The Value of Enterprise Risk Management

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ABSTRACT

This paper investigates whether Enterprise Risk Management (ERM) is valuable to listed companies within non-financial industries. While many studies have covered the financial industry, this paper performs a meso-analysis of 14 new industries. Previous contributions within the literature are too focused on single performance and risk measures as determinants for the value of ERM and are moreover inconclusive in providing its value. This paper captures all previously used measures, whilst adding new ones in three different categories; performance, risk and comparative aggregation - with the hypothesis that each category can measure the value of ERM. The quantitative nature of this study derives from a rigorous selection of 19 ERM-companies by CRO-keywords which have proven to correlate with highly strategically developed ERM. These companies are then set against their competition, which allows this paper an analysis of 731 companies in 14 new industries, with data involving recession years. This paper finds several theoretical contributions with statistical significance. Firstly, by adding new understanding to the value of ERM within general industries and different business environments, apart from the financial industry. Secondly, traditional performance indicators alone do not determine the value of ERM. Thirdly, that ERM is valuable during cycles of recessions. Lastly, with a comparative aggregation-rate based upon efficiency between risk and performance; onto an otherwise single-measured research field.

KEY WORDS

Enterprise Risk Management (ERM), Value, Chief Risk Officer (CRO), Key Performance Indicators (KPI), Value at Risk (VaR), Holistic Performance Risk Indicator (HPRI).

TABLE OF CONTENTS

The content of this paper is provided below in seven chapters, structured in sections with page numbers.

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1. INTRODUCTION

This initiating chapter introduces the study's topic by describing the background and discussing the research problem. The problematization of existing literature is rooted in previous research by its inadequate premises and inconclusive value of Enterprise Risk Management. Lastly, the purpose of the study is explained and relates to a research formulation.

1.1 Problematization background

Risk derives from the futuristic uncertainty of events and the effectual incertitude of decisions made towards objectives - ultimately making risk a quantifiable, probabilistic measure of uncertainty (Purdy, 2010). Conducting business has always been associated with risk, but it would take until the late 1940s for the first traces to appear of companies managing risk in a structured and formal way within the decision-making process (Dickinson, 2001). Ever since, the literature has been divided into two strands; the first concerning the development of insurance and financial risk, whilst the other emphasizing on general risk management thinking (ibid.). The latter strand of the discipline evolved until the mid-1990s contributing to a first glimpse of Enterprise Risk Management (ERM) forming the basis of this paper. Given this background, the ERM literature is a discipline with diverging perspectives used in several ways and for several reasons; reducing operating costs, lowering taxes, mitigating agency costs, smoothen drastic cash-flow fluctuations, improving credit risks and evaluating projects (Mayers and Smith, 1982; Stulz, 1984; Smith and Stulz, 1985; Froot, Scharfstein and Stein, 1993; and Myers 1977). The literature further depicts high leverages as a substantial reason for investing in integrated, cross-divisional ERM-processes (Hoyt & Liebenberg, 2011). All of the above measures have lately directed the literature towards a holistic risk analysis from multiple perspectives to be closely correlated with a company's strategic decision-making (Pagach & Warr, 2011). Over 80 theoretical frameworks have blossomed within the discipline leading companies to adopt frameworks such as the Committee Of Sponsoring organizations of the Treadway Commission Framework (COSO-F), ISO 31000-2009, Turnbull Guidance, the Joint Australia/New Zealand 4360-2004 standards (Lundqvist, 2014) as well as mixtures of own firm-specific initiatives (Ahmad, Ng & McManus 2014).

1.2 Problem discussion

Even though 80 frameworks suggest a vivid research field, the many theoretical concepts indicate an uncertainty of the essential components of ERM, which implies an insufficient definition (Gordon et al., 2009). Attempts to compare ERM measures across different studies would thus be problematic (Hoyt & Liebenberg, 2003). A thorough analysis of the ERM field does however reveal COSO-F as the dominant theoretical framework within the literature (Beasley, Branson & Hancock, 2010) and as the most practically used in the world (Hayne & Free, 2014). This framework forms thus the definition of ERM for this paper. From this narrowed perspective, the COSO-F definition applied onto the ERM literature allows this paper to eliminate the jungle of uncertainty raised by the 80 frameworks and gain a more analytical focus to continue upon.

Having overcome the definitional uncertainty, further elaboration into the topic reveals a new sort of uncertainty in regard to the identification of companies which are truly engaged in ERM (Hoyt & Liebenberg, 2003). Previous studies have identified ERM-companies by keywords of Enterprise Risk Management (ibid.) and others by an ERM-index (Gordon, Loeb and Tseng, 2009). However, letting companies evaluate themselves from prepared surveys to receive an ERM-index have made research findings differ across organizations by rooting rationale problems to its answers. Moreover, could the bare application of ERM-keywords imply an

inadequate implementation of ERM - which instead rides on the notion of window dressing with a lack of strategically importance in the decision making (ibid.). Thus, distinguishing ERM-companies from each other is difficult due to different functioning levels of risk processes. Continuing on the notion of strategic importance, Lundqvist (2014) extends the debate by adding four dimensions as a criterion to overcome the problem of distinguishing ERM-companies from each other. The first two dimensions are fulfilled by all companies listed on stock exchanges; as they already satisfy the requirement of strong corporate governance by balancing stakeholder interests with company objectives. The third dimension separates companies which are actively managing risk on a daily basis and those who do not. This dimension is an indicator of risk management implementation rather than governance of a risk management system (Hoyt & Liebenberg, 2011). The fourth dimension, and therefore the true ERM-identifier, addresses risk appetite into a risk management report. It also involves a senior manager overseeing the enterprise risk management closely linked with strategy (Walker, Shenkir & Barton, 2002). In other words, the fourth dimension involves a Chief Risk Officer (CRO) with close connection to the board level having a strong influence over the strategically decisions made regularly (Lundqvist, 2014). This latter dimension is of importance, as it extends the debate within the literature of identifying ERM-companies by using CRO as a keyword (Beasley, Pagach & Warr, 2008; Lundqvist, 2014; Pagach & Warr, 2010). Lundqvist (2014) does moreover suggest the fourth dimension to future research and thus forms another platform for this paper to be based on.

Despite the increased focus on ERM, there have only been a few studies trying to answer the question of its value, with no consensus on whether it truly adds value to companies or not (Lundqvist, 2014). On the one hand, there are evidences of positive value-contributions in terms of; Revenues (Mackay & Moeller, 2007), Return on Equity (Lam, 2001), Operating Profit Margin (Eckles, Hoyt & Miller, 2014), Tobin's-Q (Hoyt & Liebenberg 2011), Profit volatility (Hoyt & Liebenberg, 2011) and Earnings per Share volatility (Singapurwoko, 2011). On the other hand, there are contrasting studies showing that ERM destroys value in terms of; Return on Assets, Tobin's-Q and stock price (Lin, Wen & Yu, 2012). Lastly, there are evidences that ERM neither adds, nor destroys value (Pagach & Warr, 2011).

