizes different levels of ERM implementation as a competitive factor to firm value add.

It could result from the fact that Enterprise Risk Management implementation also does not have a significant impact on firms accounting performance, as demonstrated in my robustness check analysis. These results

are also influenced by the high level of implementation of Enterprise Risk Management in the firms that constitute the sample.

Keywords: Enterprise Risk Management, Firm Value, Value Creation, Utility Sector

# Index

Agradecimientos .....	iii
Resumo.....	iv
Abstract .....	vi
Index .....	viii
List of Tables.....	ix
List of Abbreviations.....	x
Introduction.....	11
Chapter 1.....	15
Literature Review .....	15
1.1 Notion of Risk .....	15
1.2 Traditional Risk Management .....	17
1.3 Enterprise Risk Management.....	19
1.4 Advantages of Enterprise Risk Management.....	24
1.5 COSO 2004.....	28
1.6 COSO 2012.....	30
1.7 COSO 2017.....	34
Chapter 2.....	38
Theoretical Framework and Methodology .....	38
2.1 Variables and Models.....	38
2.2 Sample Development and Utility Sector .....	46
2.3 Descriptive Statistics .....	47
Chapter 3.....	49
Estimation Results .....	49
3.1 Enterprise risk management and firm value: main results .....	49
3.2 Robustness Check: Enterprise Risk Management and firm performance.....	53
Chapter 4.....	56
Conclusions .....	56
4.1 Main Conclusions .....	56
4.2 Limitations and Future Research .....	57
Bibliography .....	59
Appendix .....	63

# List of Tables

Table 1 - Components and Principles - COSO 2017.....	40
Table 2 - Variable expected signs and sources of information.....	45
Table 3 - Descriptive Statistics.....	47
Table 4 - ERM Score frequency distribution .....	48
Table 5 - Estimation results of regression of the level of ERM implementation on Firm Value.....	51
Table 6 - Estimation results of regression of the level of ERM implementation on Firm Accounting Performance .....	55
Table 7 - ERM Score per firm and year .....	63
Table 8 - ERM Score per firm and year .....	64

# List of Abbreviations

ERM – Enterprise Risk Management

TRM – Traditional Risk Management

CRO – Chief Risk Officer

CFO – Chief Financial Officer

COSO - Committee of Sponsoring Organizations of the Treadway

Commission

S&P - Standard and Poor's

CEO – Chief Executive Officer

ROA – Return-on-Assets

OLS – Ordinary Least Squares

# Introduction

The Enterprise Risk Management (ERM) importance to firms has been increasing over the years due to the need for firms to be prepared to take advantage of opportunities and mitigate risks that are originated from uncertain environments and financial crises. In this sense, the incorporation of components as strategy, corporate governance, culture in the risk management systems became critical to firms.

In the literature, the notion of risk was created, after the seventh century, as the probability of a negative or positive outcome of a certain event. Risk is translated as an opportunity to get a competitive advantage/profit or to events that might lead to losses. Also, Risk cannot be calculated accurately, since statistics are used just to represent probabilities, the likelihood of a certain event happen at a certain period. However, the risk assessment provides data for decision-making and risk mitigation. In this sense, risk assessment provides to the firm's management a guide for rational action and data that can be used to mitigate risk in the most effective way (Reith, 2004).

Since the late 1940s and early 1950s, Risk Management is seen as a formal part of the decision-making processes within companies and it has been changing over the decades. Traditional Risk Management (TRM) assesses risk in an isolated manner, not taking into consideration the full picture. In those environments, risks are managed by business-unit leaders with minimal oversight or communication of how particular risk management responses could affect others on the enterprise, including strategic risks (Frigo & Anderson, 2011). Furthermore, risk handling in traditional approaches is commonly rather defensive in that it concentrates on the protection of the

company against adverse financial scenarios and does not take into consideration growth opportunities. (Gatzert & Martin, 2015).

Risk management can be done in two fundamentally different ways: by traditional approaches, as mentioned before, or by Enterprise Risk Management, which aggregates all the risks across the entire firm and thereby taking into account interdependencies between business units and functions. The second approach allows for a better assessment of the firm's risk situation and improves the decision-making process concerning strategy and operations development (Nocco & Stulz, 2006).

The COSO (Committee of Sponsoring Organizations of the Treadway Commission), describes Enterprise Risk Management as *“a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives”*. Lundqvist (2015) refers that ERM is a step beyond traditional risk management where additional efforts are made by the company to unite the risk management process organizationally across internal systems, processes and people. Nocco & Stulz (2006) reinforces that Enterprise Risk Management creates value for the firm and its shareholders through its effects at two levels: at a “macro” or company-wide level and a “micro” or business- unit level. At the macro level, Enterprise Risk Management creates value by enabling boards and managers to quantify and manage the risk-return trade-off that the company faces through its business model and market. By adopting this perception, Enterprise Risk Management helps the company sustain access to the capital markets and other resources necessary to implement its strategy and business plan. At the micro-level, Enterprise Risk Management becomes a way of life for all the company, from the board of directors to managers and employees.

In this study, I analyze the benefits referred by economic theory about the impact of Enterprise Risk Management in firm value, a relation which is still not extensively confirmed and evidenced by other researches. To analyze this research question, I build an OLS regression where the explained variable is Tobin's Q as a proxy to firm value, the explanatory variable is an ERM Score as proxy to firms ERM implementation level, and the control variables are those generally used in the literature and other researches, mainly company size, financial leverage, Return on Assets (ROA), sales growth, Board size and independence, and dividends.

The ERM Score is based on the twenty principles of the "Enterprise Risk Management - Integrating with Strategy and Performance" framework from COSO (2017) and has a value range from 0 to 20, where the value of 1 is given if a principle is identified and the value of 0 if a principle is not identified in the reports and documents published by the firm (please consult the appendix to see the respective ERM Score per firm and year).

To Robustness Check my analysis, I built another OLS regression, similar to the first one but with Return on Assets (ROA) as my explained variable, a proxy to firms accounting performance. For my sample, I collected data from 10 firms of the Utility sector from 2017, 2018, 2019.

The results show that Enterprise Risk Management implementation has no significant impact on firms' value. In other words, the market does not recognize different levels of ERM implementation as a factor to firm value. This could result from the fact that Enterprise Risk Management implementation also does not have a significant impact on firms accounting performance, as demonstrated in my robustness check analysis. I believe these results are influenced by the high implementation levels of Enterprise Risk Management in the firms that constitute the sample.

My Master Final Assignment is structured in 4 chapters. In Chapter 1, I review the literature about the notion of risk, traditional risk management and enterprise Risk Management, including the principal frameworks published from COSO (Committee of Sponsoring Organizations of the Treadway Commission).

In chapter 2, it is presented the methodology, the variables used as determinants, the sample collected to comprehend the research and expectable relationships between the variables

Chapter 3 presents the results and compares them to other researches about the topic while in chapter 4, I conclude on the results obtained, limitations that I have faced during the realization of the assignment and future researches that are available which could be relevant to respond to the research question.

# Chapter 1

## Literature Review

### 1.1 Notion of Risk

The notion of risk only appeared in the mid-seventeenth century, from the Anglo-French word “risqué”. Until then, there was no literature on the notion of risk in pre-industrial societies. The uncertainty of any event was expressed as a range of religious and magical beliefs, as if the fate and the luck of an individual were predetermined by the divine figure of God, going beyond human agency. Then, it was not possible to exist the concept of randomness as well (Reith, 2004).

After the seventeenth century, the development of rationalism and the growth of mercantile capitalism, speculation, insurance and credit in an international marketplace made possible the creation of the notion of risk. The creation of profits depended on foresight and planning, which in turn demanded consideration of a future that was neither fixed nor beyond human control. In this sense, probabilities and statistics started to be used to estimate the future in the long-term. Probabilities embrace the idea of an open future, where individuals shape their destiny and an event will not certainly happen but might happen, leaving behind the traditional restrictions related to religious and magical beliefs. Then, since the risk of an event occurring is the probability of it happening over a stated period, risk can be determined through probabilities (scientific methods) (Reith, 2004; Spira & Page, 2003; Woods, 2008). The Oxford dictionary defines risk as “the possibility of something bad happening at some time in the future; a situation that could be dangerous or have a bad result”.

The notion of risk is associated with the probability of a negative or positive outcome of a certain event. The risk of an investment comprehends the probability of having a future cash flow higher or lower than the expected cash flow. Risk can be defined as a combination of the probabilities of a certain event and its outcomes. We can say that risk has two sides of the same coin, one of them is the opportunity to get a gain and the other is a danger to have a loss. Harry Markowitz, in his doctoral thesis about the theory of portfolio selection, did not define risk but proposed the following rule, "*...that the investor does (or should) consider expected return a desirable thing and variance of return an undesirable thing*".

Risk is composed of two essential components, exposure and uncertainty. Therefore, the risk is the exposure to a proposition (an event occurring at a certain period) of which one is uncertain (Holton, 2004).

Risk cannot be calculated accurately, since statistics are used just to represent probabilities, like the likelihood of a certain event happen at a certain period. However, the utility of risk it's the ability to provide a logic for decision making, through risk mitigation. In this sense, risk gives individuals a guide for rational action and partial knowledge that can be used to manage risk in the most effective way (Reith, 2004).

