



UNIVERSIDADE CATÓLICA PORTUGUESA

Enterprise Risk Management and Capital Structure

Evidence from Portuguese Stock Market

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Católica Porto Business School
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Resumo

No contexto da crescente complexidade da gestão do risco e do mundo empresarial, a *framework Enterprise Risk Management* (ERM) tornou-se uma área importante de estudo e debate. As decisões sobre a estrutura de capital são consideradas cruciais nas finanças empresariais, uma vez que podem influenciar a estabilidade financeira da empresa.

O objetivo desta dissertação é explorar a relação entre as práticas de Gestão de Risco Empresarial (ERM) e as decisões de estrutura de capital, com foco nas empresas cotadas no PSI (*Portuguese Stock Index*).

O estudo aplica um modelo de regressão *Ordinary Least Squares* com efeitos fixos para investigar se as empresas que implementam mais extensivamente a *framework* de ERM do COSO 2017 exibem diferentes níveis de alavancagem financeira. Uma *ERMscore* foi construída a partir dos 20 princípios delineados na *framework* COSO e definida como a variável explicativa, enquanto a alavancagem é definida como a variável dependente e calculada pelo rácio da dívida total em relação ao valor de mercado do capital próprio. Um conjunto de variáveis fundamentais - incluindo a dimensão, a rentabilidade, a tangibilidade, a liquidez, as oportunidades de crescimento, a volatilidade e a taxa de imposto - são incorporados para ter em conta outros fatores determinantes da estrutura de capital. A amostra consiste em dados de empresas listadas no PSI, excluindo o setor financeiro, de 2018 a 2023.

Os resultados empíricos sugerem que a gestão do risco empresarial tem um impacto estatisticamente insignificante na estrutura de capital das empresas, o que indica que o estudo merece uma investigação mais aprofundada. A dimensão e a maturidade das empresas e do mercado como também a metodologia aplicada na construção do *ERMscore* podem estar a contribuir para esta insignificância. A verificação de robustez incluí uma variável alternativa de

implementação de ERM que produziu uma relação negativa, e significativa ao nível de 10%. Este facto reforça a fiabilidade dos resultados da regressão principal, no entanto, continua a ser insuficiente para tecer conclusões sólidas e fiáveis. Estudos futuros podem adaptar a amostra aumentando o número de observações ou explorá-la noutros mercados, como também, adotar metodologias alternativas para avaliar melhor a implementação do ERM e a sua eficácia.

Palavras-Chave: Risco, Gestão de Risco Empresarial, COSO, Estrutura de Capital

Contagem de Palavras: 9994

Abstract

In the context of increasing complexity in risk management and in the business world, Enterprise Risk Management (ERM) has become a significant area of study and discussion. Capital Structure decisions are considered crucial in corporate finance, as they could influence a firm's financial stability.

This dissertation aims to explore the relationship between Enterprise Risk Management (ERM) practices and capital structure decisions, focusing on companies listed in the Portuguese Stock Index.

The study applies an Ordinary Least Squares regression model with fixed effects to study whether companies that more extensively implement the COSO 2017 ERM framework exhibit different levels of financial leverage. An ERM score was constructed from the 20 principles outlined in the COSO framework, and defined as the explanatory variable, while leverage is defined as the dependent variable and measured by the ratio of total debt to market value of equity. A set of fundamental variables — including size, profitability, tangibility, liquidity, growth opportunities, volatility, and tax rate — are incorporated to account for other determinants of capital structure. The sample consists of data from companies listed on the Portuguese Stock Index, excluding the financial sector, from 2018 to 2023.

Empirical Results suggest that Enterprise Risk Management has a statistically insignificant impact on firms' capital structure, indicating that the study deserves further investigation. The size and maturity of the companies and the market, as well as the methodology used to construct the ERMscore, may be contributing to this insignificance. Robustness checks included an alternative ERM engagement variable, which yielded a negative relationship and was significant at the 10% level. This strengthens the reliability of the main findings; However, it remains insufficient to draw strong and reliable conclusions. Future studies may adapt

the sample by increasing the number of observations or explore it in other markets and adopt alternative methodologies to better assess ERM implementation and its effectiveness.

Keywords: Risk, Enterprise Risk Management, COSO, Capital Structure

Word Count: 9994

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List of Abbreviations

M&M – Modigliani & Miller

CAPM – Capital Asset Pricing Model

TRM – Traditional Risk Management

ERM – Enterprise Risk Management

CRO – Chief Risk Officer

CFO – Chief Financial Officer

COSO – Committee of Sponsoring Organizations of the Treadway Commission

OLS – Ordinary Least Squares

PSI – Portuguese Stock Index

ROA – Return on Assets

Introduction

Etymologically, Risk derives from the Anglo-French word “*Risqué*” and according to the Oxford dictionary is defined as “*the possibility of something bad happening at some time in the future; a situation that could be dangerous or have a bad result*”. This idea has been present in several domains since the dawn of mankind, and the corporate domain is no exception. Risk can severely affect a firm’s stability, profitability, and objectives but only risk exposure allows companies to obtain competitive advantages. Given this is crucial for firms to understand, identify, and apply appropriate risk management strategies. It’s not possible to eliminate risk, but an effective risk management strategy could mitigate it, reducing losses which will increase investors’ confidence and potentially firm's value. Initially, risk management was associated with the use of market insurance to protect companies and individuals from various losses associated with accidents, damages, or defects. However, this strategy was perceived as too costly and insufficient to address more complex risks, so managers started to look to other options (Dionne, 2013).

Thus, later emerged the Traditional Risk Management (TRM) framework which was mainly focused on identifying, measuring, managing, and monitoring different risks individually. Under this approach, each risk was treated separately, generally by each own department. However, managing each risk separately creates inefficiencies due to lack of coordination between the different risk management departments. Although individual risk management activities may reduce earnings volatility, there are potential interdependencies between risks across activities that might go unnoticed in this approach (Hoyt & Liebenberg, 2011). In this sense, the Enterprise Risk Management approach emerged, which requires companies to adopt a wide approach to identify, assess,

and manage risk (Kleffner et al., 2003). ERM integrates risk management practices across the entire organization, promoting a holistic view that helps identifying potential interdependencies.

One of the most precious contributions was published in 2004 by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). This framework focuses in integrating risk management into organizations' structure and process, to support them achieving their objectives. To respond to the new challenges in organizational environment and to the increased complexity of risk management, COSO published in 2017 an updated version of Enterprise Risk Management framework. On the 2017 framework, COSO defines the structure and the components of a proper ERM strategy, aiming to create value through integrated risk management strategies. Five main components and twenty principles were defined that guide organizations in assessing risks systematically and ensuring that risk management processes are embedded throughout the company's operations.

In today's business context, Capital Structure has become one of the most important decisions for managers since the delicate choice between debt and equity is crucial to maintain firm's financial stability. Over the years, were published several major theories on capital structure that diverge from Modigliani and Miller's (1958) initial assumption of capital structure irrelevance in perfect markets. Those theories underscore the idea that capital structure must be aligned with risk management strategies, reinforcing the role of ERM in optimizing financing decisions.

Higher levels of debt could be attractive due to the tax shield effect, but excessive levels of debt may increase firms' financial risk, as they must meet fixed interest obligations, potentially leading to financial distress. Risk management, particularly ERM, can mitigate this by enhancing debt capacity and reducing

financing costs (Froot et al., 1993). So, it's crucial for managers to integrate capital structure decisions with risk management strategies.

Despite some theoretical foundations, empirical evidence on the impact of ERM on Capital Structure is scarce, as most studies focus on the reverse relationship. This lack of empirical research highlights the relevance of this study on ERM's impact on capital structure. The purpose of this thesis is to assess the extent to which Portuguese listed companies observe this relationship. The empirical study aims to determine whether firms that apply the COSO 2017 ERM framework to a greater extent have higher or lower financial leverage levels.

The analysis of this research question is carried on through an OLS regression where financial leverage is defined as the dependent variable while the explanatory variable is an ERMscore, used as a proxy for the ERM implementation. This Score is based on the 20 principles of the COSO's ERM framework, and its values range from 0 to 20. This study also includes a set of fundamental variables that literature considers significant determinants of Capital Structure. These variables include Size, Profitability, Tangibility, Liquidity, Tax, Growth Opportunities, and Volatility. Also, to control for possible unobserved effects that vary between industries but are constant over time, and between years but are constant across industries, were included industry and year fixed effects.

This Master's Final Thesis is organized into 4 chapters. The first chapter – Literature Review – examines the existing literature and major theories on risk, risk management, Enterprise Risk Management, COSO's ERM Framework, and capital structure. Chapter 2 presents the research methodology, detailing the selected variables, sample composition, and econometric model used to examine the link between Enterprise Risk Management and capital structure. In Chapter 3 the results of empirical analysis are presented and discussed, evaluating the

relationship between ERM and leverage. This chapter also includes a robustness test to assess the reliability of the findings, providing a comprehensive interpretation of the results in the context of the existing literature. Chapter 4 - Conclusion highlights the main findings of this study and discusses the main limitations found, opening doors for future research.

Chapter 1

Literature Review

1.1 Risk Concept

Until the 17th century risk was associated with religious and magical beliefs, as the fate and the luck of an individual. The “consequences” were predetermined by the divine figure of God, going beyond human agency. Academically, there isn’t a consensual definition of risk since literature provides a large range of definitions. Some of them are based on probabilities or expected values, while others on undesirable events or danger, and others on uncertainty. (Aven & Renn, 2009).

One of the most well-known academic approaches to the concept of risk was made by Knight (1921). In his seminal work, Knight introduced risk by distinguishing 2 concepts – Measurable Uncertainty and Unmeasurable Uncertainty where, as the following quote indicates, the first refers to risk. *“To preserve the distinction ... between the measurable uncertainty and an unmeasurable one we may use the term risk to designate the former and the term uncertainty for the latter.”*. According to Knight, risk, or measurable uncertainty, involves situations where the probability of different outcomes is known or can be estimated through a symmetric or homogeneous dataset. A symmetric dataset implies a system where the probabilities are known based on the inherent structure system, like a die, while a homogeneous dataset implies the existence of historical data consistent enough to make estimates. Knight claims that the existence of risk allows firms to adopt appropriate management and mitigation strategies, including insurance. Conversely, Uncertainty entails scenarios where the probabilities, due to the absence of inherent symmetries or homogeneity, are unknown and cannot

be quantified. Knight adds that managers who successfully bear with Uncertainty will be rewarded with profit.