Continuing on the notion of measures in regard to the value of ERM, the literature is too focused on firm performance (Gordon et al. 2009) and need more risk-attainment measures (Linsmeier & Pearson, 2000) why there are attempts in translating individual measures into comparative, aggregated rates (Nocco & Stulz, 2006) such as the Z-score (Baxter, Bedard, Hoitash & Yezegel, 2013).

From a meso level of analysis, the financial industry has been vastly researched upon due to the difficulty of finding other industries constituting of ERM-firms (Bromiley, McShane, Nair & Rustambekov, 2014). This study has undergone a major analysis in finding industries with unique companies fulfilling the premises required. This paper extends the ERM-field by the mere presence of unique ERM-companies from industries other than finance, forming a new research frontier.

1.3 Problem formulation

Based on the discussion above, there exist a need for analyzing the value of ERM (Hoyt & Liebenberg, 2003) by giving ERM a clear definition (Gordon et al., 2009) in combination with a robust identification of ERM-companies (Lundqvist, 2014) within neglected industries (Bromiley et al., 2014) providing more risk-attainment measures (Linsmeier & Pearson, 2000) whilst attempting a comparative aggregation-rate (Nocco & Stulz, 2006). With these premises,

the current literature is criticized for being inadequate in achieving conclusive measures of the value of ERM (Hoyt & Liebenberg, 2003) and provides this paper a research gap. This research problem is formulated by the hypothesis that;

The value of ERM is measurable through firm performance, risk attainment and a comparative aggregation-rate within industries other than finance.

1.4 Purpose

The purpose of this study is to provide an understanding to the value of ERM. This paper aims at achieving a conclusive reason to the value of ERM by (1) firm performance, (2) risk attainment and (3) a comparative aggregation-ratio, within industries other than finance.

1.5 Research contribution

This paper extends the literature with several theoretical contributions. First, it provides statistical significance on a new meso-level of analysis to understand the value of ERM for previously disregarded non-financial industries. Secondly, it proves both old and new performance measures to not determine the value of ERM. Thirdly, ERM statistically proves to be valuable during times of recession. Fourthly, a comparative aggregation-rate adds an efficiency dimension between risk and performance to an otherwise single-measured research field.

2. LITERATURE REVIEW

The literature review provides an onion-like outline over previous research by first peeling of the first layer defined as risk. After that, risk management comes to provide an even clearer usage of risk events within an organizational setting. However, the lack of an all-encompassing theory with multiple linkages to objectives in a companywide perspective drives the theory towards the third layer. This layer provides a more holistic perspective and defines as Enterprise Risk Management (ERM). However, ERM is still in its infancy and have not yet reached consensus on whether it is valuable or not - and what measurements to use in determining so. The latter problem forms an inadequate literature and thus a platform of research gap for this thesis to develop upon. Measures are brought up which can be tested within an ERM-environmental setting with the purpose to contribute a comparative rate and conclusive discourse to the field, followed by a conclusion of the chapter.

2.1 Previous research

Hereby follows a more thorough review over established literature and inadequate premises in the existing research field.

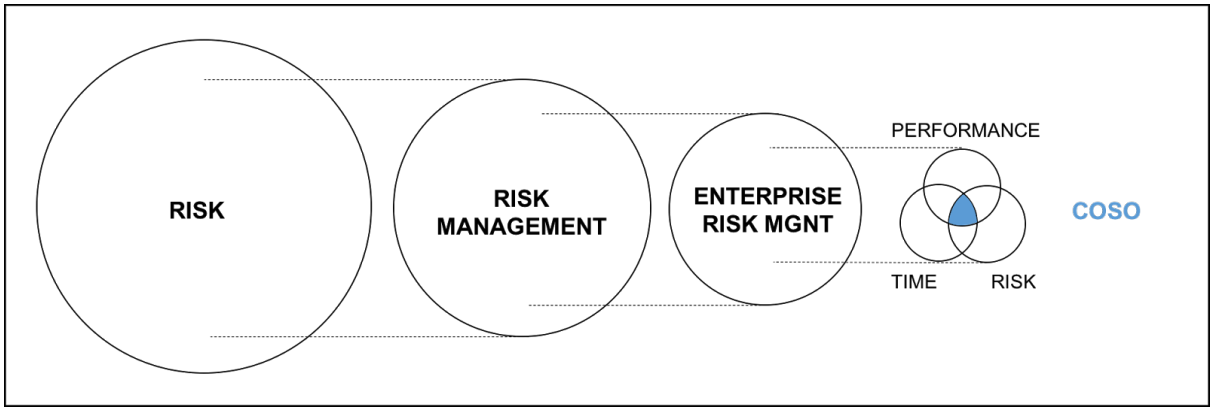

Figure 1. *Illustration of previous research within the ERM-literature.*

2.1.1 Risk

Risk derives from the uncertainty of future events and the incertitude of effects from decisions made towards objectives - ultimately making risk a quantifiable, probabilistic measure of uncertainty (Purdy, 2010). Uncertain events can happen at any time, affect both the internal and external environment of an organization, or itself, act unknowingly as the initiator of risk (Dickinson, 2001). The emerged risk can itself have different impact on various products, departments, stakeholders or societal members. Moreover, can risk function as a chain reactor triggered by multiple actors who lacks routines in avoiding it (ibid.). Actors have different willingness to accept risk as it can favor positive changes to some and affect others negatively (Purdy, 2010).

2.1.2 Risk Management

Traditional risk management approaches are usually defensive and based on narrowed risk-avoidance approaches derived from multiple, unit-specific perspectives with no coherence in between or alignment with business objectives (Hoyt & Liebenberg, 2011). A financial perspective would occupy business diversification and derivatives, an organizational perspective would focus on eliminating costs, speed delivery and maximize efficiency (Mehr & Hedges, 1963), whilst a marketing perspective would involve bad reputation or missed opportunities (Lin et al., 2012). Recent risk areas concern corporate social responsibility (CSR) and have moved to include not only the internal and external environment, but an online environment where identity and security theft composes higher IT-risk than ever before (Pagach and Warr, 2011). Risk management is moreover understood as a circular process composing of

different steps to ensure continuous risk assessment. Daniel (1961) describes this descriptive, traditional cycle as comprising of six main steps;

1. *State objectives*.....Determine every success factor to reach objectives.
2. *Identify future risk events*.....Based on the success factors; identify events that might hinder the success and their probability.
3. *Evaluate risk impact*.....Assess each risk impact with monetary loss.
4. *Prioritize risks*.....Prioritize risks by the expected-value method of each risk's probability and impact.
5. *Define risk response*.....Treat? Tolerate? Terminate? Transfer (outsource)?
6. *Monitor risk*.....Monitor events, probabilities and impacts. Restart from step one.