There are 3 types of risks that a company can be exposed to: preventable risks, strategy risks and external risks. Preventable risks are internal risks that are controllable and should be eliminated or avoided in the sense that the company does not get any strategic benefit from taking them. The best way to manage this type of risk is through active prevention such as monitoring operational processes and guiding people's behaviors and decisions towards desired norms.

Strategy risks are different from preventable risks because sometimes companies voluntarily take them to generate superior returns from their

strategy. These types of risks cannot be managed through a rules-based control model. Instead, companies need a risk-management system designed to reduce the probability that the assumed risk materializes.

External risks arise from outside of the company and are out of their control such as natural disasters, political instability or macroeconomic changes. Risk management should focus on identifying and mitigating them, through open and explicit risk discussion (Kaplan & Mikes, 2012).

## 1.2 Traditional Risk Management

Since the late 1940s and early 1950s, Risk Management is seen as a formal part of the decision-making processes within companies. For a long time, the existence of insurance markets gave to the companies the possibility to transfer certain types of risks. Some of these insurable risks could be prevented or decreased through efficient loss-prevention and control systems while some could be held and financed within the company. This leads to a broader approach to the management of insurable risks.

In the 1970s, financial risk management started to be implemented as a formal system, at the same time as the development of financial derivative products occurred, for example, futures, options and swaps. The goal was to manage various financial risks, such as movements in exchange rates, interest rates and stock prices that companies are exposed to. Financial risk management emerged in much the same way as insurance risk management had previously. It was encouraged by the existence of these financial products, which caused management to consider how much of the risks should be retained within the company and how much should be offset through external arrangements. Companies also recognized that insurable risks and financial risks should be managed together, since the purchase of insurance and the

purchase of derivatives to hedge financial risks performed essentially the same role (Dickinson, 2001).

In the Traditional Risk Management (TRM) approach, frequently referred to as a “silo” or “stovepipe” approach, risks are often managed in isolation. The risks are managed by business-unit leaders with minimal oversight or communication of how particular risk management responses could affect other aspects of the enterprise, including strategic risks (Frigo & Anderson, 2011). TRM focuses on compliance and financial reporting and it has a narrow, insurance-based view (Desender, 2011). Furthermore, risk handling in traditional approaches is commonly rather defensive in a way that it concentrates on the protection of the company against adverse financial scenarios. (Gatzert & Martin, 2015). TRM involves four dimensions: risk identification, risk measurement, risk monitoring and reporting and auditing of processes (Lundqvist, 2015).

Twenty years ago, the job of the corporate risk manager, usually, a lower-level position in the corporate treasury, involved mostly the purchase of insurance. At the same time, treasurers were responsible for the hedging of interest rates and foreign exchange exposures. Over the last years, however, corporate risk management has expanded well beyond insurance and the hedging of financial exposures to include a variety of other kinds of risk (Nocco, 2006; Woods 2008).

TRM is motivated by traditional theories as transaction costs, agency costs of debt and agency costs of managerial incentives. Transaction costs, in terms of costs of financial distress, are frequently found to be a significant determinant of hedging and risk management. Firms with high levels of debt face greater agency costs resulting from underinvestment and/or risk shifting. In this sense risk management can be used to reduce the volatility of firm value, helping to solve the underinvestment problem. Also, debtholder’s demand costly

compensations to block risk shifting from shareholders to debtholders. Aiming to reduce these compensation costs, risk management can lower the riskiness of projects which satisfy both shareholders and debtholders. Furthermore, growth proxied by (market-to-book ratio, Tobin's Q, price-to-earnings ratio, and market-adjusted cumulative abnormal return) have a positive and significant relation to hedging and risk management. Manager and shareholder relationship are a motivation to risk management because managers with stock ownership are more likely to implement it than managers with option holdings. These motives of traditional risk management discussed above are also motives to implement Enterprise Risk Management (Lundqvist, 2015), the more evolved risk management methodology, described below.

### 1.3 Enterprise Risk Management

A company that chooses to manage risks can do it in two fundamentally different ways: by traditional approaches, as mentioned before, or by Enterprise Risk Management, which aggregates all the risks across the entire firm. Taking into account interdependencies between risks allows for a better assessment of the firm's risk situation and further improves the decision process concerning strategic and operative development (Nocco & Stulz, 2006).

The focus of Enterprise Risk Management is shifted towards more offensive handling through the integration of Enterprise Risk Management into the corporate strategy and the decision process and is explicitly intended to contribute to increasing shareholder value. Enterprise Risk Management thus does not only attempt to mitigate risk but explicitly accounts for potential opportunities (Gatzert, 2015).

Risk management has developed from an insurance and transaction-based function into a much wider concept that is related to both corporate governance

and the achievement of strategic objectives. The concept of risk management includes topics such as corporate reputation, regulatory compliance, health and safety, employees, supply chain management and general operational activities, and it is not just centered in the treasury division with its use of financial instruments to hedge transaction and funding risks. Risk is now viewed from a broader perspective and it has important implications for the design of internal control systems (Woods, 2008).

Lundqvist (2015) refers that ERM is a step beyond traditional risk management where additional efforts are made by the company to unite the risk management process organizationally across internal systems, processes and people. Companies add risk governance to the traditional risk management process, to achieve an integrated approach to risk management. Risk governance is referred to as the structure of the risk management system and specifies responsibilities, authority, and accountability in the risk management system as well as the rules and procedures for making decisions in risk management.

ERM and the Balanced Scorecard overlap themselves in terms of their basic philosophies, organizational breadth and scope for use as both control and performance measurement tools. Although the Balanced Scorecard and ERM are different types of control systems, there are potential advantages to be gained by their integration. The Balanced Scorecard is a management control system that identifies four component perspectives within which a company must perform well to achieve its strategic objectives: financial, customer, internal business processes, learning and growth (Woods, 2008).

ERM is orderly or prescribed conduct or pattern of behavior for an enterprise, that has the full support and commitment of the management of the enterprise, that affects corporate decision-making, and that ultimately becomes part of the culture of that enterprise. ERM contemplate all stakeholders of the

enterprise, which include shareholders and debtholders, management and officers, employees, customers, and the community within which the enterprise resides (Casual Actuarial Society, 2003).

Arena et al. (2010) analyze the ERM dynamics through three elements: risk rationalities, uncertainty experts, and technologies. The first element, risk rationalities, refers to companies' efforts to conceptualize uncertainty into manageable and communicable risks and to appropriately distribute tasks for dealing with them. The managerial thrust of ERM is challenged by the institutionalized values associated with other organizational sub-systems and processes. The existence of established practices may result in a decoupling of new and aspiring risk rationalities so that previous practices continue to be seen as the legitimate managerial device by which managers and risks are accountable, while ERM is reduced to an add-on for internal control and compliance to external regulations.

The second element of analysis is uncertainty experts. It is necessary to understand the organizational roles that are involved to different extents in conceptualizing and controlling uncertainty (Arena, Arnaboldi & Azzone, 2010).

Since ERM must be a top-down process, the senior management is responsible for defining the objectives of the ERM and for integrating them into an integrated corporate strategy. A new management role, designed as Chief Risk Officer (CRO), is now emerging because of the complexity of identifying, controlling and managing risks across a company, a position that in general does not exist in traditional approaches. The CRO must determine the parameters for the policies and the organizational structure for the effective implementation of ERM and must delegate some responsibility to those closest to where the risks are likely to impact or arise so that early action can be taken to prevent a small problem growing into a larger one. The CRO also has a

communication function with direct reporting to the executive board and shareholders concerning the corporate firm's risk situation and profile. Thus, information asymmetries between the company representatives and shareholders can be reduced. Also, the CRO must maintain close links with the chief financial officer (CFO). The financing of risks, whether retained or transferred, rests with the chief financial officer, who will inevitably be a senior executive and will also sit on the main strategic planning committee (Dickinson, 2001; Gatzert, 2015).

Another professional group playing a role in the sphere of ERM is that of internal auditors, that have wanted to expand their professional jurisdiction, most often by taking the risk assessment tasks, but sometimes also the entire risk management process. The final group is that of management accountants, who have traditionally played a key role in controlling uncertainty through the analysis of variances in performance. The mutual entanglement of these organizational roles, along with their embedded agency in conceptualizing uncertainty, are key elements for understanding the organizational dynamics of ERM on two levels. First, these professional groups can all be translators of ERM in different organizations, or even in the same organization at different times. This impact is expected to be reinforced and performed during its translation into practices by the language, understanding and competences of those roles. Second, the overlapping of different roles, all charged with managing uncertainty, has implications relating to professional rivalry and professional development (Arena, Arnaboldi & Azzone, 2010).

Finally, there is the third element of analysis: technologies. The term technologies here denote the complex set of practices, procedures and instruments put in place by organizations to carry out strategies and plans. Some companies implement ERM as a unified practice that covers all risks with a cross-cutting approach, whereas in others ERM is more of an umbrella under

which separate risk management practices are carried out by different functional areas. Also, material ERM systems vary in their specific risk measures. The evaluation of risks can be done qualitatively or quantitatively. Finally, ERM technologies articulate different relations between business managers and ERM orchestrators (Arena, Arnaboldi & Azzone, 2010).