However, Knight's definition of risk has been the target of multiple critiques as modern authors argue that it isn't a real definition of risk since is based on a simple objectivist interpretation of probability, and in their perception, risk entails both uncertainty and exposure – possible consequences (Holton ,2004).The author argues that these elements are essential to risk since people care about outcomes, and if they have a personal interest in what transpires, that person is exposed. Furthermore, people don't know what will happen. So, in each situation, the outcome is uncertain. Given this, it's concluded that Risk is exposure to a proposition of which one is uncertain.

Risk Exposure is essential for businesses seeking growth and competitive advantage. Exposure to certain risks allows companies to pursue valuable opportunities that can drive innovation, market expansion, and profitability. (Fiegenbaum & Thomas, 2004).However, this exposure must be carefully managed. Excessive risk exposure, if not balanced with risk management to mitigate potential downsides, could severely affect firm's stability, profitability, and objectives. The focus of risk management should be on risks arising from outside of the company and that are out of managers' control, such as natural disasters, political instability, or macroeconomic changes (Kaplan & Mikes, 2012).

In the following points, will be explored the importance of proper risk management and its development from the Traditional Framework to Enterprise Risk Management.

1.2 Risk Management

Risk Management can be defined *“as the process whereby managers employ efforts to minimize, monitor, and control the probability or impact of unforeseen events”* (Hubbard, 2020). This process is considered crucial for organizations and governments to control and minimize risks, especially in the modern financial context characterized by complex and unpredictable macro-context.

Seminal theories in the finance field, such as the Modigliani & Miller Theorem (1958) and the Capital Asset Pricing Model (Sharpe, 1964), discussed the risk management topic and, in a capital structure logic, argued that it was irrelevant for value. In the Modigliani-Miller theorem, under the assumptions of the existence of a world with perfect market conditions (neutral taxes, frictionless capital markets, homogeneous participants, symmetric access to credit market), capital structure does not affect firm value, rendering risk management useless and without contribution to the value creation. Capital Asset Pricing Model (CAPM), based on Markowitz's Portfolio Theory, reinforces the assumption of perfect market conditions. The author distinguishes two types of risk: unsystematic risk or firm-specific, which relates to each individual firm, and systematic risk, inherent to the market, being unavoidable and undiversifiable. Following CAPM, investors' focus should be on firm-specific risk since if they hold a well-diversified portfolio, they can eliminate it without costs, implying that avoidable risk could be diversified without recourse to risk management practices.

Despite their significant contributions to finance, both theories were target of multiple criticisms as they rely on unrealistic assumptions. In Modigliani-Miller, many authors consider that the perfect world it relies on doesn't exist and their assumptions are wrong. Over the years, different authors have drawn conclusions about the existence of agency costs, market imperfections, and

bankruptcy costs that contradict M&M's assumptions and conclusions about the relevance of risk management in firms' value. Pagach & Warr (2011) inclusively refer to market frictions or imperfections as motivating factors for traditional risk management activities such as hedging and corporate insurance demand. The authors defend that risk associated with imperfections could impose costs to organizations and that risk management could have an important role in increasing firms' value as a result of it reducing the costs associated with financial distress, underinvestment, managerial compensation, and expected corporate tax schedules.

Overall, the growing knowledge about the negative impact of risk on companies, led to the development of strategies capable of controlling that impact, such as the Traditional Risk Management Framework.

1.2.1 Traditional Risk Management

According to Harrington & Niehaus (1999), risk management began to be increasingly applied after the Second World War, and the focus then was on pure risk management, excluding financial risk. Its main activities initially were linked to the use of insurance markets that protect companies and individuals against losses associated with workers' accidents, product damages, and defects, transferring risks to the insurance. However, this practice was perceived as too costly and insufficient to face all risks inherent to the business, as a result, new strategies emerged (Dionne, 2013). This led to a broader approach to the management of insurable risks. Some of these insurable risks could be prevented, or their impact reduced, through efficient loss-prevention and control systems, and some could be retained and financed within the company (Dickinson, 2001).

In the 70's, there was a paradigm shift in the way that risk management was seen and applied since financial risk became “accountable” to managers and company’s strategy. That period was characterized as a period of increased fluctuations in the commodities and raw materials prices as in the interest and exchange rates, leading to the need for companies to start implementing adequate strategies to deal with those risks. Combining this with the development of the option valuation model by Black & Scholes (1973), culminated in the exponential increase of hedging activities through the use of derivatives such as options, futures, and swaps. This instrument allowed companies to manage various financial risks, such as movements in exchange rates, interest rates, and prices that companies are exposed to. With this, financial risk management became a widespread practice (McShane, 2011), and this period was pointed out as the birth of the Traditional Risk Management Framework. Its application has continued, albeit at a residual level, to these days consisting in managing the different risks separately, in distinct “silos”. Under this framework, different departments would handle different risks independently, each with its own strategies, and with minimal oversight or communication of how particular risk management responses might affect other risk aspects of the enterprise, including strategic risks (Frigo & Anderson, 2011). Under TRM, risk management is recognized as a merely defensive approach, as it only concerns on protecting companies against adverse scenarios. According to Lundqvist (2015) the TRM process implies the identification, measurement, monitoring, and perhaps reporting of risk but with little formality, structure or centralization.

As previously mentioned, the focus of TRM is on managing compliance and financial risk through corporate hedging and insurance. At first glance, some shareholders may have been averse to insurance instruments since they can costlessly diversify firm-specific risk, and insurance purchases at unfair rates

reduce stockholder wealth. However, when viewed as part of the firm's financing policy, corporate insurance may increase firm value through its effect on investment policy, contracting costs, and the firm's tax liabilities (Mayers & Smith, 1982). The hedging literature suggests that, as in corporate insurance, this risk management strategy potentially mitigates incentive conflicts, reduces expected taxes, and improves the firm's ability to take advantage of attractive investment opportunities (Nance et al., 1993; Smith & Stulz, 1985). Nevertheless, managing each risk separately creates inefficiencies due to lack of coordination between the different risk management departments. Although individual risk management activities may reduce earnings volatility, there are potential interdependencies between risks across activities that might go unnoticed in TRM. (Hoyt & Liebenberg, 2011). Given this, it is essential an approach that views risk as a comprehensive portfolio, considering the interdependencies and correlations between risks. Furthermore, this approach should also encompass and respond to the broadening of the risk scope, the increasing complexity of the risk, and to several changes in the external factors of corporate environment, such as globalization, industry consolidation, deregulation, and regulatory pressure (Pagach & Warr, 2011). In this sense, the Enterprise Risk Management approach emerged.

1.2.2 Enterprise Risk Management

Interest and study of ERM intensified at the beginning of the 21st century, following the decline of the methods employed in the traditional approach and a set of financial scandals as Enron (2001) or WorldCom (2002) who led to huge losses to companies, shareholders, and exposed the weakness of risk management practices. In addition, and somewhat in response to this, increasing numbers of organizations have implemented or are considering ERM programs as consulting firms that have established specialized ERM units, or rating agencies that have begun to consider ERM in the rating process (Arena et al., 2010).

In contrast to this traditional approach, ERM requires a company-wide approach to identify, assess and manage risk (Kleffner et al., 2003). ERM integrates risk management practices across the entire organization, promoting a holistic view that helps identifying potential interdependencies. By integrating decision-making across all risk classes, firms can avoid duplication of risk management expenditures by exploiting natural hedges (Liebenberg & Hoyt, 2003a). Still along these, McShane et al. (2011) draws parallels with the Portfolio theory, concluding that ERM can increase firm value since the risk of an aggregated portfolio should be less than the sum of the individual risks if the risks are not 100% correlated, especially if natural hedges exist.

While TRM is largely concerned with protecting the firm against adverse effects of risk, ERM makes risk management part of the firm's overall strategy and decision-making, seeking not only to mitigate risks but also for potential benefits on value. Beyond many benefits, ERM enables companies to achieve higher risk-adjusted returns through effective capital allocation and assigning clear ownership and responsibility for all types of risks, which contributes to

maximize shareholder value (Meulbroek, 2002). Also, Hoyt & Liebenberg (2011) defend that ERM, by creating synergies between different risk management activities, benefits firms by decreasing earnings and stock price volatility, reducing external capital costs, and increasing capital efficiency. Another benefit of an ERM program is that it improves the information available to the firm about its aggregate risk profile. This information can be shared with investors and other stakeholders, leading to an increase in transparency and helps in mitigating information asymmetries (Berry-Stölzle & Xu, 2018).

ERM is a step beyond TRM where additional efforts are made by the firm to unite the risk management process organizationally across internal systems, processes, and people (Culp, 2001). Essentially, firms supplement the traditional process with risk governance to achieve an integrated approach to risk management. Risk Governance refers to the direction and control of the risk management system. It provides 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 the process. Lundqvist (2015) considers risk governance, the marriage of corporate governance and risk management, and an identifying component of an enterprise risk management system.

Given that ERM is part of the corporate strategy and the high relevance of its implementation, ERM decisions should be directed top-down by the senior management. The senior management is therefore responsible for defining the objectives of the ERM plan and for integrating them into the corporate strategy, ensuring that the company's defined risk appetite will not be exceeded while considering opportunities. Thereby, ERM will typically include a new senior position that, in general, doesn't exist in the traditional approach - the Chief Risk Officer. CRO should direct the risk management process and ensure the

appropriate coordination and functionality of the ERM system. CRO position also includes a communication function with direct reporting to the executive board and shareholders concerning the corporate firm's risk situation and profile. (Gatzert & Martin, 2015). This communication relationship should be especially close with the Chief Financial Officer since the financing of risks, whether retained or transferred, rests with him. CFO is not only responsible for the purchase of insurance and derivatives, since these decisions fall within the corporate treasury function, but also for the overall financial policy of the company, which includes capital structure (Dickinson, 2001). In short, risk governance and the CRO position perform as structural tools used to integrate risks into a single message to senior executives (Aebi et al., 2012).

Overall, Nocco & Stulz (2006), suggest that companies that succeed in creating an effective ERM have a long-run competitive advantage over those that manage and monitor risks individually. They argue that, by measuring and managing its risks consistently and systematically, and by giving its business managers the information and incentives to optimize the trade-off between risk and return, a company strengthens its ability to carry out its strategic plan.