However, these risk management theories above are all criticized for being unit-specific with no coherence amongst for each other to align with overall organizational objectives (Hoyt & Liebenberg, 2011), why the literature has evolved to recent years' paradigm shift. The field has developed from a silo-based perspective towards a holistic, all-encompassing view referred as enterprise risk management (Gordon et al., 2009).

2.1.3 Enterprise Risk Management

Continuing on the topic, a more specific part of the discourse has emerged in later years emphasizing the literature of Enterprise Risk Management (ERM) as it sets out to understand more than just how to manage uncertainties faced by an organization's management in a structured and disciplined manner (Sobel & Redi, 2004). The research concerning the value of ERM is still in its infancy and there exists many definitions of it, although similarities exists (Bromiley et al., 2014). The definitional similarities often stem out of the notion that ERM is a systematic and integrated approach to handle all kinds of risks faced by a company. Sobel and Reding (2004) defines ERM as a process that involves all business risks through a holistic perspective. Meulbroek (2002) emphasizes on offensive intervention on a firm-wide strategic basis with objective to identify the collective risks that affects a company's value and to achieve improvements in the management's decision making process. Liebenberg and Hoyt (2003) also emphasize a holistic approach and extend the definition by including ERM as a proactive, strategic function dealing with risks. D'arcy and Brogan (2001) further defines ERM as a strategic process to control and evaluate risk from diverging sources with an objective to increase the short and long term value to the organization's stakeholders.

Many definitions of ERM exist in the academic research area and its identification within firms range from ISO 31000-2009, the Joint Australia/New Zealand 4360-2004 standards, the Turnbull Guidance as well as own firm-specific definitions (Fraser & Simkins, 2007). The large amount of research definitions hints about an overall uncertainty concerning the essential components of ERM (Lundqvist, 2014). However, research has found COSO's Enterprise Risk Management Integrated Framework (COSO-F) as the most widespread definition within the literature (Beasley, Branson & Hancock, 2010) as well as in practice by constituting the number one enterprise risk management framework in the world (Hayne & Free, 2014). Thus, this study uses the COSO-F as a basis for defining ERM;

> *"The culture, capabilities, and practices - integrated with strategy setting and its execution that organizations rely on - to manage risk in creating, preserving and realizing value".*

2.1.3.a The COSO organization

Senior executives across the world follow COSO's framework in order to achieve a stronger, holistic risk management with strategic value to outperform competitors (Beasley et al., 2010). COSO itself is an organization consisting of four sponsoring organizations; Institute of Internal Auditors (IIA), American Institute of Certified Public Accountants (AICPA), American Accounting Association (AAA), Financial Executives International (FEI) and Institute of Management Accountants (IMA) (COSO, 2016).

2.1.3.b The COSO Framework (COSO-F)

The purpose of companies adopting the framework COSO-F is to identify and maintain risk in line with their organization's vision - all businesses have uncertainties in different aspects and the framework can help managers to decide how much uncertainty to accept (Lundqvist, 2014). There is furthermore a need for a common risk language, clearly stating processes and practices to be integrated with strategy (COSO, 2016). The framework is divided into four overlapping external and internal objective categories; (1) *strategic* top-level goals supporting the vision; (2) *operations* to efficiently use resources; (3) *reporting* financial statements; (4) *compliance* according to regulations and laws (ibid.). The objective categories are what an organization strives to achieve and the eight components represents what is needed for achieving the four objective categories. The relationships between these are displayed in figure 1 and also suggest that enterprise risk management can be assessed from the entire organization to the specific unit (ibid.).

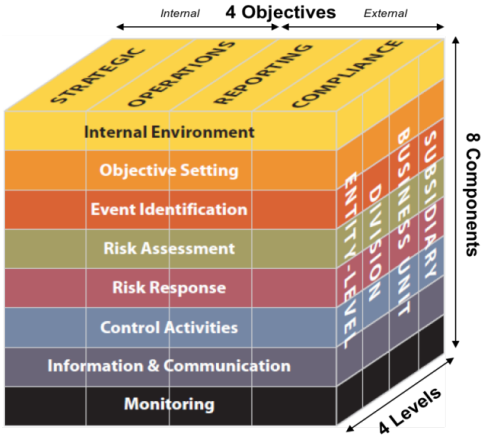

Figure 2. *The COSO ERM Framework, COSO-F, depicted in a three-dimensional matrix (COSO, 2004).*

The COSO definition further states eight components which all contribute to a thorough ERM; (1) *internal environment* as being the risk appetite culture within the company and includes the management values and which environments they operate in; (2) *objective setting* is the process by which objectives of each categories are established and set in relation to identify risks and aligned with the organization's values, goals and risk appetite; (3) *event identification* represents opportunistic and threatening events affecting the accomplishment of internal and external objectives; (4) *risk assessment* is the evaluation of risk, based on probability and consequences, and how to manage risk; (5) *risk response* clarifies whether the organization is avoiding, accepting, reducing or sharing risk in relation to their risk appetite; (6) *control activities* are tasks which ensures the previous response is performed accurately; (7) *information and communication* concerns the information gathered to be communicated to make sure employees execute their responsibilities; (8) *monitoring*, follow-up and evaluating ERM and improve eventual issues. (COSO, 2004)

2.1.4 The Value of ERM

The contributive value of ERM can be understood from three levels of analysis; macro, meso and micro (Bromiley et al., 2014). At a macro level of analysis, benefits in terms of long-term competitive advantage arise through the usage of ERM processes (Nocco & Stulz, 2006). This is made possible as the organization can reduce its non-core risks and increase its core risks in order to expose the organization to the risks it is most suited to handle. The ability to bear unexpected occurrences is ultimately a strategically positioning in the long run (ibid.).

From a meso level, the financial industry is amongst the most researched upon due to a lack of other ERM industry data (Bromiley et al., 2014). However, the previously disregarded industries are at the center of this paper, fulfilling the data required and thus forming a new research frontier by its mere presence of other industries than finance.

From a micro level of analysis, the benefits of ERM derives from the allocation of capital in relation to risk-return, where new perspectives of ERM shifts traditional defensive risk management from a narrow risk avoidance system to also include a more offensive, opportunistic approach which considers a holistic perspective of risk to be included in business strategy, ultimately increasing value (Nocco & Stulz, 2006; Hoyt & Liebenberg, 2003). Having implemented a holistic ERM framework does not make a company all resistant to risk and all-encompassing to opportunities - the number one factor for ERM implementation failure is managers' underestimations of initiating costs (Lin et al., 2012). However, after a successful ERM adoption it typically involves different developmental phases and levels of functioning (Hoyt & Liebenberg, 2011). Hence, the literature can critically be depicted as facing the challenge of different implementation degrees of ERM systems, making it difficult to compare companies with risk frameworks. The literature is in this sense further divided into two approaches to analyze the level of ERM development; either by ERM-index or ERM-keywords.