Brodeur et al. (2010) refers that boards must ensure that their company's ERM capabilities are at the level of best practices and are well adapted to the company's business culture and the nature of the risk it faces. To achieve that goal, best practices are needed in all five dimensions: risk transparency and insight, risk appetite and strategy, risk-related business processes and decisions, risk organization and governance and risk culture:

- Risk transparency and insight – a strong risk identification process captures all key risks. It should have three elements: a “heat map”, an exercise to identify the company's “big bets” and a risk reporting system that delivers consistent and insightful information.
- Risk appetite and strategy – companies, which are inherently risk-takers, should clearly articulate how much risk they are comfortable taking, what kind of risk are willing to take and how they expect to profit from those risks.
- Risk-related business processes – Good risk management needs to go well beyond the narrow boundaries of the core risk process. Indeed, risk and return tradeoffs are integral to a wide range of business processes.
- Risk organization and governance – the best boards have all their member take responsibility for risk oversight. As should be evident from the foregoing, they interact directly with management on risk matters. And they ensure that the company has an ERM organizational model that is optimized for the kinds of risks a company encounters and the work entailed in reporting on, evaluating and deciding to accept or mitigate risks.

- Risk culture – we can define “risk culture” as the norms of behavior for individuals and groups within a company that determine the collective willingness to accept or take the risk, and the ability to identify, understand, discuss, and act on the organization’s risks.

## 1.4 Advantages of Enterprise Risk Management

Nocco & Stulz (2006) refer that Enterprise Risk Management creates value to the company and its shareholders through its effects at two levels: at a “macro” or company-wide level and a “micro” or business- unit level. At the macro level, Enterprise Risk Management creates value by enabling boards and managers to quantify and manage the risk-return trade-off that the company faces through its business model and market. By adopting this perception, Enterprise Risk Management helps the company sustain access to the capital markets and other resources necessary to implement its strategy and business plan. At the micro-level, Enterprise Risk Management becomes a way of life for all the company, from the board of directors to managers and employees.

Certain individuals have the “perfect markets” view, since shareholders can diversify their portfolios, the value of a firm does not depend on its “total” risk. From this perspective, a company’s cost of capital depends mostly on the “systematic” or “non-diversifiable” component of that risk (as generally measured by a company’s “beta”). And this, in turn, suggests that efforts to manage total risk are a waste of resources. However in the real world, where investors’ information is far from complete and financial troubles can disrupt a company’s operations, a bad outcome resultant from a “diversifiable” risk, as an unexpected spike in a currency or commodity price, can have costs that go well beyond the immediate hit to cash flow and earnings. The main function of Enterprise Risk Management is protecting ability to carry the firm’s business

plan. By managing risk, a company can limit the probability that a large cash shortfall will lead to value-destroying cutbacks in investment.

One of the most complex and critical dimensions of Enterprise Risk Management is to decide what should the company hedge and what risks are worth being taken. Corporate exposures to changes in currencies, interest rates, and commodity prices can regularly be hedged inexpensively using derivatives. On the other hand, companies in the course of their normal activities take many strategic or business risks that they cannot profitably lay off in capital markets or other developed risk transfer markets. Companies should use the principle of comparative advantage in risk-bearing, in making decisions whether to retain or transfer risks. A company that cannot forecast market variables has no comparative advantage in taking the risk associated with those variables. In contrast, the same company should have a comparative advantage in taking firm-specific business risks because it knows more about these risks than anybody else. The acknowledgment that there are no economic ways of transferring risks that are unique to a company's business operations can help to underscore the potential value of reducing the firm's exposure to other, "non-core" risks. After management has decided that the firm has a comparative advantage in taking certain business risks, it should use risk management to help the firm make the most of this advantage. So, by reducing non-core exposures, Enterprise Risk Management effectively enables companies to make more strategic business risks and greater advantage of the opportunities in their core business.

A company that is implementing Enterprise Risk Management needs to ensure that decision-making not just by the board of directors, but by managers throughout the firm, takes correct account of the risk-return trade-off. To do this, the risk evaluations of new projects must be done on a decentralized basis by the managers in the business units. An essential part of senior management's

and the CRO's job is to provide the information and incentives for each unit to make these trade-offs in ways that serve the interests of the company and shareholders.

There are two main components of decentralizing the risk-return trade-off in a company: firstly, managers proposing new projects should be required to evaluate the risks in the context of the impact of the projects on the firm's total risk; secondly, to help guarantee that managers do a good job of assessing the risk-return trade-off, the periodic performance evaluations of the business units must take account of the contributions of each of the units to the total risk of the firm. If these two components are well implemented, Enterprise Risk Management can change the culture of the firm.

Spreading risk ownership throughout the company has become more significant as the range of risk management has expanded to include operating and reputational risks. Some of these risks can be insured, but companies regularly choose to reduce their exposure to such risks by changing procedures and technologies. The individuals who are closest to these risks are in the best position to measure what steps should be taken to reduce the company's exposure to them.

As referred to in the *Journal of Applied Finance* (2008), Enterprise Risk Management contributes to shareholder value but it is not easy to emphasize the impact that has on a company because if a company has made a good job of risk management, people will not notice that nothing went wrong. This presents a challenge because you do not necessarily implement a risk management program to earn more profit. The motivation is rather on reducing the probability of an unanticipated loss. Enterprise Risk Management is of greatest value to organizations in a rapidly changing market, or for an organization undergoing great change or where the management team is new or changing.

Quon, Zeghal & Maingot (2012) refer that ERM increases shareholder value because of improved capital efficiency, informed decision-making and investor confidence. Capital efficiency is improved by reducing expenditures on immaterial risks and exploiting natural hedges. ERM can support informed decision-making by exposing areas of high risk and suggesting risk-based advances. Furthermore, investor confidence increases by establishing a process that can reduce the volatility of financial results and demonstrate to all stakeholders that the organization practices risk stewardship.

Since 2007, Standard and Poor's (S&P) has included a risk management rating as a component in its overall rating of insurance companies. The rating is a sophisticated and comprehensive index that assesses the risk management culture, risk control processes, emerging risks management, risk and economic capital models, and strategic risk management. S&P assigns risk management "ERM ratings" over five categories, which is interpreted as an indicator of increasing levels of risk management sophistication ranging over three TRM levels and two ERM levels. S&P places each insurer into one of five "ERM rating" categories. A weak ERM program lacks reliable loss control systems for one or more major risks. An adequate ERM program has reliable loss control systems but may still be managing risks in silos instead of coordinating risks across the firm. The ERM program is rated adequate with a positive trend if it exhibits strong/excellent risk control systems but still lacks a well-developed process for making coordinated risk/reward decisions that are necessary for effective strategic risk management. A strong ERM program has progressed beyond silo risk management to deal with risks in a coordinated approach, the capability to envision and handle emerging risks, and well-developed risk-control processes and a focus on optimizing risk-adjusted returns that are necessary for effective strategic risk management. An excellent ERM program has the same characteristics as a strong ERM program but is even further into

the implementation, effectiveness, and execution of the ERM program. A firm with a higher rating will have lower borrowing costs and increased investor confidence (McShane, Nair & Rustambekov, 2011).

## 1.5 COSO 2004

In the United States, the Committee of Sponsoring Organizations (COSO) published the ERM Framework in 2004, one of the most popular ERM frameworks, which has strong roots in COSO's 1992 Internal Control Framework, to develop a framework to enable managers to evaluate and improve their companies' risk management systems. The profile of risk management is thus raised significantly, as it shifts from being a component of internal control to one in which it effectively encompasses internal control (Woods, 2008; Lundqvist, 2015).

The COSO (Committee of Sponsoring Organizations of the Treadway Commission), describes Enterprise Risk Management as *"a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives."*

In the COSO 2004 ERM framework, entity objectives can be viewed in the context of four categories: Strategic (high-level goals, aligned with and supporting the organization's mission), Operations (effective and efficient use of resources), Financial Reporting (reliability of operational and financial reporting) and Compliance (compliance with applicable laws and regulations). Enterprise Risk Management also considers activities at all levels of the organization: enterprise-level, division or subsidiary and business unit process.

So, it requires an entity to take a portfolio view of risks, and for that, there are eight interrelated components of the framework:

- Internal Environment – Establishes a philosophy regarding risk management. It recognizes that unexpected as well as expected events may occur.
- Objective Setting – is applied when management considers risk strategy in the setting of objectives.
- Event Identification – produces a comprehensive list of risks, organized by risk category and sub-category for business units, corporate functions, and capital projects.
- Risk Assessment – measuring and prioritizing risks so that risk levels are managed within defined tolerance thresholds without being overcontrolled or forgoing desirable opportunities.
- Risk Response – identifies and evaluates possible responses to risk.
- Control Activities – policies and procedures at all levels and in all functions of the organization that helps ensure that the risk responses are carried out.
- Information and Communications – management identifies, captures and communicates pertinent information in a form and timeframe that enables people to carry out their responsibilities.
- Monitoring – effectiveness of the other components is monitored through on-going monitoring activities, separate evaluations and a combination of the two.

There is a direct relationship between objectives, which are what an entity attempts to achieve, and enterprise risk management components, which represent what is needed to achieve them. The relationship is described in a three-dimensional matrix, in the form of a cube (COSO, 2004).

Everyone in an entity has some responsibility for enterprise risk management. The chief executive officer (CEO) is ultimately responsible and should assume ownership. Other managers support the entity's risk management philosophy, promote compliance with its risk appetite, and manage risks within their spheres of responsibility consistent with risk tolerances. A risk officer, financial officer, internal auditor, and others usually have key support responsibilities. Other entity personnel is responsible for executing enterprise risk management following established directives and protocols. The board of directors provides important oversight to enterprise risk management and is aware of and concurs with the entity's risk appetite. Several external parties, such as customers, business partners, external auditors, regulators, and financial analysts often provide information useful in effecting enterprise risk management, but they are not responsible for the effectiveness of, nor are they a part of, the entity's enterprise risk management (COSO 2004).