1.2.1.1 ERM COSO

The Committee of Sponsoring Organizations of the Treadway Commission released in 2004 one of the most significant frameworks on Enterprise Risk Management. They defined it 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."* COSO provides for companies and their respective managers a

clear, structured framework to conduct, evaluate, monitor, and improve their risk management strategies. It helps organizations to systematically identify, assess, and respond to potential risks that could impact their objectives. In the development of the framework, COSO recognizes that the appropriate ERM system will vary from firm to firm. So, it's suggested a contingency perspective toward the appropriate ERM system for a particular organization.

The 2004 COSO Framework, denominated as Enterprise Risk Management—Integrated Framework was strongly influenced by COSO's 1992 Internal Control Framework, and intended to direct companies to adopt a risk management program integrated into internal control and firms' structure and processes. The purpose of the 2004 publication was to help firms to better protect and enhance stakeholder value. Its underlying philosophy was that *"value is maximized when management sets strategy and objectives to strike an optimal balance between growth and return goals and related risks, and efficiently and effectively deploys resources in pursuit of the entity's objectives."* (COSO, 2004)

Since 2004, the increased complexity of risk management practices due to the appearance of new risks and tools, as the increased attention and acceptance of management to the topic led to the release of updates versions of the framework, the last of which was published in 2017 and denominated as Enterprise Risk Management - Integrating with Strategy and Performance. Both frameworks are different and have different focuses, but neither supersedes the other. However, they do connect. The 2004 Framework encompasses internal control, which is referenced in part in this updated publication, and therefore the earlier document remains viable and suitable for designing, implementing, conducting, and assessing internal control, and for consequent reporting.

The updated framework connects more clearly ERM with a multitude of stakeholder expectations and positions risk in the context of an organization's strategy and performance, rather than as the subject of an isolated exercise. This

integration provides greater insight into the value of ERM when setting and carrying out strategy and also improves the process of setting performance targets and understanding the impact of risk on performance. New technologies have also assumed an important role in the framework, with data analytics becoming crucial in supporting decision-making.

In this sense, COSO developed a very helpful system for companies, establishing core definitions, components, and principles for all levels of management involved in designing, implementing, and conducting enterprise risk management practices. Specifically, it is a set of twenty principles organized into five interrelated components: Governance & Culture; Strategy & Objective-Setting; Performance; Review & Revision; Information, Communication & Reporting. The principles encompass a wide range of practices that can be applied in different ways for different organizations, regardless of size, type, or sector.

- Governance & Culture: governance sets the organization's tone, reinforcing the importance of, and establishing oversight responsibilities for, ERM. While Culture pertains to ethical values, desired behaviours, and understanding of risk in the entity.
- Strategy & Objective-Setting: risk management, strategy, and objective-setting work together in the strategic-planning process, with an established risk appetite aligned with it. Business objectives put strategy into practice while serving as a basis for identifying, assessing, and responding to risk.
- Performance: risks that may impact the achievement of strategy and business objectives need to be identified and assessed. Risks are 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.

- Review and Revision: 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, and what revisions are needed.
- Information, Communication, and Reporting: The component pursues a continual process of obtaining and sharing necessary information, from both internal and external sources, which flows up, down, and across the organization.

Figure 1 and 2 highlights each component, and the set of principles attached to each.



Figure 1 - ERM framework COSO 2017



Figure 2 – COSO ERM Principles

1.3 ERM and Capital Structure Decisions

1.3.1 Capital Structure Theories

Capital structure refers to the mix of a company's debt and equity used to fund its operations. It is a critical decision in corporate finance, as the composition of debt and equity can significantly impact a firm's risk, cost of capital, and overall value. Three major theories on Capital Structure diverge from the 1958 Modigliani-Miller assumptions of perfect markets and irrelevance of capital structure, as the Pecking Order, the Trade-off, and the Market Timing Theory.

Firstly, in Modigliani & Miller (1963) authors rectified the original theory by including the effect of corporate taxes. They demonstrated that debt financing provides a tax shield, as interest expenses are tax-deductible, reducing taxable income and increasing firm value. This corrected model suggests that, in a world with corporate taxes but without bankruptcy costs or other market imperfections, firms can enhance their value by increasing leverage.

Pecking Order Theory (Myers & Majluf, 1984) suggests that companies have a preferred financing hierarchy. This theory is based on the existence of information asymmetry between managers and external stakeholders, as debtholders and shareholders. To compensate for this asymmetry, external users demand higher returns to account for the additional risk. Given this, managers should prioritize internally generated funds since they minimize information asymmetries and reduce financing costs. When internal funds are insufficient, debt is preferred over equity since it is generally cheaper. Moreover, equity issuance could signal to the market that firm's stock may be overvalued, potentially lowering its price, and so it should be used as a last resort. Overall, under Pecking Order Theory, firms should prioritize internally generated funds, then debt, and lastly equity.

Trade-off theory was developed both in the static and dynamic branches, with the contribution of several authors, as Myers (1984), Kraus & Litzenberger (1973) and Fischer et al. (1989) suggesting that companies should balance the benefits of debt, as tax shields, against the costs of financial distress to determine their optimal capital structure. This framework highlights the importance of finding the right mix of debt and equity to maximize firm value while minimizing the risks associated with excessive leverage (Abel, 2018).

Market Timing Theory (Baker & Wurgler, 2002) is also grounded in the information asymmetry assumption and defends the idea that managers should allocate capital considering the prevailing market conditions. Under this theory, firms time their equity issues in the sense that they issue new stock when the stock price is perceived to be overvalued and take on debt to buy back their own shares when they are considered undervalued. Consequently, the market conditions will affect the capital structure dynamics.

Furthermore, Jensen & Meckling (1976) also challenge the M&M assumption that investment decisions are independent of capital structure by introducing a theory where agency costs play a crucial role in determining firms' capital structure. Agency costs refer to the costs arising from conflicts of interest between different stakeholders within the firm, particularly between managers and external users, such as shareholders. These conflicts are a result of the separation of control from ownership, since managers (who control) may not always act in the best interests of the shareholders (owners) but rather in their own interests. The authors suggest that debt could mitigate the conflicts between managers and shareholders since debtholders oblige managers to generate cashflows and fulfil their financial commitments, reducing potential inefficiencies. However, relying on excessive levels of debt could create conflicts with debtholders as it may lead to the "asset substitution" problem. Equity holders of a levered firm can potentially extract value from debtholders by increasing investment risk after

debt. By doing so, shareholders can shift their potential gains, transferring the downside risks to debtholders. This decision can erode the relationship between firm managers and debtholders and lead to an increase in the Cost of Debt. Given this, this problem must be recognized and controlled within the choice of capital structure, addressing the choice of Investment Financing, and its link with optimal risk exposure, as a central decision to the economic performance of corporations (Kochhar, 1996; Leland, 1998).

Empirically, in one of the most significant studies on capital structure, Shyam-Sunder & Myers (1999) tests the major theories of literature. The study views theories as hypotheses and examines their relative explanatory power. Authors conclude that Pecking Order theory is an excellent first-order descriptor of corporate financing behaviour. The static trade-off theory, when tested independently, also seems to perform well, although results suggest greater confidence for the previous model.

Rajan & Zingales (1995) investigate the determinants of capital structure choice by analysing the financing decisions of public firms in the major industrialized countries. This study suggests that capital structure decisions are influenced by factors such as firm size, profitability, and tangibility across different countries. Whereas, specific determinants and their impacts can vary significantly due to country-specific factors, financial distress, and the type of debt being analysed.

1.3.2 ERM and Capital Structure

Companies that rely heavily on debt increase their financial risk, as they must meet fixed interest obligations. Excessive debt can lead to financial distress, whereas a more conservative level of debt provides stability. In the first scenario, risk management activities can reduce the probability that a firm will find itself in a situation where it is unable to repay that debt. Thus, if financial distress is costly, and if there is an advantage to having debt in the capital structure (tax shield effect or agency problems), risk management may be used to increase debt capacity (Froot et al., 1993). Given this, it would be interesting to study if risk management affects Capital Structure decisions. Taking into consideration the current enterprise environment and the growing interest in ERM, it is appropriate to study how the level of implementation of this system affects Capital Structure. This study is also driven by the lack of literature regarding the impact of Enterprise Risk Management on the Capital Structure, especially in the Portuguese Context.

As previously mentioned, ERM provides a holistic approach, integrating risk considerations into strategic decisions, including capital structure. By adopting ERM, firms can assess how their different risk exposures influence their capital structure choices. In literature, some authors analysed the relationship between ERM and some of the previously mentioned theories of Capital Structure. Within Pecking Order theory, a strong ERM system can help reduce information asymmetry by enhancing transparency and demonstrating effective risk management to stakeholders. This may reduce the need for costly external financing or, alternatively, improve access to debt and equity under more favourable conditions (Khan et al., 2016). In Agency theory, efforts employed in an ERM system, with a strong governance structure that reinforces the CRO and Board's roles and that aligns the interests of different stakeholders, could reduce

Agency Costs. Additionally, agency theory suggests that boards by embracing explicit and robust risk oversight activities to monitor management's risk-taking actions, would help the organization achieve their strategic objectives. (Beasley et al., 2015). Overall, efforts employed in ERM program, by presenting an appropriate company strategy, a trustful risk handling as well as an adequate risk policy, send positive signals to the market, creditors and investors, which could lead to improved risk evaluation and reduce debt cost. Therefore, on the background of these favourable conditions, firms may decide to increase their financial leverage (Bromiley et al., 2015; Meulbroek, 2002).

On the other hand, the ERM implementations require financial resources, and it is easier for firms with lower levels of leverage to initiate such a program (Anton & Nucu, 2020). So, firms engaging in ERM may have lower financial leverage if they have decided to lower their probability of financial distress. In their empirical study Sax & Andersen (2019) found that ERM has a significant negative impact on financial leverage. Authors argue that lower financial leverage reflects that the firms' total risk is reduced and their ability to respond to change and survive is enhanced. Therefore, it's expected that firms committed to ERM practices are likely to present lower financial leverage in order to provide financial slack for strategic responses and reduce financial stress. Under this view, ERM may not directly improve financial performance, contributes to financial health and firm value by promoting a more conservative capital structure.

In general, despite the existence of some theoretical foundation in the effect of ERM on Capital Structure, the empirical evidence is very limited. This highlights the relevance of a potential study, as it could provide empirical insights into this relationship and contribute to fill this gap in literature.