The ERM-index provides comparable scales based on companies which evaluate themselves in research surveys, whilst keywords focus on ERM-terms in publicly listed sources (Gordon, Loeb and Tseng, 2009). However, letting companies evaluate themselves from prepared surveys to receive an ERM-index have made research findings differ across organizations by rooting rationale problems to the representative answering the survey. Moreover, could the bare application of ERM-keywords imply an inadequate implementation of ERM - which instead rides on the notion of window dressing with a lack of strategically importance in the decision making (ibid.). Thus, distinguishing ERM-companies against each other is difficult due to different functioning levels of risk processes. A solution to this problem is to use a Chief Risk Officer (CRO) as a keyword to attain a strong signal of a fully developed ERM system (Lundqvist, 2014; Beasley, Pagach and Warr, 2008; Hoyt & Liebenberg, 2003; Pagach & Warr, 2010; Beasley, Clune and Hermanson, 2005). In other words, the CRO is closely connected to the board level with strong influence over the strategically decisions made regularly (Lundqvist, 2014; Power, 2007) and is therefore dependent on the management's support (Walker et al., 2002). CROs are encouraged to evaluate risk and return in every strategic decision made at the board level, moreover to align it with the organization's risk appetite and opportunities which have significant impact on the organization's performance measures (Pagach & Warr, 2010) and risk measures (Nocco & Stulz, 2006) but also proves to destroy value for the business (Lin et al., 2012; Pagach & Warr, 2010) why the current literature is criticized for being inadequate in achieving conclusive measures of the value of ERM (Hoyt & Liebenberg, 2003).

2.1.5 The Value of ERM by performance measures

There are evidences of positive value-contributions in terms of; increased Revenues (Mackay & Moeller, 2007), Return on Equity (Lam, 2001), Operating Profit Margin (Eckles, Hoyt & Miller, 2014) and Tobin's-Q (Hoyt & Liebenberg 2011). However, there are contrasting studies showing that ERM destroys value in terms of; Return on Assets, Tobin's-Q and stock price (Lin et al., 2012). There are moreover evidences that financial performance is neither positive nor negative as a result from adopting ERM (Pagach & Warr, 2010).

2.1.5.a Return on Assets (ROA)

ROA is the net income divided by total assets (Berk & DeMarzo, 2011). This measure describes how effective the return is on total assets. A high ROA indicates that the total assets within a company give a high return, which leads to a high net income. A low volatility of the ROA would imply a more valuable ERM than a high volatility ROA (Baxter et. al. 2013) as it describes how well managed the assets are in relation to the management of risk.

2.1.5.b Return on Equity (ROE)

The Return on Equity is the net income divided by the equity of a company. It explains how well the company is generating income of the shareholders' equity (Berk & DeMarzo, 2011). A high value means that the organization is efficient in transforming equity into income. The ROE has been used in earlier studies about ERM as a measure to see how efficient the long term financial performance has developed (Pagach & Warr, 2010).

2.1.5.c Return on Debt (ROD)

Tibiletti and Uberti (2015) analyzes organizations from an ERM-perspective where commitments to achieve objectives are uncertain and vague, why a Return on Debt (ROD) provides a good measure to evaluate debt against return. Increasing the amount of debt can be healthy for the investment as it provides capital and leverage, but translates into a risk as soon as the return is not met; higher debt during unsatisfactory returns thus increases risk (ibid.). Higher ROD indicates better performance.

2.1.5.d Return on Capital Employed (ROCE)

Return on Capital Employed (ROCE) is another financial indicator to show the profitability of the organization (Wang & Mathur, 2011). It provides an indication of profitability and the degree of efficiency over how its management uses its capital; thus higher ROCE indicates better performance. Implementing ROCE to the study would provide the ERM-field with a new contributive measure to the value of ERM, as no previous research has done so and is impossible to test since all sorts of risks are reflected in a company's performance indicators (Cumming & Hirtle, 2001).

2.1.5.e Operating Profit margin (OPM)

The operating profit margin is a measure of the operating income as a percentage of the revenues, in order to see how an organization performs and how profitable it is (Eckles, Hoyt & Miller, 2014). A high profit margin indicates an efficient company, whilst a low profit margin indicates inefficiency. The measure is of importance for this study as it can indicate how well the holistic, proactive ERM-strategy affects the profit margin over time (Mackay & Moeller, 2007).

2.1.6 The Value of ERM by risk attainment

There are evidences of positive value-contributions in terms of lowered; Profit volatility (Hoyt & Liebenberg, 2011) and Earnings Per Share volatility (Singapurwoko, 2011). The most frequently practiced tool to measure risk is the standard deviation () of volatility over a specific time period (Berk & DeMarzo, 2011). However, the standard deviation is criticized for emphasizing the same weight to downside and upside outcomes, why this measure is

contradictory when stating that exceeding positive returns are defined as risk (Kroll & Kaplansky, 2001). Value at Risk (VaR) is a measure to overcome this problem and does so by capturing the minimum expected amount of performance (*p*) over a certain period of time (*t*) at a given confidence level (*cl*). The *p* can therefore provide both positive and negative returns but overcomes upside-outcome problems by showing the minimum expected amount (ibid.). Translated into practical terms, the VaR at a 99% level of confidence, determines a 1% risk that *p,* or even greater losses than *p,* will incur over the period *t*. In other words, it provides a cut-off from the best 99% and worst 1% in mean distribution of a performance value, thus a higher VaR shows a higher risk.

2.1.7 The Value of ERM by a comparative aggregation-ratio

In regard to the value of ERM, the literature is too focused on firm performance (Gordon et al. 2009) providing more risk-attainment measures (Linsmeier & Pearson, 2000), why attempts to convert many individual measures into one aggregated rate to allow comparison have been suggested (Nocco & Stulz, 2006) and tested by a Z-score (Baxter et al., 2013) determined by ROA divided by its own standard deviation. The COSO-F's explicit, phrasal formulation of maximal ERM value is defined as attained when the management's strategy and objectives are in line with accomplishing optimal balance between time, profits and related risks (COSO, 2016). A composite indicator (CI) defines as a mathematical aggregation of individual indicators to measure multi-dimensional concepts (Zhou, Ang & Poh, 2007). In other words, the CI is used to summarize diverse, complex processes to benchmark results. This is in line with ERM's systematic, holistic approach to manage all sorts of risks which are reflected in a company's risk strategy and subsequently in its performance indicators (Cumming & Hirtle, 2001) as well as the growth dimension applied to benchmarking in the COSO framework (COSO, 2016). However, the CI result will depend on the underlying weighting of the different dimensions as specific abilities will dominate others (Zhou, Ang & Poh, 2007). From a methodological perspective, weighted linear combination (WLC) is considered the norm and the Data Envelopment Analysis (DEA) provides objective weights to the CI. Even though DEA derives at objective weights, it can overestimate the efficiency of an analyzed company. This happens if the analyzed company has a certain dimension of indicator dominating other companies (e.g. within an industry), to which the company would always obtain maximum efficiency score, even though it severely underperforms in other important indication dimensions (ibid.). This can make DEA to falsely overestimate the value of ERM, why this paper instead considers the WLC method in its multi-criteria decision-making to form the Holistic Performance Risk Indicator (HPRI). It is based on the arithmetic mean to form a weighted average, and the weights are multiplied with each dimension to subsequently summarize the products for each analyzed entity (Churchman, Ackoff & Arnoff, 1957). The dimensions are in this paper defined as KPIs and VaR, whilst an entity falls under the definition of a company.