## 1.6 COSO 2012

Given that risk is integral to the pursuit of value, strategic-minded enterprises do not strive to eliminate risk or even to minimize it, these enterprises seek to manage risk exposures across all parts of their organizations so that, at any given time, they incur just enough of the right kinds of risk to effectively pursue strategic goals (Frigo & Anderson, 2011). This is the "sweet spot," or optimal risk-taking zone (COSO, 2012). To achieve this, enterprises need a structured and disciplined risk assessment process that is practical, sustainable, and easy to understand. It must be correctly sized to the enterprise's size, complexity, and geographic reach (COSO, 2012).

Within the COSO 2012 ERM framework, risk assessment follows event identification and precedes risk response. Some risks are dynamic and require continual ongoing monitoring and assessment, such as certain market and production risks. Other risks are more static and require reassessment periodically with ongoing monitoring triggering an alert to reassess sooner should circumstances change (COSO, 2012).

The first activity within the risk assessment process is to develop a common set of assessment criteria to be deployed across business units. Traditional risk analysis defines risk as a function of likelihood and impact, but unlikely events often occur with astonishing speed. To answer questions like how fast the risk could arise, how fast could you respond or recover, and how much downtime could you tolerate, you need to determine vulnerability and speed of onset (COSO, 2012).

Most organizations define scales for rating risks in terms of impact, likelihood, and other dimensions. These scales comprise rating levels and definitions that foster consistent interpretation and application by different constituencies. The more descriptive the scales, the more consistent their interpretation will be by users (COSO, 2012).

Impact refers to the extent to which a risk event might affect the enterprise. When assigning an impact rating to a risk, assign the rating for the highest consequence anticipated. Some entities define impact scales for opportunities as well as risks. Likelihood represents the possibility that a given event will occur. Likelihood can be expressed using qualitative terms, as a percent probability, or as a frequency (COSO, 2012).

Vulnerability refers to the susceptibility of the entity to a risk event in terms of criteria related to the entity's preparedness, agility, and adaptability. The more vulnerable the entity is to the risk, the higher the impact will be in the case of an event occurrence. Assessing vulnerability allows entities to determine

how well they're managing risks. Speed of onset refers to the time that elapses between the occurrence of an event and the point at which the company first feels its consequences. Knowing the speed of onset is useful when developing risk response plans (COSO, 2012).

When assessing risks, it's important to determine whether respondents will be asked to assess inherent risk, residual risk, or both. In *Enterprise Risk Management – Integrated Framework (2004)*, COSO defines inherent risk as the risk to an entity in the absence of any action's management might take to alter either its likelihood or impact. Residual risk is the risk remaining after management's response to the risk. Some entities interpret inherent risk to be level of risk assuming responses currently in place fail, and residual risk to be the level of risk assuming existing responses operate according to design. Other entities interpret inherent risk to be the current level of risk assuming existing responses operate according to design and residual to be the estimated risk after responses under consideration are put into place (COSO, 2012).

Risk assessment is often performed as a two-stage process. An initial screening of the risks and opportunities is performed using qualitative techniques followed by a more quantitative treatment of the most important risks and opportunities lending themselves to quantification (COSO, 2012).

For qualitative assessments, the most commonly used assessment techniques are interviews, cross-functional workshops, surveys, benchmarking, and scenario analysis. Quantitative techniques range from benchmarking and scenario analysis to generating forward-looking point estimates (deterministic models) and then to generating forward-looking distributions (probabilistic models), one of the most relevant is causal at-risk models (COSO, 2012).

The assessment can be conducted through one-on-one interviews or facilitated meetings. Cross-functional workshops are preferable to interviews or surveys for assessment purposes as they facilitate consideration of risk

interactions and break down siloed thinking. Interviews may be more appropriate for board members due to their time constraints. Surveys are useful for large, complex, and geographically distributed enterprises or where the culture suppresses open communication. Benchmarking is a collaborative process among a group of entities. (COSO, 2012).

Scenario analysis entails defining one or more risk scenarios, detailing the key assumptions that determine the severity of impact, and estimating the impact on a key objective. Gross Margin at Risk, Cash Flow at Risk, and Earnings at Risk are metrics built on causal models where specific risk factors drive future uncertainty of key cash flow or earnings components. Using a causal at-risk model can provide insight into how historical relationships might become uncoupled and deviate meaningfully from expectations. (COSO, 2012).

ERM enables an integrated and holistic view of risks. Three explicit ways to capture risk interactions increasing in level of complexity and richness of information are risk interaction maps, correlation matrices, and bow-tie diagrams (COSO, 2012). McShane et al. (2011) refer that risk interactions assessment is important because individual risk can correlate with a certain event or other risk and have bigger losses or growth opportunities to the firm. Through a portfolio view of risk, ERM can create value for the firm, because the portfolio risk will be lower than the sum of the individual risks.

A risk interaction map is the simplest form of graphical representation in which the same list of risks forms the x and y axes. Risk interactions are then indicated by an X or other qualitative indicator. Diagrams that break a complex risk occurrence into its parts showing the chains of events that could lead to or result from the occurrence can be indispensable for the identification and assessment of risk responses and key risk indicators. Three commonly used diagrams are fault trees, event trees, and bow-ties. Fault trees are used for analyzing events or combinations of events that might lead to a hazard or an

event. Event trees are used for modeling sequences of events arising from a single risk occurrence. A bow-tie diagram combines a fault tree and an event tree and takes its name from its shape (COSO, 2012).

The term risk profile represents the entire portfolio of risks facing the enterprise. Some entities represent this portfolio as a hierarchy, some as a collection of risks plotted on a heat map. Similar to assessing risks, ranking and prioritizing are often done in a two-step process. First, the risks are ranked according to one or more criteria such as impact rating multiplied by likelihood rating or impact multiplied by the vulnerability. Second, the ranked risk order is reviewed in light of additional considerations such as impact alone, speed of onset, or the size of the gap between current and desired risk level (COSO, 2012). The last step, after identifying, assessing and prioritize risks, the firms need to develop a strategy of response to those risks. McShane et al. (2011) e Nocco & Stulz (2006) refer that firms should mitigate risks that they do not have knowledge to estimate market variables and do not have comparative advantage on taking them, compared to other firms. In contrast, the same firm should have a comparative advantage in taking firm-specific business risks because it knows more about these risks than anybody else.

## 1.7 COSO 2017

COSO Enterprise Risk Management—Integrated Framework, published in 2004, has been used successfully around the world, across industries, and in organizations of all types and sizes to identify risks, manage those risks within a defined risk appetite, and support the achievement of objectives. However, COSO published an updated framework, in 2017, to examine certain aspects with more dept and clarity. So, this updated framework connects more clearly

enterprise risk management with a multitude of stakeholder expectations, positions risk in the context of an organization's performance, rather than as the subject of an isolated exercise, enables organizations to better anticipate risk so they can get ahead of it, with an understanding that change creates opportunities, not simply the potential for crises (COSO, 2017).

"Enterprise Risk Management - Integrating with Strategy and Performance" clarifies the importance of enterprise risk management in strategic planning and inserting it throughout an organization, aligns strategy and performance across all departments and functions. The Framework is a set of principles organized into five interrelated components: Governance and Culture, Strategy and Objective-Setting, Performance, Review and Revision, and Information, Communication and Reporting. The five components in the updated Framework are supported by a set of twenty principles. These principles cover everything from governance to monitoring. They are manageable in size, and they describe practices that can be applied in different ways for different organizations regardless of size, type, or sector (COSO, 2017).

Governance sets the organization's tone, reinforcing the importance of, and establishing oversight responsibilities for, enterprise risk management. Culture pertains to ethical values, desired behaviors, and understanding of risk in the entity (COSO, 2017). Boards must ensure that their company's ERM capabilities are at the level of best practices and are well adapted to the company's business culture and the nature of the risk it faces (Brodeur et al.,2010)

Risk management, strategy and objective-setting work together in the strategic-planning process. The risk appetite is established and aligned with strategy; business objectives put a strategy into practice while serving as a basis for identifying, assessing, and responding to risk. Risks that may impact the achievement of strategy and business objectives need to be identified and assessed which are later prioritized by severity in the context of risk appetite.

The organization then selects risk responses and takes a portfolio view of the amount of risk it has assumed. The results of this process are reported to key risk stakeholders. By reviewing entity performance, an organization can consider how well the enterprise risk management components are functioning over time and in light of substantial changes while identifying revisions needed. Enterprise risk management requires a continual process of obtaining and sharing necessary information, from both internal and external sources, which flows up, down and across the organization (COSO, 2017). Brodeur et al. (2010) refer that a risk reporting process needs to produce insightful and well-synthesized board-level risk reports. The board report should be part of an integrated system, and management information flow and reporting are consistent with board reporting.