Whereas the opposite relationship – Effect of Capital Structure on ERM implementation - has been widely studied with extensive empirical and

theoretical evidence. Liebenberg and Hoyt (2003) and Golshan and Rasid (2012) found leverage to be significantly positively related to ERM. Golshan & Rasid (2012) defend that the positive coefficient supports the assumption of more efficient risk management systems in higher leveraged companies to mitigate potential losses due to a greater risk of financial distress. While Liebenberg & Hoyt (2003) argue that the implementation of an ERM program requires a substantial initial investment, and firms with higher levels of capital or lower levels of leverage may find it easier to start a new ERM program. In contrast, Lechner & Gatzert (2018) found a significant negative relation between ERM and Financial Leverage. They argued that less leveraged firms are more likely to implement ERM, implying that firms with a holistic risk management system may reduce the amount of debt relative to equity to avoid financial distress. Hoyt and Liebenberg (2011) also show a significant negative relationship between ERM and Financial Leverage. According to their results, companies with lower financial leverage, which is generally associated with lower financial risks, tend to decide in favour of an ERM system to be able to take more financial risk in the future. Then, authors as Pagach & Warr (2015) conclude that the relation between ERM adoption and leverage is unclear. They found weak or insignificant evidence that more leveraged firms hedge more.

Chapter 2

Methodology

2.1 Model Specifications

As previously discussed, different authors adopt distinct empirical approaches to the relationship between Capital Structure and ERM, therefore, it is crucial to define the appropriate approach for this thesis. For instance, considerable empirical evidence exists on how financial leverage affects risk management practices. However, the study of the opposite effect, meaning how ERM implementation affects a firm's capital structure, lacks evidence. Given this gap, it would be relevant to address the issue, and therefore, in this thesis, the second approach is followed, exploring how ERM affects the firm's financial leverage. Furthermore, this study is set in the Portuguese context, which suffers from a lack of literature in ERM and Capital structure in general, making the exploration even more significant for contributing to this research field.

To fulfil the objective of the study, an Ordinary Least Squares (OLS) regression model is employed. This is a statistical method used to estimate the relationships between variables, widely applied due to its simplicity and interpretability. This technique establishes the connection between a dependent variable and one or more independent variables, on a linear relation. Besides the assessment of the significance between variables, it also allows to evaluate the impact of each explanatory variable on the dependent variable. OLS Regression was and still is commonly used by several authors in finance and economics, inclusively in studies that include ERM and Capital Structure Decision.

2.2 Variables

This section contains a description of the variables used in this study. An Enterprise Risk Management score is defined as our explanatory variable, while leverage ratio is defined as the dependent variable. In a regression involving leverage it is crucial to include other variables that may influence capital structure decisions, denominated as fundamental variables. Given this and based on previous studies, as Rajan & Zingales (1995), Serghiescu & Văidean (2014) and Titman & Wessels (1988) the following variables were selected: Size, Profitability, Tangibility, Liquidity, Growth opportunities, Volatility, and Tax Rate. To control for possible unobserved effects were included industry and year fixed effects.

Taking all this into account, the model translates as follows:

$$\begin{aligned} \text{Leverage}_{i,t} = & \beta_0 + \beta_1 \text{ERMscore}_{i,t} + \beta_2 \text{Size}_{i,t} + \beta_3 \text{ROA}_{i,t} + \beta_4 \text{Tangability}_{i,t} + \\ & \beta_5 \text{GrowthOpp}_{i,t} + \beta_6 \text{Liquidity}_{i,t} + \beta_7 \text{Volatility}_{i,t} + \beta_8 \text{TaxRate}_{i,t} + \\ & \beta_9 \sum_{t=1}^5 \text{Year Dummy}_t + \beta_{10} \sum_{j=1}^5 \text{Industry Dummy}_j + \varepsilon_{i,t} \end{aligned}$$

where i represents the company, t the time (2018-2023) and j the industry.

Furthermore, it is now necessary to describe each of these variables, how they are calculated, and the expected relationship with capital structure:

The dependent variable, $\text{Leverage}_{i,t}$ is commonly used to characterize the capital structure of a firm, and it is measured using the ratio between total liabilities/debt book value over equity market value. Total debt book value is the sum of firm's short- and long-term debt, while equity market value, or market capitalization, involves multiplying the current market price of the company's stock by the number of shares outstanding. Since stock price fluctuates

continuously, this indicator is calculated based on the closing price at the last trading day of company's fiscal year. The leverage ratio is a critical metric for understanding a firm's capital structure since it reflects the balance between debt and equity financing.

The independent variable, $ERMscore_{i,t}$ pretends to measure the level of implementation of ERM framework. Relying on previous empirical methods as Gordon et al. (2009) and Ferreira dos Santos (2021) an ERMscore was created based on the twenty principles from COSO's work "Enterprise Risk Management – Integrating with Strategy and Performance ". In Table 1 are described the principles and the inherent components.

Table 1 - ERM Principles

| Components | Principles | Description |
|--|--|---|
| 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. Implement Risk Responses | The organization identifies and selects risk responses. |
| Review & Revision | 14. Develops Portfolio View | The organization develops and evaluates a portfolio view of risk |
| | 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. |
| Information, Communication & Reporting | 17. Pursues Improvement in Enterprise Risk Management | The organization pursues improvement of enterprise risk management |
| | 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. |

Based on those principles and in the description of each provided by COSO, an analysis of their implementation by each company of the sample was performed. To do so, and since firms do not explicitly report whether they engage in ERM or not, it was carried out a careful analysis of companies' public

information such as corporate reports (Consolidated Annual Report, Risk Management policy, Sustainability and Governance Report), focusing on searching for implicit or explicit information to match with each of the principles. Depending on the information obtained through this analysis, a score of 0 or 1 was attributed to each principle. When there was evidence of the application of the principle, a score of 1 was attributed. Otherwise, if there was no evidence regarding the implementation of the principle, the score attributed was 0. The ERMscore corresponds to the sum of the values attributed to which principle from the COSO ERM Framework and ranges from an absolute value of 0 to 20. To ensure the score accuracy and that all information has been properly analysed, this process was performed at least twice (The results of the ERMscore could be consulted in Appendix).

This approach is an improvement regarding other commonly used methods, as in Pagach & Warr (2011) or Liebenberg & Hoyt (2003), who used a dummy variable as the appointment of Chief Risk Officer to identify the implementation of an ERM system. This method was accused of leading to biased results in cases where the existence of a CRO does not correspond to the implementation ERM system, or in cases where the title changes (Grace et al., 2015). It's also an improvement over previous methods as it includes central issues in ERM as culture, strategy, and corporate governance. Even so, despite being an improvement of previous methods, it suffers from some weaknesses as subjectivity, since the ERMscore depends on personal interpretation, whereas previous studies were based on something concrete, such as the appointment of a CRO. Besides that, this score doesn't assess neither reflects the quantity and quality of implementation of each principle and the Enterprise Risk Management system overall.

Firm's Size was proxied by the logarithm of the firm's total assets' book value. Empirical evidence found that firm's size is strongly positively correlated to

capital structure. Larger firms could have easier access to credit market at lower borrowing costs than small firms, which may cause discrepancies in their Capital Structure (Kurshev & Strebulaev, 2015).

Profitability is measured by Return on Assets and calculated as the ratio of net income to the book value of total assets. This metric indicates how efficiently a firm utilizes its assets to generate profit, providing insight into its operational performance. Pecking Order Theory predicts a negative relationship between profitability and financial leverage, as more profitable firms tend to rely less on external debt since they generate sufficient internal funds to finance their operations and investments. Empirically, most studies have indicated a negative influence of profitability on the capital structure (Mazur, 2007). Nevertheless, some authors consider that more profitable companies are perceived as less risky by lenders, enabling them to access debt at more favourable terms.

Growth opportunities variable in public firms is commonly proxied by Market-to-Book value ratio, and there are mixed results about the relationship with leverage. In literature, Agency Theory argues that leverage is inversely related to growth opportunities since growing firms may pursue to invest in risky projects at the expense of creditors, increasing the cost of debt and making debt financing less attractive. Conversely, Pecking Order Theory implies that high-growth firms have greater need for funds and, therefore, can be expected to borrow more. Empirically, Titman & Wessels (1988), support the negative relationship between the variables while Bevan & Danbolt (2002) found growth opportunities to be positively correlated with total debt.

Liquidity, proxied by the ratio of current assets to current liabilities, has a mixed impact on capital structure decisions. First, firms with higher liquidity ratios have more ability to meet their short-term obligations, allowing them to support higher debt ratios. On the other hand, following Pecking Order Theory,

firms with high liquidity levels can use this liquidity to finance their investments, implying a negative relationship on leverage (Ozkan, 2001).

Tangibility, measured as the ratio of non-current tangible assets to total assets. The fact firm possesses larger levels of tangible assets can be considered by its creditors as collateral, providing greater assurance in the event of financial distress. Thereby, tangibility may increase a firm's borrowing capacity, being this relationship found as significant by several authors (Rajan & Zingales, 1995).

Volatility, proxied by market price volatility over the last year, captures the fluctuation in stock prices. Market volatility plays a crucial role in shaping capital structure decisions, as firms tend to adjust their debt levels in response to uncertainty in equity prices. Empirical evidence found that firms respond to increased volatility by preferring more flexible financing options, such as equity issuance, rather than committing to debt.

Tax Rate is calculated as the ratio of paid taxes to earnings before taxes. Modigliani & Miller (1963) predicts a positive effect on debt, arguing that companies with higher corporate tax rate benefit from increasing debt as they maximize the tax deduction of the debt interest. Given this concluded that firms would prefer debt to other financing resources.

This study relies on a panel data, or cross-sectional timeseries, since it's the gathering of cross-sectional observations of firms in a period of time. Given these two different dimensions of variation, the model should control for endogeneity issues originated by eventual unobserved and omitted variables that may be correlated with the explanatory variables. To address this were adopted Fixed Effects estimators, incorporating year and industry fixed effects in the regression. In practice, were added year dummy variables that take the value of 1 whenever an observation refers to a given year and 0, otherwise. The year dummies control for those omitted variables that are assumed common across firms for each year but that may vary across years. This includes factors as economic conditions,

regulatory changes or market trends. In the same sense, were added industry dummy variables that take the value of 1 if the observation corresponds to a specific industry and 0, otherwise. The purpose of industry dummies is to control specific effects that are constant over time but might vary across them. Each industry faces its own set of environmental conditions and risks, which influences both risk management strategy and capital structure. For instance, sectors with highly volatile earnings tend to possess a higher portion of equity to safeguard against the possibility of bankruptcy (Balakrishnan & Fox, 1993). Moreover, errors in our estimation may be correlated across firms, and ignoring this may bias our standard errors, so a cluster in the firm variable was performed to allow errors to be arbitrarily correlated within firms.