2.2 Conclusion

Departing from risk theory, the chapter takes a first glimpse on the subject and defines it as a futuristic uncertainty of events with a probabilistic dimension to ultimately make it a quantifiable measure (Purdy, 2010). Moreover, are traditional risk management theories described as how to handle this quantifiable risk from an internal and external environment, by treating cyclical processes to ensure continuous assessment (Daniel, 1961). Unfortunately do the theories shed light on multiple, unit-specific perspectives with no coherence amongst each other or alignment with business objectives (Hoyt & Liebenberg, 2011) even though later research has included risk areas such as CSR or a new, third environment consisting of IT-risks (Pagach and Warr, 2011). Thus, is enterprise risk management (ERM) enhancing the literature further, where scattered perspectives from the same field come together and form a strategically approach with holistic risk processes to deliver higher company value (Bromiley et al., 2015). The COSO-framework is described as the most widespread definition within the literature (Beasley, Branson & Hancock, 2010) as well as in practice by being the most used risk framework in the world (Hayne & Free, 2014). However, there are still no consensus on whether ERM delivers value to a company or not and what measures ought to be used to derive at such a conclusion (Pagach & Warr, 2010). Distinguishing ERM-companies against each other is difficult due to different functioning levels of risk processes. A solution to this problem is to use a Chief Risk Officer (CRO) as a keyword to attain a strong signal of a fully developed ERM system (Lundqvist, 2014; Beasley, Pagach and Warr, 2008; Hoyt & Liebenberg, 2003; Pagach & Warr, 2010; Beasley, Clune and Hermanson, 2005). Moreover, have previous studies provided a good basis for the financial industry, while neglecting other (Bromiley et al., 2014) and therefore provides a gap in the literature with a rigorous analysis of whether ERM brings value in non-financial industries (Lundqvist, 2014). Continuing on the notion of measures in regard to the value of ERM, the literature is too focused on firm performance (Gordon et al. 2009) and needs more risk-attainment measures (Linsmeier & Pearson, 2000) why there are attempts in translating individual measures into comparative, aggregated rates (Nocco & Stulz, 2006). This research problem is formulated by the hypothesis that;

The value of ERM is measurable through firm performance, risk attainment and a comparative aggregation-rate within industries other than finance.

Authors (Year)	Research field	Research contribution
Baxter, Bedard, Hoitash and Yezegel (2010)	S&P ERM Rating/Value	Positive Z-score & higher Tobin's Q
Beasley, Clune & Hermanson (2005)	ERM/CRO	CRO = greater stage of ERM adoption
Beasley, Pagach & Warr (2008)	ERM/CRO/Value	Neither higher, nor lower performance
Churchman, Ackoff and Arnoff (1957)	Operations Research	Weighted Linear Combination (WLC)
Eckles, Hoyt and Miller (2014)	ERM/Value	Better Operating Profit Margin
Kroll and Kaplansky (2001)	ERM/Value	Value-at-Risk
Gordon, Loeb and Tseng (2009)	ERM-index/Value	Higher firm value
Lam (2001)	CRO/Value	Higher Return on Equity
Liebenberg and Hoyt (2011)	ERM/Value	Higher Tobin's-Q
Lin, Wen and Yu (2012)	ERM/Value	Lower ROA, Tobin's-Q and stock price
Lundqvist (2014)	ERM/CRO	CRO = ERM-company identification
Mackay and Moeller (2007)	Hedging/Value	Higher revenue & Tobin's Q
Pagach and Warr (2010)	ERM/CRO/Value	Neither higher, nor lower
Pagach & Warr (2011)	ERM/CRO	ERM follows poor performance
Singapurwoko (2011)	ERM/Value	Better volatility-EPS with ERM
Tibiletti and Uberti (2015)	Benchmarking	Return on Debt
Zhou, Ang and Poh (2007)	Eco-Economic Method	Composite indicator (CI)

Table 1. *Conclusion over previous theoretical research.*

3. RESEARCH DESIGN

This chapter describes the research design of the thesis by first depicting the problem, purpose, and research contribution as a basis for the study. Thereafter is the research hypothesis operationalized to enable an actionable investigation. Furthermore, is the ontological and epistemological approach motivated which constitutes the basis of the study, after which its methodology and method is explained in more detail. Finally, there are source-critical considerations and ethical reflections.

3.1 Problem, Purpose & Contribution

Despite the recent year's increased focus on ERM, there have only been a few studies trying to answer the question of its contribution, with no consensus on whether it truly adds value to companies or not (Lundqvist, 2014). On the one hand, there are evidences of positive value contributions in terms of; Revenues (Mackay & Moeller, 2007), Return on Equity (Lam, 2001), Operating Profit Margin (Eckles, Hoyt & Miller, 2014), Tobin's-Q (Hoyt & Liebenberg 2011), Profit volatility (Hoyt & Liebenberg, 2011), Z-score (Baxter et. al. 2013) and Earnings Per Share volatility (Singapurwoko, 2011). On the other hand, there are contrasting studies showing that ERM destroys value in terms of; Return on Assets, Tobin's-Q and stock price (Lin et al., 2012). Lastly, there are evidences that ERM neither adds, nor destroys value (Pagach & Warr, 2010).

From a meso level of analysis, the financial industry has been vastly researched upon due to the difficulty of finding any other industry constituted of ERM-firms (Bromiley et al., 2014). Whilst the spotlight has been focused on traditional finance, other disregarded industries have grown in the shadow to slowly fulfill sufficient data. Having undergone a major analysis to find such unique ERM-industries which fulfils required premises are thus enabling this study to challenge the existing research frontier. This paper extends therefore the ERM-field by the mere presence of unique ERM companies from the non-financial industry.

There exists a need for analyzing the value of ERM (Hoyt & Liebenberg, 2003) by giving ERM a clear definition (Gordon et al., 2009) in combination with a robust identification of ERM-companies (Lundqvist, 2014) within neglected industries (Bromiley et al., 2014) providing more risk-attainment measures (Linsmeier & Pearson, 2000) whilst attempting a comparative aggregation-rate (Nocco & Stulz, 2006). With these premises, the current literature is criticized for being inadequate in achieving conclusive measures of the value of ERM (Hoyt & Liebenberg, 2003) and provides this paper a research gap.