Strategy selection is about making choices and accepting trade-offs. So, it makes sense to apply enterprise risk management to strategy as that is the best approach for untangling the art and science of making well-informed choices. The 2017 Framework emphasizes, two additional aspects to enterprise risk management can have a far greater effect on an entity's value: the possibility of the strategy not aligning, and the implications from the strategy chosen. The first of these, the possibility of the strategy not aligning with an organization's mission, vision, and core values as some organizations are skeptical about truly embracing their corporate credos. But the mission, vision, and core values have been demonstrated that matter, especially when it comes to managing risk and remaining resilient during periods of change. The other additional aspect is the implications from the strategy chosen because each alternative strategy has its risk profile and these are the implications arising from the strategy. The board of directors and management need to determine if the strategy works in tandem with the organization's risk appetite and how it will help drive the organization to set objectives and ultimately allocate resources efficiently (COSO, 2017).

Enterprise risk management is as much about understanding the implications from the strategy and the possibility of strategy not aligning as it is about managing risks to set objectives. Enterprise risk management enhances strategy selection. Choosing a strategy calls for structured decision-making that analyses risk and aligns resources with the mission and vision of the organization (COSO, 2017).

# Chapter 2

## Theoretical Framework and Methodology

### 2.1 Variables and Models

To evaluate the effect of the level of Enterprise Risk Management on firm value, it was executed an OLS regression with cluster in “firms” variable and robust errors, with Tobin’s Q as the explained variable and an Enterprise Risk Management Score as the explanatory variable.

Tobin’s Q is generally used in corporate finance (Hoyt & Liebenberg, 2011) and is considered as a proxy to firm value from the shareholder perspective which reflects the future expectations of shareholders (Gatzert & Martin, 2015). Tobin’s Q is the ratio between the sum of equity market value and total liabilities book value over the total assets book value. This measure dominates other performance measures, as accounting measures and stock returns, because it’s free from managerial manipulation of accounting information and does not require risk adjustment or normalization (Lang & Stulz, 1994). According to Hoyt and Liebenberg (2011), as Tobin’s Q reflects the market expectations and the market does not react immediately to ERM implementation, it is expected that the benefits of ERM will not be immediately recognized.

I used an Enterprise Risk Management Score as my explanatory variable to measure the level of implementation of ERM on firms (please consult the appendix to see the respective ERM Score per firm and year). The Score is based on the twenty principles of “Enterprise Risk Management - Integrating with Strategy and Performance” from COSO (2017). As mentioned before, these principals are organized into five interrelated components: Governance and

Culture, Strategy and Objective-Setting, Performance, Review and Revision, and Information, Communication and Reporting. They're manageable in size and they describe practices that can be applied in different ways for different organizations regardless of size, type, or sector.

To measure the implementation level of ERM, I assessed the identification of each principle in each firm and gave the value of 1 if I could identify the principle on the reports and documents published by the firm and a value of 0 if I could not identify the principle. The final result is a score ranging from 0 to 20 (sum of each principle value) to each firm. To identify the principles in each firm, I analyzed firm public reports and documents published every year (Consolidated Annual Reports, Corporate Governance Reports, Sustainability Reports) as well as website information, looking for information that explicit or implicit that demonstrate each principle descriptions. All the documents were reviewed several times to ensure that the correct analysis was being made and no important information was left off.

This methodology was also used by Manuel Maia (2020) and it is an improvement compared to other methodology that uses a dummy to identify the implementation of Enterprise Risk Management since it differentiates the different levels of implementation and considers different and interrelated components such as culture, strategy and corporate governance characteristics that fall aside from a more traditional risk management view. However, this methodology has some weaknesses as it is a subjective analysis and it depends on personal interpretation compared to other objectives analysis used. Since I just assessed the identification of each principle and gave the same weight to each one of them, I could not assess the quality of implementation of each principle which can translate to a Score. It means that the analysis does not correspond to the exact reality of each firm ERM implementation level.

Another limitation is that the Score is developed based on a Framework that was published in 2017, therefore the data analyzed is limited to the period from 2017 to 2019, which is a smaller database than desirable (2020 reports are not published at the time).

Table 1 - Components and Principles - COSO 2017

<b>Components</b>	<b>Principles</b>	<b>Description</b>
Governance & Culture	1. Exercises Board Risk Oversight	The board of directors provides oversight of the strategy and carries out governance responsibilities to support management in achieving strategy and business objectives.
	2. Establishes Operating Structures	The organization establishes operating structures in the pursuit of strategy and business objectives.
	3. Defines Desired Culture	The organization defines the desired behaviours that characterize the entity's desired culture.
	4. Demonstrates Commitment to Core Values	The organization demonstrates a commitment to the entity's core values.
	5. Attracts, Develops, and Retains Capable Individuals	The organization is committed to building human capital in alignment with the strategy and business objectives.
Strategy & Objective-Setting	6. Analyses Business Context	The organization considers potential effects of business context on risk profile.
	7. Defines Risk Appetite	The organization defines risk appetite in the context of creating, preserving, and realizing value.
	8. Evaluates Alternative Strategies	The organization evaluates alternative strategies and potential impact on risk profile.
	9. Formulates Business Objectives	The organization considers risk while establishing the business objectives at various levels that align and support strategy.
Performance	10. Identifies Risk	The organization identifies risk that impacts the performance of strategy and business objectives.
	11. Assesses Severity of Risk	The organization assesses the severity of risk.
	12. Prioritizes Risks	The organization prioritizes risks as a basis for selecting responses to risks.
	13. Implements Risk Responses	The organization identifies and selects risk responses.
	14. Develops Portfolio View	The organization develops and evaluates a portfolio view of risk.
Review & Revision	15. Assesses Substantial Change	The organization identifies and assesses changes that may substantially affect strategy and business objectives.
	16. Reviews Risk and Performance	The organization reviews entity performance and considers risk.
	17. Pursues Improvement in Enterprise Risk Management	The organization pursues improvement of enterprise risk management
Information, Communication, & Reporting	18. Leverages Information and Technology	The organization leverages the entity's information and technology systems to support enterprise risk management.
	19. Communicates Risk Information	The organization uses communication channels to support enterprise risk management.
	20. Reports on Risk, Culture, and Performance	The organization reports on risk, culture, and performance at multiple levels and across the entity.

The set of control variables is composed of variables that are described by the literature to have an impact on firm value. As a proxy to Size, I used the logarithm of total assets book value as it is generally the variable used in the literature and other researches. ERM implementation has a positive relationship with the size of a firm, a larger firm size is generally associated with increasing scope and complexity of risks, which increases the likelihood of an ERM implementation (Gatzert, 2015). However, the relation between Tobin's Q and Size is ambiguous, since larger firms value could increase due to scale economies, bigger market share and lower costs related to lower risk of defaulting (McShane et al., 2011), but more agency problems can decrease the value of the firms (Allayannis & Weston, 2001).

Leverage is measured using the ratio between total liabilities book value over equity market value and represents capital structure. The relation between leverage and firm value is ambiguous. The use of leverage can create tax shields and therefore can reduce tax cash flows and implies higher manager discipline since will not make investments in sub-optimal projects. However, the use of high levels of leverage can lead to a higher probability of default and higher distress costs (Hoyt & Liebenberg, 2011).

Sales Growth is generally used as a growth measure and it is the ratio of revenue Year-over-Year (YoY). It is expected that firm value has a positive relation to sales growth as ERM is seen as an important factor to firms with high growth opportunities since they face more uncertainty and should make an effort in implementing Enterprise Risk Management to mitigate the risks and take advantage of the high number of opportunities.

Profitability is measured by Return-on-Assets (ROA) and is the ratio between net revenue and total assets book value. ROA is expected to have a positive

relationship with firm value, especially to the shareholder, since more profitable firms tend to negotiate at a premium (Allayannis & Weston, 2001).

Corporate Governance determinants also have an impact on firm value. The size of the Board of Directors has a negative relation with firm value as Baxter et al. (2013) found a negative influence of board size on financial performance as measured by ROA but no significant effect on firm value as measured by Tobin's Q and Yermack (1996) which presented evidence that small boards of directors are more effective in the way they provide higher firm values and favorable financial ratios. On the other side, Independence on the Board of Directors also has a positive relationship with firm value (Rosenstein and Wyatt, 1990) and is measured by the percentage of outsiders as board members.

In literature research, Dividends impact firm value and it was measured using the Pay-out Ratio as the ratio between dividends over net income. In my opinion, the Pay-out Ratio is an improvement to other researches that use a dummy to the payment of dividends since we can differentiate the firms that pay more dividends from the firms that pay fewer dividends. The relation between dividends and firm value is ambiguous since the payment of dividends is a good sign about financial performance to the capital markets, reduction of costs of agency, reduction of liquidity and incentive hedging (Lundqvist, 2015, Géczy et al., 1997). On the other side, the payment of dividends can reduce value creation since it can be a sign to investors that the firm does not have growth opportunities. Mature firms generally pay more dividends because they have fewer growth opportunities (Hoyt & Liebenberg, 2011).

The presence of omitted and unobserved variables that may be correlated with the observed explanatory variable can create Endogeneity problems in the equations. To address this issue, I added dummy variables that take the value of 1 whenever an observation refers to a given year. The year dummies control

for those omitted variables that are assumed constant (over firms) for each year but that may vary across years. To avoid Multicollinearity problems, I added two-year dummy variables. Also, errors in our estimation may be correlated across firms and ignoring this may bias our standard errors, so I performed a cluster in the “firm” variable in the OLS regression to allow errors to be arbitrarily correlated within firms.