For Robustness, an additional and similar OLS regression was developed, in which I controlled the effect of ERM on leverage. Instead of using the ERM score, it was verified whether the company mentions the implementation of the COSO ERM framework. As in the first approach was performed an analysis of firms' public information, searching for ERM key-related related. Given this, The ERMEngagement is a dummy variable equal to 1 if there is evidence of ERM activity and zero otherwise. This variable controls for ERM engagement rather than its level of implementation as in the previous test.

$$\begin{aligned}
Leverage_{i,t} = & \beta_0 + \beta_1 ERMEngagement_{i,t} + \beta_2 Size_{i,t} + \beta_3 ROA_{i,t} \\
& + \beta_4 Tangability_{i,t} + \beta_5 GrowthOpp_{i,t} + \beta_6 Liquidity_{i,t} \\
& + \beta_7 Volatility_{i,t} + \beta_8 TaxRate_{i,t} + \beta_9 \sum_{t=1}^5 Year\ Dummy_t \\
& + \beta_{10} \sum_{j=1}^5 Industry\ Dummy_j + \varepsilon_{i,t}
\end{aligned}$$

2.3. Data

In this Research, data were collected from public traded Portuguese companies that currently compose the Portuguese Stock Index (PSI), between 2018 and 2023. Of those firms, it was excluded Banco Central Português due to its distinct regulatory environment and capital structure dynamics, which differ substantially from non-financial firms. So, the Sample includes 14 firms: Altri, Corticeira Amorim, CTT, EDP, EDP Renováveis, GALP, IBERSOL, Jerónimo Martins, Mota-Engil, NAVIGATOR, NOS, REN, SEMAPA, SONAE. The choice of public traded companies ensures easier access to corporate Data and metrics, including the dynamics of capital structure and risk management policies. These companies are required to disclose detailed financial and corporate data, which facilitates the analysis of how ERM practices are integrated into their strategic and financial decisions. The focus in PSI firms guarantees a balanced representation of the Portuguese stock market by including leading firms across different sectors, providing insights into how Portuguese firms approach ERM.

Regarding the time horizon, literature suggests a period of at least 5 years for a robust analysis. Since the analysis and evaluation of ERMscore rely on the COSO's framework published in 2017, it's appropriate that our time horizon began in 2018. This period captures the implementation stage of the framework and provides a sufficient timeframe to assess its impact and evolution on capital structure decisions.

As your time horizon encompasses a period of 6 years, the model includes 5-year dummies with our reference¹ year being 2018, the first. Regarding the industry, the 14 firms of the company are organized in 6 industries as shown in Table 2:

Table 2 - PSI Sector Division

| Sector | Firms |
|------------------------------|---|
| Energy | EDP Energias de Portugal; EDP Renováveis; Galp Energia; REN Redes Energéticas Nacionais |
| Retail & Consumer | Jerónimo Martins; Sonae SGPS; Ibersol SGPS |
| Construction | Mota Engil SGPS |
| Telecom | NOS SGPS |
| Services | CTT - Correios de Portugal |
| Industry | Altri SGPS; Navigator Company; Semapa; Corticeira Amorim |

Given this, the model includes 5 industry dummies. As reference was selected the industry sector since it, along Energy sector, encompasses the largest number of companies in the sample. Additionally, this sector is less regulated and volatile than Energy sector, which has the same number of companies.

To gather the financial data and ratios required for this analysis, was used the Refinitiv Eikon DataStream. With the exception of ERMscore, which was constructed following the methodology outlined in the previous section and based on information from companies' annual reports.

¹ To avoid Multicollinearity, it's necessary to exclude one dummy variable from both the industry and year categories to serve as the reference group.

2.4 Descriptive Statistics

In Table 3, are presented the main descriptive statistics for the defined variables:

Table 3 - Descriptive Statistics

| | <i>Mean</i> | <i>Median</i> | <i>Max</i> | <i>Min</i> | <i>SD</i> |
|--------------------|-------------|---------------|------------|------------|-----------|
| <i>Leverage</i> | 1,4406 | 0,8771 | 7,3813 | 0,09823 | 1,6423 |
| <i>ERMscore</i> | 15,7262 | 16,0000 | 19,0000 | 13,0000 | 1,7310 |
| <i>Size</i> | 9,5321 | 9,5920 | 10,7561 | 7,9790 | 0,6140 |
| <i>ROA</i> | 0,0426 | 0,0313 | 0,2881 | -0,0773 | 0,0480 |
| <i>Tangibility</i> | 0,3978 | 0,4330 | 0,8018 | 0,0001 | 0,2063 |
| <i>Growth Opp</i> | 2,0313 | 1,9750 | 5,8200 | -3,6500 | 1,3474 |
| <i>Liquidity</i> | 1,0298 | 0,8750 | 2,4600 | 0,3500 | 0,4997 |
| <i>Volatility</i> | 0,2194 | 0,2185 | 0,4019 | 0,1007 | 0,0562 |
| <i>Tax</i> | 0,2040 | 0,1854 | 0,8221 | 0,0000 | 0,1496 |

Leverage exhibits an average of 1.44 and a median of 0.88, indicating a right-skewed distribution. The maximum of 7.38 suggests that some firms rely heavily on debt, while others maintain a conservative capital structure (minimum of 0.10). The standard deviation of 1,64 highlights these significant differences across firms. The ERMscore (mean: 1,73, range: 13-19) suggests strong risk management across firm which may influence leverage decisions. Firm size, with a mean of 9,53, shows relatively low dispersion, suggesting that larger firms in the sample have stable financial positions. Larger firms typically have better access to credit markets, influencing their leverage decisions. Regarding ROA, some firms show negative returns (min: -7,7%), which could indicate operational inefficiencies or financial distress, while others have strong profitability (max:28,8%).

Tangibility range (0,0001 - 0.80) indicates that some firms have almost no tangible assets, while others have a significant proportion.

Growth opportunities, with a mean of 2.03 a, indicate that some firms have strong expansion prospects. The minimum (-3,65) appears to be an outlier, as is the only negative value in the sample.

Liquidity, measured by current ratio, has a mean slightly above the 1 threshold, which typically separates adequate from inadequate liquidity (1,03) and median below it (0,87). This may suggest that many firms may struggle to cover short-term liabilities with current assets. A weak liquidity position can limit access to credit and increase borrowing costs, ultimately constraining strategic flexibility.

Volatility remains low (mean = 0,22), implying financial stability. While tax rate varies significantly (mean = 20,4%, max = 82,2%), suggesting that tax strategies differ across firms. Some firms benefit from tax incentives, while others face higher fiscal burdens.

Chapter 3

Estimations Results

3.1 Enterprise Risk Management and Capital Structure: Main Findings

This chapter presents the results of the econometric model that studied the effect of Enterprise Risk Management on Capital Structure. To obtain the estimation results, the statistical software STATA was utilised. The output of the STATA regression is presented in Table 4. The model explains 89,69% of the variation in leverage, which indicates a strong explanatory power. This suggests that the included variables capture key factors influencing firms' leverage.

Table 4 - Estimation Results of Regressions of ERM implementation impact on Capital Structure

| Variable | Coefficient | P>t | SD |
|-------------------|-------------|-------|-----------|
| ERMscore | -0,1530 | 0,131 | 0,0950429 |
| Size | 0,4387** | 0,019 | 0,1645958 |
| ROA | -2,8932 | 0,104 | 1,657112 |
| Tangibility | -0,6400 | 0,121 | 0,3858962 |
| GrowthOpp | -0,4201*** | 0,000 | 0,0602039 |
| Liquidity | -0,1903 | 0,124 | 0,1155785 |
| Volatility | 2,6905 | 0,527 | 4,138306 |
| Tax | -0,5421 | 0,471 | 0,7309209 |
| Y_2019 | 0,3819** | 0,049 | 0,1761049 |
| Y_2020 | 0,4669* | 0,066 | 0,2323831 |
| Y_2021 | 0,4548* | 0,086 | 0,2454727 |
| Y_2022 | 0,6849* | 0,098 | 0,383879 |
| Y_2023 | 0,5340 | 0,351 | 0,5519141 |
| Energy | -0,1266 | 0,676 | 0,2965522 |
| Retail & Consumer | -0,1303 | 0,393 | 0,1488367 |
| Construction | 3,5558*** | 0,00 | 0,532327 |
| Telecom | 0,2068 | 0,614 | 0,3997969 |
| Services | 3,6836*** | 0,000 | 0,2674014 |
| _cons | -0,2755 | 0,817 | 1,166328 |

Statistics are based in 84 observations $R^2 = 0,8969$ *** denote p-values < 0.01, ** denote p-values < 0.05, and * denote p-values < 0.10

The estimated coefficient for ERM is negative, suggesting that higher ERM scores are associated with lower leverage. If significant, this would imply that firms with stronger risk management practices may adopt a more conservative capital structure. However, the estimated p-value of 0,131 is considered insignificant, as it's above the conventional 5% significance level, suggesting that further investigation is needed to confirm whether ERM has a meaningful negative impact on leverage.

The set of fundamental variables shows diversified results regarding significance and alignment with theoretical expectations. As in Kurshev & Strebulaev (2015) results from Size suggest that larger firms tend to increase leverage, as they have easier access to credit, better credit ratings, and can sustain higher debt levels without excessive financial risk ($p = 0,019$).

Profitability (ROA), despite the negative coefficient suggesting that more profitable firms tend to decrease debt, which aligns with expectations, as profitable firms generate internal funds and rely less on external financing (Myers, 1984), the results are not statistically significant at 5% level ($p = 0,104$).

Tangibility coefficients show that firms with more tangible assets tend to decrease leverage, which contradicts traditional capital structure theories and evidence as in Titman & Wessels (1988) that suggest tangible assets serve as collateral, facilitating debt financing. However, since the p-value is insignificant ($p = 0,121$), this relationship deserves further investigation. Growth opportunities show strong and significant negative results ($p=0,000$) suggesting that firms with more growth opportunities tend to decrease leverage, being consistent with theories arguing that high-growth firms prefer equity financing to avoid future financial constraints. Another reason for this relationship stems from the tendency for firms to issue stock when their stock price is high relative to earnings or book value. This would imply that the correlation between the

market-to-book ratio and leverage is driven by firms that issue lots of equity (Rajan & Zingales, 1995).