3.1.1 Operationalization of the research hypothesis

The research hypothesis is categorized in three sub-hypotheses based on the problem discussed above. The operationalization can be illustrated by numbering the hypothesis. The first sub-hypothesis (H_1) concerns the evidences of ERM leading to positive contributions in terms of key performance indicators (Mackay & Moeller, 2007; Lam, 2001; Eckles, Hoyt & Miller, 2014; Hoyt & Liebenberg 2011. The second sub-hypothesis (H_2) derives from the evidences of lower risk, where new perspectives of ERM shifts traditional defensive risk management from a narrow risk avoidance system to also include a more holistic perspective of risk to be included in business strategy (Nocco & Stulz, 2006; Hoyt & Liebenberg, 2003; Lin et al., 2012; Meulbroek, 2002; Beasley et al., 2005; Pagach & Warr, 2011). The third (H_3) tests if the HPRI is significant in measuring the value of ERM as in line with Nocco and Stulz (2006). From a meso level, the financial industry is amongst the most researched upon due to a lack of other ERM industry data (Bromiley et al., 2014). However, the previously disregarded industries (IND) are at the center of this paper, fulfilling the data required and thus forming a new research frontier by its mere presence of other industries than finance.

(Hypothesis): The value of ERM is measurable through (H_1) firm performance, (H_2) risk attainment and (H_3) a comparative aggregation-rate within industries other than finance.

$H_1: KPI_{ERM} > KPI_{IND}$ *mean KPI for ERM-companies is greater than the industry's mean KPI*
$H_2: VaR_{ERM} < VaR_{IND}$ *mean VaR for ERM-companies is less than the industry's mean VaR*
$H_3\ HPRI_{ERM} > HPR_{IND}$ *mean HPRI for ERM-companies is greater than the industry's mean HPRI*

3.2 Scholarly Perspective

According to Slevitch (2011), the things that are considered real are defined as ontology, which in turn defines what is perceived as legitimate knowledge, epistemology, and thus how knowledge can be obtained. This will in its turn, define the principles for scientific research, methodology, which ultimately directs the research techniques, methods, being used (ibid.). In compliance with this reasoning, the scholarly perspective of this study is discussed below to explain and legitimize its design.

Ontological questions concerning the existence deals with how the world is composed (Bryman & Bell, 2011). An ontological position describes what can be considered as true and how different categories of existence relate to each other (Slevitch, 2011). The social science can simplified be divided into two ontological paradigms; objectivism and constructionism (Bryman & Bell, 2011). These paradigms look onto the reality with its existing beings as either; independent of social actors and thus can be objectively perceived - or that social construction forms out of the perceptions and values held by individuals, thus forming constructionism. The view on the social actors in this study applies an objective perception, were the organization is seen as an outer force influencing its members, rather than organizations understood as a result from ongoing socialization between internal and external individuals. That is why more emphasis of this study concerns how ERM companies perform in relation to their competitors.

From the ontological paradigm, follows epistemological assumptions regarding the nature of knowledge (Slevitch, 2011) which includes questions relating to what is regarded as true knowledge within a research field (Bryman & Bell, 2011). As an objectivistic paradigm is forming the basis for this thesis, positivism forms the epistemological assumption in the paper, perceiving the access to reality as already existing out there to be discovered by an objective approach (Slevitch, 2011); the true value of ERM and whether or not it is adding value to companies are yet for this paper to be realized. An interpretivist perception has thus been disregarded as the dogma develops the truth based on social interaction (ibid).

The epistemological assumption leads the study to make a description of its methodological reasoning on how to acquire the knowledge. There are three types of reasoning; inductive, deductive and abductive - with the former two being most common (Bryman & Bell, 2011; Patel and Davidson, 2011). This paper constitutes a deductive logic as is used by experimental researchers who use disciplinary accepted theories to describe new phenomenon with them (Patel & Davidson, 2011). The deductive logic is most common for studies using top-down premises to reach a general conclusion (Bryman & Bell, 2011) and thus represents a good way to achieve the purpose of the study in testing whether ERM value can be derived from an efficiency ratio. Having provided an objectivistic positivism of deductive reasoning, the research design continues with its method - that is, its procedures to interpret the new phenomena (ibid) where organizations apart from financial industry have come to implement Chief Risk Officers to lead a holistic risk strategy in order to outperform competition.

3.3 Method

3.3.1 Research rationale

The quantitative method provides this paper a tool to compare the collected data, generalize it and ultimately test the research hypothesis. The chosen method is usually a synonym with the deductive theory where the collection of numerical data is compared to theory (Bryman & Bell, 2011). A qualitative method has been discarded, for the reason that the study is collecting information with different quantifiable variables to strive towards testing the research formulation.

3.3.2 Research instrument

3.3.2.a Population selection

This study focuses on companies listed on worldwide stock exchanges, set in relation to a CRO identification as proposed by Lundqvist's (2014) fourth dimension as well as Pagach and Warr (2010) to narrow down the population to fully developed ERM companies. The paper brings moreover empirical data with full coverage of all ERM companies' respective competitors, which thus are placed within the IND-group. Gordon et al (2009) found that firm performance of ERM implementation depends on firm size, thus we continue on this premise by selecting companies with similar sizes. The selection of the ERM companies are therefore limited to the primary stock exchange, whilst excluding the alternative stock exchanges from the data in order to achieve a common basis of ERM-structure (ibid.) and to minimize steering effects (Bryman & Bell, 2011). The competitors must be publicly listed at the same year as the CRO implementation, otherwise they are discarded. A compliance perspective of ERM is excluded due to the quantitative state of the paper (Lya, Maggib, Montalic, Rinderle-Mad & van der Aalst, 2015).

The keywords *Chief Risk Officer*, *CRO*, *Chief Risk Management Officer* and *CRMO* are used to identify fully developed ERM-companies as previous research suggest. A rigorous pre-analysis is thus made from these keywords by forming inputs for searches amongst articles stored in the database LexisNexis. This allows the paper to carefully select worldwide companies with solid experience from CROs in different industries apart from finance. Moreover, are all of their respective competitors gathered and analyzed. Here below follows a list of the companies found.