Given the panel-data nature of the data, the first estimation equation is given by:

$$\begin{aligned}
TobQ_{i,t} = & \beta_0 + \beta_1 ERMScore_{i,t} + \beta_2 Size_{i,t} + \beta_3 Leverage_{i,t} + \beta_4 SalesGrowth_{i,t} \\
& + \beta_5 ROA_{i,t} + \beta_6 BoDSize_{i,t} + \beta_7 BoDIndependence_{i,t} \\
& + \beta_8 Dividends_{i,t} + \beta_{10} \sum_{k=1}^2 YearDummy_k + \varepsilon_{i,t}
\end{aligned}$$

where  $TobQ_{i,t}$  denotes Tobin’s Q value in firm  $i$  in year  $t$ ,  $ERMScore_{i,t}$  denotes the ERM Score for firm  $i$  in year  $t$ ,  $Size_{i,t}$  denotes the natural logarithm of total assets value in firm  $i$  in year  $t$ ,  $Leverage_{i,t}$  denotes the leverage ratio in firm  $i$  in year  $t$ ,  $SalesGrowth_{i,t}$  denotes the annual variation of revenue in firm  $i$  in year  $t$ ,  $ROA_{i,t}$  denotes the ratio between net revenue over total assets in firm  $i$  in year  $t$ ,  $BoDSize_{i,t}$  denotes the number of members that constitutes the Board of Directors of firm  $i$  in year  $t$ ,  $BoDIndependence_{i,t}$  denotes the percentage of the independent members on the Board of Directors of firm  $i$  in year  $t$ ,  $Dividends_{i,t}$  denotes the ratio of the pay-out dividend of firm  $i$  on year  $t$ ,  $YearDummy_k$  denotes  $k = 1, 2$  denotes a dummy variable that takes the value 1 if year  $t$  refers to year  $k$ , and  $\varepsilon_{i,t}$  denotes the error term associated to firm  $i$  and year  $t$ .

For robustness check I have also developed an additional OLS regression with cluster in “firms” variable and robust errors, which I have controlled for the effect of the level of ERM implementation on firm performance. Following Baxter et al. (2013) and Florio & Leoni (2017), I have used ROA to measure historical accounting performance. In this case, the explained variable is ROA and the explanatory variables are the same as in the first regression model. As so, the second estimation equation is given as follows:

$$\begin{aligned}
 ROA_{i,t} = & \beta_0 + \beta_1 ERMScore_{i,t} + \beta_2 Size_{i,t} + \beta_3 Leverage_{i,t} + \beta_4 SalesGrowth_{i,t} \\
 & + \beta_5 BoDSize_{i,t} + \beta_6 BoDIndependence_{i,t} + \beta_7 Dividends_{i,t} \\
 & + \beta_9 \sum_{k=1}^2 YearDummy_k + \varepsilon_{i,t}
 \end{aligned}$$

where  $ROA_{i,t}$  denotes the ratio between net revenue over total assets in firm  $i$  in year  $t$ ,  $ERMScore_{i,t}$  denotes the ERM Score for firm  $i$  in year  $t$ ,  $Size_{i,t}$  denotes the natural logarithm of total assets value in firm  $i$  in year  $t$ ,  $Leverage_{i,t}$  denotes the leverage ratio in firm  $i$  in year  $t$ ,  $SalesGrowth_{i,t}$  denotes the annual variation of revenue in firm  $i$  in year  $t$ ,  $BoDSize_{i,t}$  denotes the number of members that constitutes the Board of Directors of firm  $i$  in year  $t$ ,  $BoDIndependence_{i,t}$  denotes the percentage of the independent members on the Board of Directors of firm  $i$  in year  $t$ ,  $Dividends_{i,t}$  denotes the ratio of the pay-out dividend of firm  $i$  on year  $t$ ,  $YearDummy_k$  denotes  $k = 1, 2$  denotes a dummy variable that takes the value 1 if year  $t$  refers to year  $k$ , and  $\varepsilon_{i,t}$  denotes the error term associated with firm  $i$  and year  $t$ .

I have collected data for firm value, size, leverage, growth opportunities, profitability and dividends for the period between 2017 to 2019 using the EIKON: Thomson Reuters data stream. The data for board size and board independence was collected from firm reports and documents published every year (Consolidated Annual reports, Corporate Governance reports, sustainability reports) and website information.

Table 2 - Variable expected signs and sources of information

<b>Variable</b>	<b>Expected Sign</b>	<b>Source</b>
Tobin's Q		EIKON: Thomson Reuters
ERM Score	+	Firms reports and documents published every year and website information.
Size	Ambiguous	EIKON: Thomson Reuters
Leverage	Ambiguous	EIKON: Thomson Reuters
Sales Growth	+	EIKON: Thomson Reuters
ROA	+	EIKON: Thomson Reuters
Board Size	-	Firms reports and documents published every year and website information.
Board Independence	+	Firms reports and documents published every year and website information.
Dividends	Ambiguous	EIKON: Thomson Reuters

## 2.2 Sample Development and Utility Sector

In this research, to analyze the impact of different levels of Enterprise Risk Management implementation on firm value, I have collected data from 10 firms in the Utility sector for the years 2017, 2018 and 2019, which resulted in a total of 30 observations. Those firms include the two largest Portuguese companies in utility sector, EDP – Energias de Portugal and RENE – Redes Energéticas Nacionais, and top European players on the sector, as ENDESA, IBERDROLA, EDF, E.ON, SSE, NATURGY, RWE and ENGIE. All these firms are publicly traded companies, not just to guarantee access to market measures of company value, but also because publicly traded companies are more likely to disclose information about ERM (Hoyt and Liebenberg, 2011). As referred before, the data was collected for the years 2017, 2018 and 2019 to analyze the data under the scope of the latest ERM policy published by COSO 2017 (please consult the appendix to see the respective ERM Score per firm and year).

I chose to analyze the Utility sector for different reasons. First, it is the sector that has more weight in the PSI-20 index due to the size of firms like EDP, REN and EDP RENOVÁVEIS. Secondly, it is the sector that is in constant innovation to address issues such as climate change and consumer preferences. This is demonstrated on the strategic goals that are common to all the firms in the utility sector as they aim not only to be the leaders in the market but also the leaders on the climate transition. These changes lead to an environment of uncertainty that will create new opportunities for firms to take advantage and new risks that the firms need to be aware of and mitigate to have the best performance possible to be a key player in this sector in the following decades. Hence, I think that Enterprise Risk Management implementation can have an impact on these firm's value and performance in the future.

## 2.3 Descriptive Statistics

Table of descriptive statistics involving the explained, explanatory and control variables:

Table 3 - Descriptive Statistics

<b>Variables</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
Tobin's Q	1.1370	1.0620	0.15911	0.94823	1.5472
ERM Score	16.567	16.000	1.2780	15.000	19.000
Size	10.727	10.705	0.46389	9.7153	11.482
Leverage	2.9490	2.3893	1.9857	0.96448	8.3479
Sales Growth	-0.042361	-0.011396	0.20962	-0.73206	0.39485
ROA	0.027449	0.024545	0.032588	-0.069454	0.13275
Board Size	15.533	15.500	3.8928	10.000	21.000
Board Independence	0.58742	0.60000	0.17710	0.33333	1.0000
Dividends	0.83420	0.22739	1.7081	0.00000	9.1345

\* The statistics presented are computed across 30 observations.

The median firm in the data has in the median year, an Tobin's Q of 1.0620 and an ERM Score of 16.000, a value of total assets of 19763 million euros, a higher portion of debt compared to its market capitalization by a ratio of 2.38, an annual variation of revenue of -1,1% and profitability of 2,5% in terms of ROA, a Board of Directors composed by 16 members and 60% are independent and a Pay-out ratio of dividends of 22%. As Tobin's Q is greater than 1 implies that a firm's stock is more expensive than the replacement cost of its assets, which implies the stock is overvalued. ERM Score value is 16 which means the median firm has high levels of ERM implementation. The size of the median firm is high, which means it is a large firm. The leverage ratio is higher than 2, which is not considered excellent, the optimal ratio value would be 0.5 or lower. The sales growth ratio value is not positive, which does not represent firms with growth opportunities. ROA ratio value is positive which means the median firm is profitable. Board size and independence values mean that the

Board of Directors of the median firm has a medium/high number of members and have a good percentage of independence. The Payout ratio of dividends of the median firm means that the firm distributes dividends to its shareholders, representing high levels of firm maturity.

Table 4 presents the ERM Score variable frequency distribution (please consult the appendix to see the respective ERM Score per firm and year). As it is shown, the sample does not comprise firms with low ERM levels, which may be a factor to consider during the analysis.

Table 4 - ERM Score frequency distribution

<b>ERM Score</b>	<b>Freq</b>	<b>Percent</b>	<b>Cum</b>
15	7	23,33%	23.33%
16	10	33.33%	56.67%
17	4	13.33%	70.00%
18	7	23.33%	93.33%
19	2	6.67%	100.00%

# Chapter 3

## Estimation Results

### 3.1 Enterprise risk management and firm value: main results

In this chapter are presented the estimation results for the equation that analyses the impact of ERM level of implementation in firm value.

Table 5 presents three different specifications with respective coefficient estimates, standard errors and individual significance tests. Specification (i) is an OLS regression of my measure of firm value on my measure of ERM level of implementation and the set of controls described above. Specification (ii) is a OLS regression of my measure of firm value on my measure of ERM level of implementation and the set of controls described above, including year dummies, and specification (iii) is an OLS regression with cluster in “firms” variable and robust errors of my measure of firm value on my measure of ERM level of implementation. The set of controls described above, including year dummies. I used the statistic software STATA to generate the estimates of the specifications.