Liquidity coefficient as in Mazur (2007) indicate that more liquid firms tend to decrease leverage, as they can fund their investments internally rather than relying on debt, though this result is not statistically significant ($p = 0,124$). The volatility coefficient suggests that firms with more volatile earnings may have higher leverage, but this result is also statistically insignificant ($p = 0,527$). Similarly, tax results are not statistically significant ($p = 0,471$). Nevertheless, it should be noted that the 0,5421-coefficient value presupposes that higher taxes appear to be associated with lower leverage, which is counterintuitive to the literature, as firms facing higher taxes might be expected to rely more on debt to benefit from tax shields (Modigliani & Miller, 1963).

Leverage increased significantly in 2019, with an approximately 38,2% increase, compared to 2018 (reference year), indicating a rise in debt financing even before the COVID-19 pandemic. This trend continued in 2020 and 2021, though the statistical significance slightly decreased to insignificant levels at 5% ($p = 0,066/0,087$), likely reflecting a possible impact of the pandemic and firms' increased reliance on debt. In 2022 and 2023, despite the estimated coefficients being consistent with previous, they lack statistical significance. Analysing the Industry Dummies, the results indicate that construction and services are more leveraged than the reference - Industry Sector. The highly significant coefficients show that construction is 3,555813 times more leveraged than the reference sector, while services are 3,6836 times, confirming that these sectors rely more on debt financing. Telecommunications also present a positive coefficient, but the variable is insignificant. Energy and Retail & Consumer present negative coefficients, purposing that these sectors are less levered than the Industry Sector, however, they are not significant.

The lack of significance of the effect of ERM on Leverage could result from multiple factors. One potential issue is the small sample size, which may reduce the statistical power of the analysis. However, the dimension and characteristics of the Portuguese Stock Exchange limit the possibility of expanding the sample size. Another possible explanation is that firm maturity does not necessarily lead to a differentiated market perception regarding risk management practices. That is, even if more mature firms are expected to have more structured ERM systems, the market may not recognize or reflect such differences, which may also help to explain the absence of a significant effect. Additionally, as in Maia (2020), the Methodology employed in constructing the ERMscore may not properly differentiate the differences between the distinct levels of ERM implementation. The subjectiveness in the evaluation of each principle of the framework, as well as the challenge of accurately assess and quantify the implementation of each, may lead to flaws in measuring and capturing the real impact of ERM on financial leverage. These limitations suggest that future research should explore alternative methods to measure ERM implementation, as expand the sample size, perform a robustness test, or incorporate additional fundamental variables to better isolate the effect of ERM on leverage.

The robustness test could play a crucial role, being a first step in validating the reliability of the results. By testing the stability of the estimated relationship between ERM and leverage under different model specifications, the robustness test can provide further confidence in the findings and help confirm whether the observed effect is truly driven by ERM practices or influenced by other factors.

3.2 Robustness Check

To validate the robustness of the primary regression results, an alternative estimation was conducted. The robustness test provides further insights into the consistency and reliability of the results.

The negative coefficient for ERM engagement is significant at 10%, strengthening the argument that firms with stronger risk management practices tend to reduce leverage may be accurate ($p = 0,055$).

Firm size retains its positive coefficient and statistical significance. ROA maintains its negative coefficient, reinforcing that more profitable firms rely less on debt, as its significance approaches the 5% threshold. Tangibility ratio continues to exhibit a negative and insignificant relationship with leverage, further challenging traditional expectations about collateral usage. Meanwhile, Growth opportunities remain highly significant, confirming the negative relationship between leverage and firms with strong growth potential. Liquidity results become slightly stronger and statistically significant, suggesting that firms with higher liquidity reduce debt reliance. Volatility still presents a positive coefficient but remains statistically insignificant. Similarly, Tax negative results continue to be insignificant.

For the time dummies, the results are similar to the main regression. Robustness coefficients continue to show an increase in leverage after 2018, but results tend to be significant at the 10% level in 2019 and insignificant for the 2020-2023 period. Regarding industries, reinforcing the main regression, construction and services continue to exhibit higher leverage than the reference sector and highly significant results. Energy, Retail & Consumer, and Telecom show negative coefficients, though still not statistically significant.

Overall, the robustness check approximates the central study of this thesis from a clear conclusion. Results get closer to evidence from Sax & Andersen

(2019) and to the idea that firms engaging in ERM may have lower financial leverage if they have decided to lower their probability of financial distress by decreasing financial risk. Even so, robustness results are not statistically sufficient to confirm the negative impact of ERM practices on leverage. Given this, the study requires further investigation to achieve conclusive results about this relationship.

Despite this, the robustness allowed to reinforce the significance of growth opportunities, liquidity and size impact on capital structure. Moreover, the influence of time and industry classification on firms' capital structure remains inconclusive, as the significance of the variables worsened.

Table 5 - Estimation results of robustness regression of ERM implementation impact on Capital Structure

| Variable | Coefficient | P> t | SD |
|------------------------------|-------------|-------|----------|
| ERMengagement | -0,2880* | 0,055 | 0,136484 |
| Size | 0,2942** | 0,032 | 0,122209 |
| ROA | -3,0829* | 0,057 | 1,473216 |
| Tangibility | -0,7554 | 0,156 | 0,501199 |
| GrowthOpp | -0,3825*** | 0,000 | 0,042211 |
| Liquidity | -0,3069** | 0,014 | 0,107629 |
| Volatility | 2,2314 | 0,603 | 4,186073 |
| Tax | -0,4898 | 0,515 | 0,731708 |
| Energy | -0,2654 | 0,328 | 0,260944 |
| Retail & Consumer | -0,1010 | 0,532 | 0,157395 |
| Construction | 3,3369*** | 0,000 | 0,601904 |
| Telecom | -0,0951 | 0,619 | 0,186621 |
| Services | 3,3243*** | 0,000 | 0,321753 |
| Y_2019 | 0,3420* | 0,069 | 0,172673 |
| Y_2020 | 0,4289* | 0,064 | 0,212077 |
| Y_2021 | 0,3177 | 0,101 | 0,179899 |
| Y_2022 | 0,4931 | 0,156 | 0,327166 |
| Y_2023 | 0,3174 | 0,473 | 0,429198 |
| _cons | -0,8174 | 0,609 | 1,557512 |

Statistics are based in 84 observations $R^2 = 0,8891$ *** denote p-values < 0.01, ** denote p-values < 0.05, and * denote p-values < 0.10

Chapter 4

Conclusions

The evolution and growing complexity of the business environment have driven the need for firms to adopt a comprehensive risk management system that allows firms to holistically identify, assess, and mitigate potential risks. Enterprise Risk Management promotes the idea that risk management should be part of the firm's overall strategy and decision-making, seeking not only to mitigate risks but also for potential benefits on value. The twenty principles from "Enterprise Risk Management - Integrating with Strategy and Performance" framework provide a significant contribution to the field, offering firms a valuable framework to enhance their risk management practices. Furthermore, in recent years, Capital Structure emerged as one of the most important decisions within a firm as the equity debt balance could significantly affect risks, cost of capital and firm value. Throughout this thesis, major theories on capital structure were explored as well as how Enterprise Risk Management relates to.

This thesis intends to analyse the effect of Enterprise Risk Management practices on the Capital Structure in the Portuguese market. This research emerged to fill a gap in the literature and to provide a significant contribution to the field. While both ERM and capital structure have been widely explored in theoretical and empirical studies, the specific relationship between ERM and leverage remains underexplored. The exploration of this study was accomplished through the application of one OLS regression accounting for fixed effects and clustered in firms. The Sample includes a set of Portuguese Listed Companies that compose the Portuguese Stock Index, excluding BCP.

In this regression Leverage Ratio was defined as the independent variable while an ERMscore based on the "Enterprise Risk Management - Integrating with

Strategy and Performance” framework by COSO (2017) was defined as the dependent variable. To each principle and depending on the evidence of his implementation in corporate reports, a score of 1 or 0 was attributed. The cumulative results of the principles is the ERMscore that ranges from an absolute value of 0 to 20. This study also includes a set of fundamental variables that, according to the literature, may impact the capital structure decision. For robustness an additional and similar OLS regression was realized where the ERM variable was defined based on whether the firm adopts an ERM system rather than in the 20 principles of COSO’s Framework.

Although the Robustness Test present a significant relationship at 10% level, the main study lacks statistical significance being insufficient to draw solid conclusions. Therefore, it is necessary to develop further studies to confirm whether this relationship supports the idea from Sax & Andersen (2019) that found that firms engaging in ERM tend to decrease debt levels to lower the probability of financial distress.

Despite the lack of strong statistical significance for ERM, the study results found significance of growth opportunities liquidity and firm size. In the context of Industry and Year, although some considerations can be made about the effect of these variables, further investigation is required to obtain more comprehensive results.

Overall, this emphasizes that future research is necessary to respond to the question: How does Enterprise Risk Management affect Capital Structure. Given the global scarcity of studies reflecting this relationship, researchers could explore this issue in markets other than Portugal. Future studies should employ different methodologies when measuring ERM implementation, as well as explore and define different samples offering different perspectives, thus contributing to the enrichment of the literature.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of my written thesis, Enterprise Risk Management and Capital Structure: Evidence from Portuguese Stock Index, Consensus and ChatGPT were used for the following tasks: literature review, data analysis, text revision, with the prompts used listed at the end of the document in the Prompts List section. After using these tools, I reviewed and edited the content as necessary, and I take full responsibility for the content of the work presented.

I also declare that I am aware of and respect the Artificial Intelligence Rules of Conduct of Católica Porto Business School.

Prompt List:

Chat GPT:

Proxy for Growth Opportunities: Market-to-book ratio or % increase in sales/assets?

How to implement Industry Dummies on Stata? How to analyse the results?

How to implement a cluster in firms in Stata?

Review the results of my empirical study (in image) and compare with my conclusions

Review the grammar and the ideas of this document. Correct errors and suggest improvements

How to reference an Annual Report – APA?

Consensus:

Theories on Risk.

Criticisms to Knight 1921.

Benefits from ERM.

How Risk Management relates to Theories of Capital Structure.

Evidence on Collateral and Capital Structure.