ERM-company	CRO Initiation	Country	Industry	IND-competitors
Calpine Co	2007	United States	Electricity	31
Canadian Pacific Railway Ltd	2010	Canada	Industrial Transportation	12
Coca-Cola Amatil Ltd	2009	Australia	Beverages	6
General Electric Co	2005	United States	General Industries	24
General Motors Co	2005	United States	Automobile	16
Hydro One Ltd	2000	Canada	General Retailer	15
Lowe's Companies Inc	2008	United States	General Retailer	112
McDermott International Inc	2002	United States	Oil Equipments & Services	49
Mitsubishi Chemical Holdings Co	2006	Japan	Chemical	158
NRG Energy Inc	2004	United States	Electricity	30
Olam International Ltd	2012	Singapore	Food Producers	33
Panasonic Co	2000	Japan	Leisure Goods	23
Petronas Gas Bhd	2011	Malaysia	Gas, Water & Multiutilities	9
Pfizer Inc	2010	United States	Pharmaceuticals & Biotechnology	11
PPL Co	2009	United States	Utility	29
Siemens AG	2003	Germany	General Industrials	3
Tata Global Beverages Ltd	2011	India	Food Producers	47
Telia Company AB	2000	Sweden	Mobile Telecommunications	3
Toyota Motor Co	2003	Japan	Automobile	101
19 ERM-companies	170 years of ERM	9 countries	14 industries	712 competitors

Table 2. *Overview of ERM-companies and the IND-group.*

3.3.2.b Data selection

The collection of data is gathered from the Thomson Reuters Datastream, as it has proven to be a useful database in many quantitative studies (Ince and Porter 2006). The database consists of data from companies' official annual reports, allowing identification of KPIs in order to perform economic analyzes. This paper takes advantage of the database by selecting time periods from

each company's initial public offering date, until the year of 2015. From this time period, each unique ERM-company's CRO-initiation determines the starting point of the analysis. Therefore, companies within the same country and industry can have different amounts of competitors depending on the year of CRO implementation. Non-publically listed companies are discarded from the set of data. Furthermore, does the period includes a financial crisis during 2008 which makes the analysis even more interesting as the companies can be evaluated in terms of risk across unstable years caused by a crisis.

Two fixed variables from the database contribute to the comparison; local currency and a financial period from the end of previous fiscal year. Moreover, are the key performance indicators in Thomson Reuters Datastream defined as follows; WC08316 (Operating Profit Margin), WC18191 (EBIT), WC02999 (Total Assets), WC03101 (Total Current Liabilities), WC08301 (ROE), WC08326 (ROA), WC01751 (Net Income Available to common share) and WC03351 (Total Liabilities).

3.3.2.c HPRI formulation

The Holistic Performance Risk Indicator (HPRI) is formulated below by a thorough mathematical explanation, composing the method used for analyzing the value of ERM. All data is retrieved from Thomson Reuters Datastream, and involves certain Key Performance Indicators (KPI) together with risk (VaR 99%) to derive at its efficiency ratio;

(1)

$$ROE = \frac{Net\ Income}{(Shareholder's\ Equity)}$$

$$ROA = \frac{Net\ Income}{Total\ Assets}$$

$$ROD = \frac{Net\ Income}{Total\ Liabilities}$$

$$ROCE = \frac{Earnings\ Before\ Interest\ and\ Taxes}{Total\ Assets - Current\ Liabilities}$$

$$OPM = \frac{Operating\ Income}{Net\ Sales}$$

(2)

$$\sigma = \sqrt{\frac{1}{N} * \sum_{i=1}^{N} (x_i - \mu)^2}$$

Where:
σ = *Standard deviation*
N = *Amount of years*
x_i = *Individual indicator values*
μ = *Mean*

(3)

Value at Risk ($VaR_{99\%}$) = σ * 2,326

Where:
σ = *Standard deviation*
99% = Confidence level at 99%

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(4)

Holistic Performance Risk Indicator (HPRI)

$$\overline{KPI_j} = \frac{1}{n} * \sum_{i=1}^{n} KPI_{ij}$$

$$\overline{VaR_j} = \frac{1}{n} * \sum_{i=1}^{n} VaR_{ij}$$

$$HPRI_j = \frac{\overline{KPI_j}}{\overline{VaR_j}}$$

Where:
n= Amount of companies
i = Indicator
j = Company

3.3.3 Quantitative assessment

3.3.3.a Reliability

Reliability defines the overall consistency of a study and to what extent it can be replicated providing the same result (Björklund & Paulson, 2003). The data from this paper derives from annual reports, the financial measures described are commonly used, a CRO as an ERM-company indicator together with a disregard of the non-financial industry, have all support from earlier studies and thus contributes to reliability.

3.3.5.b Validity

Validity is in what extent the study is measuring what is stated to be measured. During the collecting of the data and the analysis of it, nothing should steer the results in a certain direction affecting the outcome of the study. (Bryman & Bell, 2011) The gathered data derives from the guidance of previous studies and have been analyzed accordingly to provide a valid answer to the research hypothesis.

3.3.5.c Measurability

Measurability refers to the instrument which is used to evaluate the data (Coelli et al., 2005). The right instrument for measurement is important to provide an outcome which is in line with the purpose, in order to give an unbiased and adequate result (Bryman & Bell, 2011).

3.4 Source critical considerations

Although there have not been many registered errors when using Thomson Reuters Datastream, researchers need to be aware of this and should therefore screen their data (Ince and Porter 2006). The authors of this paper are aware of the problem and uses screening tests to compare the gathered data with annual reports in order to avoid errors.

The annual reports can therefore be biased by the companies' different accounting principles. However, the data is collected over a longer period of time, which has a smoothening effect for any eventual short-term undertakings of creative accounting (Bryman & Bell, 2011). The companies are only compared within the same industry and country, thus eliminating the problem with different accounting principles. Moreover, is it difficult to know exactly when ERM-companies have implemented their ERM processes due to the fact that a public announcement does not represent a point in time to which the ERM implementation has effect (Hoyt & Liebenberg, 2003).

This paper is also aware of the macro and external factors that could affect the performance of the companies. These factors include recessions, business cycles, crises, political influences and similar. However, it is rather difficult to avoid this problem since all companies are currently active - since this paper takes a meso level of analysis, all the companies within the same industry and country are influenced by the same macro factors. This makes the bigger influences more or less equal to all and can thus be eliminated, but worth considering as source criticism.

Furthermore, is VaR criticized for assuming normal distribution, as skewness and kurtosis of data will provide different under- and overestimations of VaR (Linsmeier & Pearson, 2000). To overcome this problem, a historical simulation of VaR (VaR_{HIS}) can be used where historical data is given equal weight and provides no restrictions of minimum observations (ibid.). However, the VaR_{HIS} is itself criticized for giving wrong risk measures, since it could consider extreme volatile cases as repetitive, whilst the reality proves not to be (Čorkalo, 2011; Pritsker, 2005).

3.5 Ethical considerations

There are four general principles where the ethical barriers can be violated. The first considers the harm to participants to which anonymity can provide protection (Bryman & Bell, 2011). The data used of the companies involved in this paper, is publicly available and therefore represents empirical data which is not harmful. The second criterion concerns the lack of informed consent. This is not a problem either, since an annual report is meant for all stakeholders to take part of. The third principle takes into account the invasion of privacy as an important criterion for ethical considerations. Deception is the last criteria which refer to false perceptions of the validity and the reliability of the paper (ibid.). In this study the companies are neither unanimous, nor informed about the study. However, given the basis for the gathering of publicly stated data the study exists within the lines of ethical considerations.