In specification (i), there is no significant effect of the level of implementation ERM on firm value. The Leverage control variable is statistically significant at the 10% level, which means if Leverage increases by 1%, the firm value decreases by 0,03 as measured by Tobin’s Q. The Board size control variable is statistically significant at the 10% level, which means that if the Board adds 1 member, the firm value decreases by 0,014 as measured by Tobin’s Q. Board independence control variable is statistically significant at the 5% level, which means that if the Board independence ratio increases by 1%, the firm value

increases by 0,3 as measured by Tobin's Q. Dividends control variable is statistically significant at the 10% level, which means that if the dividends payout ratio increases by 1%, the firm value increases by 0,026 as measured by Tobin's Q. The specification has an R-Squared of 0.68

Specification (ii) contains year dummies in the equation and the ERM level of implementation has still no significance. The Board Size control variable is statistically significant at the 10% level, which means that if the Board of Directors adds one member to the board, the firm value decreases by 0,014 as measured by Tobin's Q. Board Independence control variable is statistically significant at the 10% level, which means that if the board independence ratio increases by 1%, the firm value increases by 0,3 as measured by Tobin's Q. Dividends control variable is statistically significant at the 10% level, which means that if the dividends pay-out ratio increases by 1%, the firm value increases by 0,028 as measured by Tobin's Q.

In specification (iii), ERM level of implementation impact on firm value isn't statistically significant. Board Size control variable is statistically significant at the 5% level, which means that if the Board of Directors adds one member to the board, the firm value decreases by 0,014 as measured by Tobin's Q. Board Independence control variable is statistically significant at the 10% level, which means that if the board independence ratio increases by 1%, the firm value increases by 0,3 as measured by Tobin's Q. Dividends control variable is statistically significant at the 5% level, which means that if the dividends pay-out ratio increases by 1%, the firm value increases by 0,028 as measured by Tobin's Q. The specification has an R-Squared of 0.68. Overall, these results show no significant relationship between the level of ERM implementation and firm value as the market does not recognize the involvement of firms in high levels of ERM implementation as a relevant signal

Table 5 - Estimation results of regression of the level of ERM implementation on Firm Value

Variables	OLS regression		OLS regression with cluster and robust errors
	(i)	(ii)	(iii)
ERM Score	0,0100676 (0,020061)	0,0130238 (0,021357)	0,0130238 (0,0271818)
Size	-0,0302649 (0,0660972)	-0,0247776 (0,0691818)	-0,0247776 (0,1166309)
Leverage	-0,0307641* (0,0166904)	-0,0306049 (0,0173607)	-0,0306049 (0,0214973)
Sales Growth	-0,131133 (0,1108216)	-0,1324483 (0,1151797)	-0,1324483 (0,098441)
ROA	-0,0497052 (0,7055589)	0,0966481 (0,7786707)	0,0966481 (0,819395)
Board Size	-0,0145359* (0,0073232)	-0,0146278* (0,007616)	-0,0146278** (0,0060114)
Board Independence	0,3029232** (0,1423557)	0,3013809* (0,1496511)	0,3013809* (0,1416409)
Dividends	0,0267629* (0,0130586)	0,028932* (0,0139553)	0,028932** (0,0122526)
Year Dummies	No	Yes	Yes
Clusters	No	No	10
R-Squared	0,6801	0,6875	0,6875

\*The specifications include a constant term and are based on 30 observations. Standard errors in parentheses. \*\*\* denotes p-values <0,01, \*\* denotes p-values <0,05, and \* denotes p-values <0,10.

In the literature and economic theory, Enterprise Risk Management implementation should impact positively the firm value of the firm. However, in my results, Enterprise Risk Management implementation is not statistically significant to impact the firm value. This can result from my sample characteristics as I only used firms with high levels of Enterprise Risk Management. The market shows to not differentiate between higher levels of Enterprise Risk Management implementations, so if companies integrate sufficiently good ERM systems, the exact level of the ERM implementation seems to have residual importance to the market. This result agrees with those

presented by McShane et al. (2011) that refer that the market does not distinguish between high levels of ERM quality but only refers a significant and positive reaction of the market to distinguish between TRM and ERM. Baxter et al. (2013), Farrell and Gallagher (2015) and Florio & Leoni (2017) in their researches demonstrate a significant and positive impact of ERM implementation in firm value due to the use of firms with a wide range of different levels of ERM implementation, which is not the case of our research.

Also, Farrell and Gallagher (2015) and Florio & Leoni (2017) define ERM as a dummy variable that takes the value 1 for the upper levels of their defined scores and 0 otherwise, which means they aggregated all the observations with good levels of ERM implementation in one group, do not allow for differentiation between them.

Also, my results are similar to the results of Manuel Maia (2020) which also used an ERM Score ranging from 0 to 20 based on the twenty principles of the “Enterprise Risk Management - Integrating with Strategy and Performance” framework from COSO (2017). This demonstrates that this scoring methodology does not differentiate properly between high levels of ERM implementation (please consult the appendix to see the respective ERM Score per firm and year).

The Utility sector firms are firms generally very sophisticated and developed with high levels of risk management in a regulated environment as a good risk management system is considered as critical to the performance of the firms and not a distinguishing factor between them. The use of a different sector with firms with a wider range of development and different levels of Enterprise Risk Management implementation could change the result.

## 3.2 Robustness Check: Enterprise Risk Management and firm performance

Table 6 presents three different specifications with respective coefficient estimates, standard errors and individual significance tests, to analyze the impact of ERM level of implantation in firm accounting performance.

Specification (i) is an OLS regression of my measure of firm accounting performance on my measure of ERM level of implementation and the set of controls described above. Specification (ii) is an OLS regression of my measure of firm accounting performance on my measure of ERM level of implementation and the set of controls described above, including year dummies, and specification (iii) is an OLS regression with cluster in “firms” variable and robust errors of my measure of firm accounting performance on my measure of ERM level of implementation and the set of controls described above, including year dummies. I used the statistic software STATA to generate the estimates of the specifications.

In specifications (i) and (ii) there is no significant effect of the level of implementation ERM on firm accounting performance and the specifications have an R-Squared of 0,27 and 0,35 respectively. Specification (iii) shows that the ERM level of implementation impact on firms accounting performance is not statistically significant. Board Independence control variable is statistically significant at the 10% level, which means that if the board independence ratio increases by 1%, the firms accounting performance increases by 6,4% as measured by ROA. The Dividends control variable is statistically significant at the 10% level, which means that if the dividends pay-out ratio increases by 1%, the firm accounting performance decreases by 2,8% as measured by ROA. The specification has an R-Squared of 0.35. Overall, these results show no significant

relationship between the level of ERM implementation and firm accounting performance.

The results demonstrate that there is no significant effect of ERM Score on firm accounting performance measured by ROA, which is different from Baxter et al. (2013) and Florio & Leoni (2017) research that refers to a positive and significant relationship between high levels of ERM with firms operating performance. The reasons for this result can be the same reasons for the insignificant effect of ERM implementation on firm value as the difficulty to differentiate high levels of ERM implementation and the use of only firms with high levels of ERM in the sample. Also refer that one reason the market does not react and recognize different levels of ERM implementation is that ERM implementation does not have a significant impact on firms accounting performance.

Table 6 - Estimation results of regression of the level of ERM implementation on Firm Accounting Performance

Variables	OLS regression		OLS regression with cluster and robust errors
	(i)	(ii)	(iii)
ERM Score	0.0010901 (0.0060574)	-0,0002723 (0,0061327)	-0,0002723 (0,0074685)
Size	-0.0125811 (0.0197918)	-0,0144298 (0,0196028)	-0,0144298 (0,0143724)
Leverage	-0.0050929 (0.0049251)	-0,0047786 (0,0048695)	-0,0047786 (0,0046248)
Sales Growth	-0.0440398 (0.032144)	-0,0380166 (0,0319645)	-0,0380166 (0,0291985)
Board Size	0.0013381 (0.0021944)	0,0011681 (0,0021714)	0,0011681 (0,002399)
Board Independence	0.0660861 (0.0406431)	0,0648233 (0,0404562)	0,0648233* (0,0345521)
Dividends	-0.0037056 (0.0038661)	-0,0043583 (0,0038872)	-0,0043583* (0,0023709)
Clusters	No	No	10
Year Dummies	No	Yes	Yes
R-Squared	0,2705	0,3533	0,3533

\*The specifications include a constant term and are based on 30 observations. Standard errors in parentheses. \*\*\* denotes p-values <0,01, \*\* denotes p-values <0,05, and \* denotes p-values <0,10.

# Chapter 4

## Conclusions

### 4.1 Main Conclusions

This study analyses the impact of Enterprise Risk Management implementation on firm value in the Utility sector. The sample includes two large Portuguese firms and eight large European players in the sector. It contributes to the research field because, to my best knowledge, it is the first research about Enterprise Risk Management in the Utility sector, and it adds knowledge on the impact of Enterprise Risk Management on firms' value. To respond to the research question, I performed an OLS regression with cluster in "firms" variable and robust errors, where the explained variable is Tobin's Q as a proxy to firm value and the explanatory variable is an ERM Score as proxy to firms ERM implementation level. As control variables I added some accounting variables and corporate governance variables that are generally used on the literature and other researches.