Stock Price Volatility and Capital Structure

Bibliography

- Abel, A. B. (2018). Optimal Debt and Profitability in the Trade-Off Theory. *Journal of Finance*, 73(1), 95–143. <https://doi.org/10.1111/jofi.12590>
- Aebi, V., Sabato, G., & Schmid, M. (2012). Risk management, corporate governance, and bank performance in the financial crisis. *Journal of Banking and Finance*, 36(12), 3213–3226. <https://doi.org/10.1016/j.jbankfin.2011.10.020>
- Anton, S. G., & Nucu, A. E. A. (2020). Enterprise Risk Management: A Literature Review and Agenda for Future Research. *Journal of Risk and Financial Management*, 13(11), 281. <https://doi.org/10.3390/jrfm13110281>
- Arena, M., Arnaboldi, M., & Azzone, G. (2010). The organizational dynamics of Enterprise Risk Management. *Accounting, Organizations and Society*, 35(7), 659–675. <https://doi.org/10.1016/j.aos.2010.07.003>
- Aven, T., & Renn, O. (2009). On risk defined as an event where the outcome is uncertain. *Journal of Risk Research*, 12(1), 1–11. <https://doi.org/10.1080/13669870802488883>
- Baker, M., & Wurgler, J. (2002). Market timing and capital structure. *Journal of Finance*, 57(1), 1–32. <https://doi.org/10.1111/1540-6261.00414>
- Balakrishnan, S., & Fox, I. (1993). Asset specificity, firm heterogeneity and capital structure. *Strategic Management Journal*, 14(1), 3–16. <https://doi.org/https://doi.org/10.1002/smj.4250140103>
- Beasley, M., Branson, B., & Pagach, D. (2015). An analysis of the maturity and strategic impact of investments in ERM. *Journal of Accounting and Public Policy*, 34(3), 219–243. <https://doi.org/10.1016/j.jaccpubpol.2015.01.001>
- Berry-Stölzle, T. R., & Xu, J. (2018). Enterprise Risk Management and the Cost of Capital. *Journal of Risk and Insurance*, 85(1), 159–201. <https://doi.org/10.1111/jori.12152>

- Bevan, A. A., & Danbolt, J. (2002). Capital structure and its determinants in the UK - A decompositional analysis. *Applied Financial Economics*, 12(3), 159–170. <https://doi.org/10.1080/09603100110090073>
- Black, F., & Scholes, M. (1973). The Pricing of Options and Corporate Liabilities. *Journal of Political Economy*, 81(3), 637–654. <https://doi.org/10.1086/260062>
- Bromiley, P., McShane, M., Nair, A., & Rustambekov, E. (2015). Enterprise Risk Management: Review, Critique, and Research Directions. *Long Range Planning*, 48(4), 265–276. <https://doi.org/10.1016/j.lrp.2014.07.005>
- COSO. (2004). *Enterprise Risk Management – Integrated Framework*.
- Culp, C. L. (2001). *The risk management process: Business strategy and tactics* (Vol. 81). John Wiley & Sons.
- Dickinson, G. (2001). Enterprise Risk Management: Its Origins and Conceptual Foundation. In *Issues and Practice* (Vol. 26, Issue 3).
- Dionne, G. (2013). Risk management: History, definition, and critique. *Risk Management and Insurance Review*, 16(2), 147–166. <https://doi.org/10.1111/rmir.12016>
- Ferreira dos Santos, D. F. C. (2021). *Enterprise Risk Management and Value: Evidence from the Utility sector*.
- Fiegenbaum, A., & Thomas, H. (2004). Strategic risk and competitive advantage: an integrative perspective. *European Management Review*, 1(1), 84–95. <https://doi.org/10.1057/palgrave.emr.1500002>
- Fischer, E. O., Heinkel, R., & Zechner, J. (1989). Dynamic Capital Structure Choice: Theory and Tests. In *Source: The Journal of Finance* (Vol. 44, Issue 1).
- Frigo, M. L., & Anderson, R. J. (2011). Strategic risk management: A foundation for improving enterprise risk management and governance. *Journal of Corporate Accounting and Finance*, 22(3), 81–88. <https://doi.org/10.1002/jcaf.20677>

- Froot, K. A., Scharfstein, D. S., & Stein, J. C. (1993). Risk Management: Coordinating Corporate Investment and Financing Policies. *The Journal of Finance*, 48(5), 1629–1658. <https://doi.org/10.1111/j.1540-6261.1993.tb05123.x>
- 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. <https://doi.org/10.1111/rmir.12028>
- Golshan, N. M., & Rasid, S. A. (2012). Determinants of enterprise risk management adoption: An empirical analysis of Malaysian public listed firms. *International Journal of Social and Human Sciences*, 119--126.
- Gordon, L. A., Loeb, M. P., & Tseng, C. Y. (2009). Enterprise risk management and firm performance: A contingency perspective. *Journal of Accounting and Public Policy*, 28(4), 301–327. <https://doi.org/10.1016/j.jaccpubpol.2009.06.006>
- Grace, M. F., Leverty, J. T., Phillips, R. D., & Shimpi, P. (2015). The value of investing in enterprise risk management. *Journal of Risk and Insurance*, 82(2), 289–316. <https://doi.org/10.1111/jori.12022>
- Harrington, S. E., & Niehaus, G. (1999). *Risk Management and insurance*.
- Holton, G. A. (2004). Defining risk. In *Financial Analysts Journal* (Vol. 60, Issue 6, pp. 19–25). CFA Institute. <https://doi.org/10.2469/faj.v60.n6.2669>
- 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>
- Hubbard, D. W. (2020). *The failure of risk management: Why it's broken and how to fix it* (John Wiley & Sons, Ed.).
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. In *Journal of Financial Economics* (Issue 4). Harvard University Press. <http://hupress.harvard.edu/catalog/JENTHF.html>

- Kaplan, R. S., & Mikes, A. (2012). Managing Risks: A New Framework. *Harvard Business Review*, 90, 48–60.
- Khan, M. J., Hussain, D., & Mehmood, W. (2016). Why do firms adopt enterprise risk management (ERM)? Empirical evidence from France. *Management Decision*, 54(8), 1886–1907. <https://doi.org/10.1108/MD-09-2015-0400>
- Kleffner, A. E., Lee, R. B., & McGannon, B. (2003). The Effect of Corporate Governance on the Use of Enterprise Risk Management: Evidence From Canada. *Risk Management Insurance Review*, 6(1), 53–73. <https://doi.org/10.1111/1098-1616.00020>
- Knight, F. H. (1921). *Risk, uncertainty and profit* (Vol. 31). Houghton Mifflin.
- Kochhar, R. (1996). Explaining firm capital structure: The role of agency theory vs. transaction cost economics. *Strategic Management Journal*, 17(9), 713–728. [https://doi.org/10.1002/\(SICI\)1097-0266\(199611\)17:9<713::AID-SMJ844>3.0.CO;2-9](https://doi.org/10.1002/(SICI)1097-0266(199611)17:9<713::AID-SMJ844>3.0.CO;2-9)
- Kraus, A., & Litzenberger, R. H. (1973). A State-Preference Model of Optimal Financial Leverage. In *Source: The Journal of Finance* (Vol. 28, Issue 4).
- Kurshev, A., & Strebulaev, I. A. (2015). Firm Size and Capital Structure. *The Quarterly Journal of Finance*, 05(03), 1550008. <https://doi.org/10.1142/S2010139215500081>
- Lechner, P., & Gatzert, N. (2018). Determinants and value of enterprise risk management: empirical evidence from Germany. *European Journal of Finance*, 24(10), 867–887. <https://doi.org/10.1080/1351847X.2017.1347100>
- Leland, H. E. (1998). Agency costs, risk management, and capital structure. *Journal of Finance*, 53(4), 1213–1243. <https://doi.org/10.1111/0022-1082.00051>
- Liebenberg, A. P., & Hoyt, R. E. (2003). The Determinants of Enterprise Risk Management: Evidence From the Appointment of Chief Risk Officers. *Risk Management Insurance Review*, 6(1), 37–52. <https://doi.org/10.1111/1098-1616.00019>

- 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.
<https://doi.org/10.1016/j.jaccpubpol.2015.05.002>
- Maia, M. C. T. da C. (2020). *Enterprise Risk Management and Firm Value: Evidence from the Construction & Engineering Industry*.
- Mayers, D., & Smith, C. W. (1982). *On the Corporate Demand for Insurance*.
- Mazur, K. (2007). The determinants of capital structure choice: Evidence from Polish companies. *International Advances in Economic Research*, 13(4), 495–514.
<https://doi.org/10.1007/s11294-007-9114-y>
- McShane, M. K., Nair, A., & Rustambekov, E. (2011). Does enterprise risk management increase firm value? *Journal of Accounting, Auditing and Finance*, 26(4), 641–658. <https://doi.org/10.1177/0148558X11409160>
- Meulbroek, L. K. (2002). *Integrated Risk Management for the Firm: A Senior Manager's Guide*.
- Modigliani, F., & Miller, M. H. (1958). *The Cost of Capital, Corporation Finance and the Theory of Investment* (Vol. 48, Issue 3).
- Modigliani, F., & Miller, M. H. (1963). *Corporate Income Taxes and the Cost of Capital: A Correction* (Vol. 53, Issue 3).
- Myers, S. C. (1984). *CAPITAL STRUCTURE PUZZLE*.
- Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), 187–221. [https://doi.org/https://doi.org/10.1016/0304-405X\(84\)90023-0](https://doi.org/https://doi.org/10.1016/0304-405X(84)90023-0)
- Nance, D. R., Smith, C. W., & Smithson, C. W. (1993). On the Determinants of Corporate Hedging. *The Journal of Finance*, 48(1), 267–284.
<https://doi.org/10.1111/j.1540-6261.1993.tb04709.x>

- Nocco, B. W., & Stulz, R. M. (2006). Enterprise Risk Management: Theory and Practice. *Journal of Applied Corporate Finance*, 18(4), 8–20. <https://doi.org/10.1111/j.1745-6622.2006.00106.x>
- Ozkan, A. (2001). Determinants of capital structure and adjustment to long run target: Evidence from UK company panel data. *Journal of Business Finance and Accounting*, 28(1–2), 175–198. <https://doi.org/10.1111/1468-5957.00370>
- Pagach, D., & Warr, R. (2011). The Characteristics of Firms That Hire Chief Risk Officers. *Journal of Risk and Insurance*, 78(1), 185–211. <https://doi.org/10.1111/j.1539-6975.2010.01378.x>
- Pagach, D., & Warr, R. (2015). The effects of Enterprise risk Management on Firm Performance". In *The Routledge Companion to Strategic Risk Management* (pp. 381–393). Routledge.
- Rajan, R. G., & Zingales, L. (1995). What Do We Know about Capital Structure? Some Evidence from International Data. *The Journal of Finance*, 50(5), 1421–1460. <https://doi.org/10.1111/j.1540-6261.1995.tb05184.x>
- Sax, J., & Andersen, T. J. (2019). Making Risk Management Strategic: Integrating Enterprise Risk Management with Strategic Planning. *European Management Review*, 16(3), 719–740. <https://doi.org/10.1111/emre.12185>
- Serghiescu, L., & Văidean, V.-L. (2014). Determinant Factors of the Capital Structure of a Firm- an Empirical Analysis. *Procedia Economics and Finance*, 15, 1447–1457. [https://doi.org/10.1016/s2212-5671\(14\)00610-8](https://doi.org/10.1016/s2212-5671(14)00610-8)
- Sharpe, W. F. (1964). CAPITAL ASSET PRICES: A THEORY OF MARKET EQUILIBRIUM UNDER CONDITIONS OF RISK. *The Journal of Finance*, 19(3), 425–442. <https://doi.org/10.1111/j.1540-6261.1964.tb02865.x>
- Shyam-Sunder, L., & Myers, S. C. (1999). Testing static tradeoff against pecking order models of capital structure. *Journal of Financial Economics*, 51, 219–244.