The ERM Score is based on the twenty principles of the "Enterprise Risk Management - Integrating with Strategy and Performance" framework from COSO (2017) and has a value range from 0 to 20, where the value of 1 is given if a principle is identified and the of 0 if a principle is not identified in the reports and documents published by the firms (please consult the appendix to see the respective ERM Score per firm and year).

To robustness check my analysis, I realized another OLS regression with cluster in "firms" variable and robust errors similar to the first one, but ROA is my explained variable as a proxy to firms accounting performance and ERM Score still is my explanatory variable as a proxy to ERM implementation.

The result demonstrates that Enterprise Risk Management implementation has no significant impact on firms' value. In other words, the market does not recognize different levels of ERM implementation as a differentiator factor to the firm value. It could result from the fact that Enterprise Risk Management implementation also does not have a direct impact on firms accounting performance, as demonstrated in my robustness check analysis. The result about ERM implementation impact on firm's value agrees with other researches that also does not show a significant impact, however, the result from ERM implementation impact on firms accounting performance disagrees with other researches that refer that ERM implementation has a significant and positive impact of firms accounting performance. These results are influenced by the high implementation levels of Enterprise Risk Management in the firms that constitute the sample.

## 4.2 Limitations and Future Research

The main limitations I faced during the realization of the research were the years in sample restriction due to the "Enterprise Risk Management - Integrating with Strategy and Performance" framework from COSO was published in 2017. The data collected is prior to the publishing and includes data from 2017 to 2019 (2020 reports not published at the time). Additionally, it was performed a subjective analysis on the identification of principles during the realization of the ERM Score as some principles are not explicitly referred to on the documentation and reports of the firms, requiring some personal assessment about the implicit information available.

Also, the Utility sector has firms with highly developed systems of risk management, so in my sample, I only have collected data from firms with high

levels of Enterprise Risk Management. The difficulty to differentiate high levels of Enterprise Risk Management in the methodology used could have impacted the results.

Future researches still have a wide range of research questions to be investigated and answered about the implementation of Enterprise Risk Management in firms and the impact it can have on firms' value, but also the impact on the Utility sector. The relation between Enterprise Risk Management implementation and firm value can still be analyzed with a larger sample of firms and years in the Utility sector but also in other sectors, to confirm and compare results. On those samples, it can be used firms with high and low levels of risk management giving a wider range of results on the ERM Score. Enterprise Risk Management literature and economic theory still have not been confirmed and evidenced in the markets, giving margin to continue to investigate this topic with different samples and methodologies.

# Bibliography

Allayannis, G., & Weston, J. P. (2001). The use of foreign currency derivatives and firm market value. *The review of financial studies*, 14(1), 243-276.

Arena, M., Arnaboldi, M. & Azzone, G. 2010. The organizational dynamics of Enterprise Risk Management. *Accounting, Organizations and Society*, 35(7): 659-675.

Brodeur, A., Buehler, K., Patsalos-Fox, M., & Pergler, M. (2010). A board perspective on enterprise risk management. *McKinsey Working Papers on Risk*, 18, 1-15.

Casualty Actuarial Society (2003). Overview of Enterprise Risk Management. Enterprise Risk Management Committee

COSO. 2004. Enterprise Risk Management - Integrated Framework. Retrieved from <https://www.coso.org> (2021/03/05; 23H 30M).

COSO. 2012. Risk assessment in practice. Retrieved from <https://www.coso.org> (2021/03/05; 23H 30M).

COSO. 2017. Enterprise Risk Management Integrating with strategy and performance. Retrieved from <https://www.coso.org> (2021/03/05; 23H 30M).

Desender, K. (2011). On the determinants of enterprise risk management implementation. *In Enterprise IT governance, business value and performance measurement* (pp. 87-100). IGI Global.

Dickinson, G. (2001). Enterprise risk management: Its origins and conceptual foundation. *The Geneva Papers on Risk and Insurance. Issues and Practice*, 26(3), 360-366.

Florio, C., & Leoni, G. (2017). Enterprise risk management and firm performance: The Italian case. *British Accounting Review*, 49(1), 56–74.  
<https://doi.org/10.1016/j.bar.2016.08.003>

Friego, M. L., & Anderson, R. J. (2011). Strategic risk management: A foundation for improving enterprise risk management and governance. **Journal of Corporate Accounting & Finance**, 22(3), 81-88.

Gatzert, N., & Martin, M. (2015). Determinants and value of enterprise risk management: Empirical evidence from the literature. *Risk Management and Insurance Review*, 18(1), 29-53.

Géczy, C., Minton, B. A. & Schrand, C. 1997. Why Firms Use Currency Derivatives. **The Journal of Finance**, 52(4): 1323-1354.

Holton, G. (2004). Defining Risk. *Financial Analysts Journal*, 60(6).

Hoyt, R. E., & Liebenberg, A. P. (2011). The Value of Enterprise Risk Management. *Journal of Risk and Insurance*, 78(4), 795–822.  
<https://doi.org/10.1111/j.1539-6975.2011.01413.x>

Kaplan, R., & Mikes, A. (2012). Managing risks: a new framework. **Harvard business review**.

Lang, L. H. P. & Stulz, R. M. 1994. Tobin's q, Corporate Diversification, and Firm Performance. **The Journal of Political Economy**, 102(6): 1248-1280.

Lundqvist, S. A. (2015). Why firms implement risk governance—Stepping beyond traditional risk management to enterprise risk management. **Journal of Accounting and Public Policy**, 34(5), 441-466.

McShane, M. K., Nair, A., & Rustambekov, E. (2011). Does enterprise risk management increase firm value?. *Journal of Accounting, Auditing & Finance*, 26(4), 641-658.

Nocco, B. W., & Stulz, R. M. (2006). Enterprise risk management: Theory and practice. **Journal of applied corporate finance**, 18(4), 8-20.

Quon, T. K., Zeghal, D., & Maingot, M. (2012). Enterprise risk management and firm performance. *Procedia-Social and Behavioral Sciences*, 62, 263-267.

Reith, G. (2004). Uncertain times: the notion of 'risk' and the development of modernity. *Time & Society*, 13(2-3), 383-402.

Rosenstein, S., & Wyatt, J. G. (1990). Outside directors, board independence, and shareholder wealth. *Journal of financial economics*, 26(2), 175-191.

Simkins, B. (2008). Enterprise risk management: Current initiatives and issues journal of applied finance roundtable. *Journal of Applied Finance*, 18(1), 115.

Spira, L. F. & Page, M. 2003. Risk management: The reinvention of internal control and the changing role of internal audit. **Accounting, Auditing and Accountability Journal**, 16(4): 640-661.

Woods, M. (2007). Linking risk management to strategic controls: a case study of Tesco plc. **International Journal of Risk Assessment and Management**, 7(8), 1074-1088.

# Appendix

Table 7 - ERM Score per firm and year

ERM SCORE	EDP			REN			ENDESA			IBERDROLA			EDF		
	2019	2018	2017	2019	2018	2017	2019	2018	2017	2019	2018	2017	2019	2018	2017
<b>Principles</b>															
1. Exercises Board Risk Oversight	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2. Establishes Operating Structures	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3. Defines Desired Culture	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4. Demonstrates Commitment to Core Values	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5. Attracts, Develops, and Retains Capable Individuals	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6. Analyzes Business Context	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7. Defines Risk Appetite	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
8. Evaluates Alternative Strategies	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
9. Formulates Business Objectives	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1
10. Identifies Risk	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11. Assesses Severity of Risk	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12. Prioritizes Risks	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1
13. Implements Risk Responses	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14. Develops Portfolio View	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
15. Assesses Substantial Change	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
16. Reviews Risk and Performance	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17. Pursues Improvement in Enterprise Risk Management	1	0	0	1	1	1	1	1	1	1	1	1	0	0	0
18. Leverages Information and Technology	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1
19. Communicates Risk Information	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1
20. Reports on Risk, Culture, and Performance	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<b>SCORE</b>	<b>18</b>	<b>17</b>	<b>17</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>19</b>	<b>19</b>	<b>18</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>18</b>	<b>17</b>	<b>17</b>

Table 8 - ERM Score per firm and year

ERM SCORE	E.ON			SSE			NATURGY			RWE			ENGIE		
	2019	2018	2017	2019	2018	2017	2019	2018	2017	2019	2018	2017	2019	2018	2017
<b>Principles</b>															
1. Exercises Board Risk Oversight	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2. Establishes Operating Structures	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3. Defines Desired Culture	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4. Demonstrates Commitment to Core Values	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5. Attracts, Develops, and Retains Capable Individuals	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6. Analyzes Business Context	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7. Defines Risk Appetite	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0
8. Evaluates Alternative Strategies	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0
9. Formulates Business Objectives	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10. Identifies Risk	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11. Assesses Severity of Risk	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12. Prioritizes Risks	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
13. Implements Risk Responses	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14. Develops Portfolio View	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
15. Assesses Substantial Change	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1
16. Reviews Risk and Performance	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17. Pursues Improvement in Enterprise Risk Management	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1
18. Leverages Information and Technology	1	1	1	0	0	0	1	1	0	1	1	1	1	0	0
19. Communicates Risk Information	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1
20. Reports on Risk, Culture, and Performance	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<b>SCORE</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>15</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>18</b>	<b>15</b>	<b>15</b>