Smith, C. W., & Stulz, R. M. (1985). The Determinants of Firms' Hedging Policies.

The Journal of Financial and Quantitative Analysis, 20(4), 391.

<https://doi.org/10.2307/2330757>

Titman, S., & Wessels, R. (1988). The Determinants of Capital Structure Choice.

The Journal of Finance, 43(1), 1–19. [https://doi.org/10.1111/j.1540-](https://doi.org/10.1111/j.1540-6261.1988.tb02585.x)

[6261.1988.tb02585.x](https://doi.org/10.1111/j.1540-6261.1988.tb02585.x)

Appendices

Table 6 - ERMscore per firm 2023

| 2023 | | Altri | Amorim | CTT | EDP | EDP R. | GALP | IBERSOL | Jerónimo Martins | Mota-Engil | NAVIGATOR | NOS | REN | SEMAPA | SONAE |
|--|--|-------|--------|-----|-----|--------|------|---------|------------------|------------|-----------|-----|-----|--------|-------|
| Governance & Culture | 1. Exercises Board Risk Oversight | 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 |
| | 3. Defines Desired Culture | 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 |
| | 5. Attracts, Develops, and Retains Capable Individuals | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Strategy & Objective - Setting | 6. Analyses Business Context | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 7. Defines Risk Appetite | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 |
| | 8. Evaluates Alternative Strategies | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Performance | 9. Formulates Business Objectives | 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 |
| | 11. Assesses Severity of Risk | 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 | 1 | 1 | 1 | 1 | 1 |
| | 13. Implements Risk Responses | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Review & Revision | 14. Develops Portfolio View | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | 15. Assesses Substantial Change | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 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 |
| Information, Communication & Reporting | 17. Pursues Improvement in Enterprise Risk Management | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | 18. Leverages Information and Technology | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | 19. Communicates Risk Information | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 20. Reports on Risk, Culture, and Performance | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | ERM SCORE | 18 | 16 | 16 | 19 | 18 | 18 | 15 | 14 | 16 | 18 | 18 | 16 | 15 | 18 |

Table 7 - ERMscore per firm 2022

| 2022 | | Altri | Amorim | CTT | EDP | EDP R. | GALP | IBERSOL | Jerónimo Martins | Mota-Engil | NAVIGATOR | NOS | REN | SEMAPA | SONAE |
|--|--|-------|--------|-----|-----|--------|------|---------|------------------|------------|-----------|-----|-----|--------|-------|
| Governance & Culture | 1. Exercises Board Risk Oversight | 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 |
| | 3. Defines Desired Culture | 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 |
| | 5. Attracts, Develops, and Retains Capable Individuals | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Strategy & Objective - Setting | 6. Analyses Business Context | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 7. Defines Risk Appetite | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| | 8. Evaluates Alternative Strategies | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Performance | 9. Formulates Business Objectives | 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 |
| | 11. Assesses Severity of Risk | 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 | 1 | 1 | 1 | 1 | 1 |
| | 13. Implements Risk Responses | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Review & Revision | 14. Develops Portfolio View | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | 15. Assesses Substantial Change | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 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 |
| Information, Communication & Reporting | 17. Pursues Improvement in Enterprise Risk Management | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | 18. Leverages Information and Technology | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | 19. Communicates Risk Information | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 20. Reports on Risk, Culture, and Performance | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | ERM SCORE | 18 | 16 | 16 | 17 | 18 | 19 | 15 | 13 | 16 | 18 | 18 | 16 | 15 | 18 |

Table 8 – ERMscore per firm 2021

| 2021 | | Altri | Amorim | CTT | EDP | EDP R. | GALP | IBERSOL | Jerónimo Martins | Mota-Engil | NAVIGATOR | NOS | REN | SEMAPA | SONAE |
|--|--|-------|--------|-----|-----|--------|------|---------|------------------|------------|-----------|-----|-----|--------|-------|
| Governance & Culture | 1. Exercises Board Risk Oversight | 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 |
| | 3. Defines Desired Culture | 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 |
| | 5. Attracts, Develops, and Retains Capable Individuals | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Strategy & Objective - Setting | 6. Analyses Business Context | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 7. Defines Risk Appetite | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| | 8. Evaluates Alternative Strategies | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 9. Formulates Business Objectives | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Performance | 10. Identifies Risk | 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 |
| | 12. Prioritizes Risks | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 13. Implements Risk Responses | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 14. Develops Portfolio View | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Review & Revision | 15. Assesses Substantial Change | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 |
| | 16. Reviews Risk and Performance | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Information, Communication & Reporting | 17. Pursues Improvement in Enterprise Risk Management | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | 18. Leverages Information and Technology | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | 19. Communicates Risk Information | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| | 20. Reports on Risk, Culture, and Performance | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ERM SCORE | | 15 | 16 | 16 | 16 | 17 | 18 | 15 | 13 | 16 | 17 | 18 | 14 | 15 | 18 |

Table 9 – ERMscore per firm 2020

| 2020 | | Altri | Amorim | CTT | EDP | EDP R. | GALP | IBERSOL | Jerónimo Martins | Mota-Engil | NAVIGATOR | NOS | REN | SEMAPA | SONAE |
|--|--|-------|--------|-----|-----|--------|------|---------|------------------|------------|-----------|-----|-----|--------|-------|
| Governance & Culture | 1. Exercises Board Risk Oversight | 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 |
| | 3. Defines Desired Culture | 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 |
| | 5. Attracts, Develops, and Retains Capable Individuals | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Strategy & Objective - Setting | 6. Analyses Business Context | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 7. Defines Risk Appetite | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 8. Evaluates Alternative Strategies | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 9. Formulates Business Objectives | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Performance | 10. Identifies Risk | 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 |
| | 12. Prioritizes Risks | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 13. Implements Risk Responses | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Review & Revision | 14. Develops Portfolio View | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | 15. Assesses Substantial Change | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | 16. Reviews Risk and Performance | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Information, Communication & Reporting | 17. Pursues Improvement in Enterprise Risk Management | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | 18. Leverages Information and Technology | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 19. Communicates Risk Information | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| | 20. Reports on Risk, Culture, and Performance | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ERM SCORE | | 13 | 13 | 16 | 16 | 17 | 16 | 14 | 13 | 16 | 17 | 18 | 14 | 15 | 15 |

Table 10 - ERMscore per firm 2019

| 2019 | | Altri | Amorim | CTT | EDP | EDP R. | GALP | IBERSOL | Jerónimo Martins | Mota-Engil | NAVIGATOR | NOS | REN | SEMAPA | SONAE |
|--|--|-------|--------|-----|-----|--------|------|---------|------------------|------------|-----------|-----|-----|--------|-------|
| Governance & Culture | 1. Exercises Board Risk Oversight | 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 |
| | 3. Defines Desired Culture | 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 |
| | 5. Attracts, Develops, and Retains Capable Individuals | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Strategy & Objective - Setting | 6. Analyses Business Context | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 7. Defines Risk Appetite | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 8. Evaluates Alternative Strategies | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 9. Formulates Business Objectives | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Performance | 10. Identifies Risk | 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 |
| | 12. Prioritizes Risks | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 13. Implements Risk Responses | 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 | 1 | 1 | 0 | 0 | 0 |
| Review & Revision | 15. Assesses Substantial Change | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | 16. Reviews Risk and Performance | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 17. Pursues Improvement in Enterprise Risk Management | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Information, Communication & Reporting | 18. Leverages Information and Technology | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 19. Communicates Risk Information | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| | 20. Reports on Risk, Culture, and Performance | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ERM Score | | 13 | 13 | 16 | 16 | 16 | 16 | 13 | 13 | 16 | 17 | 18 | 14 | 14 | 14 |

Table 11 - ERMscore per firm 2018

| 2018 | | Altri | Amorim | CTT | EDP | EDP R. | GALP | IBERSOL | Jerónimo Martins | Mota-Engil | NAVIGATOR | NOS | REN | SEMAPA | SONAE |
|--|--|-------|--------|-----|-----|--------|------|---------|------------------|------------|-----------|-----|-----|--------|-------|
| Governance & Culture | 1. Exercises Board Risk Oversight | 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 |
| | 3. Defines Desired Culture | 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 |
| | 5. Attracts, Develops, and Retains Capable Individuals | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Strategy & Objective - Setting | 6. Analyses Business Context | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 7. Defines Risk Appetite | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | 8. Evaluates Alternative Strategies | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 9. Formulates Business Objectives | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Performance | 10. Identifies Risk | 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 |
| | 12. Prioritizes Risks | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 13. Implements Risk Responses | 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 | 1 | 1 | 0 | 0 | 0 |
| Review & Revision | 15. Assesses Substantial Change | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | 16. Reviews Risk and Performance | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 17. Pursues Improvement in Enterprise Risk Management | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Information, Communication & Reporting | 18. Leverages Information and Technology | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 19. Communicates Risk Information | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| | 20. Reports on Risk, Culture, and Performance | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ERM Score | | 13 | 13 | 16 | 16 | 15 | 17 | 13 | 13 | 16 | 17 | 17 | 14 | 14 | 14 |