4. FINDINGS & ANALYSIS

The chapter starts with an analytical setup to generally describe the components of the analytical tool, followed by descriptive statistic providing an overview of the findings. This is followed by the hypothesis along with its sub-hypotheses set in relation to theory and modeled to a statistical testing.

4.1 Analytical setup

The tool for this analysis consists of a statistical test of the three hypotheses. T-test is a statistical testing tool to test the null-hypothesis and thus comparing the mean for two different groups in order to find a significant difference between them (Emerson, 2017; Johnson, 1999). Having a big sample and a high confidence level reduces the probability of Type-I error (i.e. rejecting a correct null-hypothesis) and Type-II error (i.e. accepting a false null-hypothesis) (Johnson, 1999). The T-test assumes that the gathered data falls into a normal distribution curve and that the two groups are independent of each other. The data can either be *paired* where the same participant is included in all compared groups, or *two-sampled* to which the participant is represented in one of the groups (Emerson, 2017). Results from the data generate a p-value. A smaller p-value compared to a chosen alpha (α) level, indicates that the results from the testing is not due to chance and thus proves a significant difference between the two groups (Johnson, 1999). A p-value of less or equal to alpha contributes to a rejection of the null-hypotheses, whilst a p-value greater than alpha leads to an accepted null-hypotheses. A value of "1-p" indicates the probability of getting the same results given that the study is to be conducted again (ibid). This study uses an alpha (α) level of 5%.

4.2 Descriptive Statistics

Statistical findings from the three different hypotheses are set to a statistical significance level of 95%. The KPI, VaR and HPRI are tested between the ERM-group and the IND-group respectively. Performance measures defined as KPIs proves to be insignificant in providing the value for ERM. However, findings show that companies having adopted ERM has statistically lower risk-attainment as defined by VaR and proves ERM as valuable for; ROCE-VaR, ROE-VaR and ROD-VaR. Moreover, does the comparative aggregation-rate HPRI bring statistical significance and prove ERM as valuable.

Hypothesis (H)	ERM	IND	P-value	Stat.Sign 5%
(H_1) Hypothesis 1				
OPM_{ERM} > OPM_{IND}	13,88	8,65	**0,06**	Insignificant
$ROCE_{ERM}$ > $ROCE_{IND}$	8,79	8,79	**0,50**	Insignificant
ROE_{ERM} > ROE_{IND}	10,56	8,27	**0,19**	Insignificant
ROA_{ERM} > ROA_{IND}	5,03	4,19	**0,28**	Insignificant
ROD_{ERM} > ROD_{IND}	9,11	7,90	**0,38**	Insignificant
(H_2) Hypothesis 2				
OPM VaR_{ERM} >OPM VaR_{IND}	8,29	14,08	**0,14**	Insignificant
ROCE VaR_{ERM} >ROCE VaR_{IND}	9,69	17,03	**0,04**	Significant
ROE VaR_{ERM} > ROE VaR_{IND}	15,71	27,82	**0,002**	Significant
ROA VaR_{ERM} > ROA VaR_{IND}	7,06	11,87	**0,10**	Insignificant
ROD VaR_{ERM} > ROD VaR_{IND}	11,03	32,09	**0,04**	Significant
(H_3) Hypothesis 3				
$HPRI_{ERM}$ > $HPRI_{IND}$	1,37	0,56	**0,01**	Significant

Table 3. *Shows the p-value for the hypotheses and whether they are significant or insignificant at a 95% confidence interval.*

4.3 Findings and Hypotheses analyzed in relation to theory

This section is structured by the three hypotheses.

4.3.1 Hypothesis 1: $KPI_{ERM} > KPI_{IND}$

The majority of earlier studies suggests that ERM leads to positive contribution in terms of increased Revenues (Mackay & Moeller, 2007), Return on Equity (Lam, 2001), Operating Profit Margin (Eckles, Hoyt & Miller, 2014) and Tobin's-Q (Hoyt & Liebenberg 2011). However, there are contrasting studies showing that ERM destroys value in terms of; Return on Assets, Tobin's-Q and stock price (Lin et al., 2012). It is worth considering that performance has moreover shown to be statistically insignificant when comparing KPIs between similar groupings before. Therefore, there are evidences that financial performance is neither positive, nor negative as a result from adopting ERM (Pagach & Warr, 2010). This study confirms the latter, in accordance to the findings presented in table 4-8 below. The mean value between the two groups are not statistically significant; ERM companies at 9,4726 and the IND at 7,5563. Thus, the findings from this study suggest that traditional performance indicators alone, do not determine the value of ERM.

ERM-company	OPM_{ERM}	OPM_{IND}
Calpine Co	11,57	17,06
Canadian Pacific Railway Ltd	26,86	13,88
Coca-Cola Amatil Ltd	13,97	-19,92
General Electric Co	15,99	10,59
General Motors Co	1,48	7,79
Hydro One Ltd	19,25	20,00
Lowe's Companies Inc	7,69	7,66
McDermott International Inc	4,16	14,21
Mitsubishi Chemical Holdings Co	3,95	5,03
NRG Energy Inc	15,90	16,54
Olam International Ltd	4,17	5,21
Panasonic Co	2,72	5,27
Petronas Gas Bhd	44,36	2,25
Pfizer Inc	28,99	16,27
PPL Co	24,84	17,32
Siemens AG	6,6	6,02
Tata Global Beverages Ltd	7,90	5,70
Telia Company AB	19,18	8,77
Toyota Motor Co	4,05	4,66
Statistical information		
Mean	13,87	8,66
Variance	128,12	76,90
Observations	19	19
F-Test (Two-Sample for Variances)		
df	18	18
F	1,67	N/A
P(F<=f) one-tail	0,15	N/A
F Critical one-tail	2,22	N/A
T-Test (Two-Sample, Equal Variances)		
Hypothesized Mean Difference	0	N/A
df	36	N/A
t Stat	1,59	N/A
P(T<=t) one-tail	0,12	N/A
t Critical one-tail	2,02	N/A

Table 4. *Operating Profit Margin (OPM) analyzed for statistical significance with F-test and T-test.*

ERM-company	$ROCE_{ERM}$	$ROCE_{IND}$
Calpine Co	8,31	5,99
Canadian Pacific Railway Ltd	10,1	10,24
Coca-Cola Amatil Ltd	15,35	6,88
General Electric Co	4,92	12,57
General Motors Co	3,05	14,47
Hydro One Ltd	6,12	2,26
Lowe's Companies Inc	16,40	13,66
McDermott International Inc	11,35	9,12
Mitsubishi Chemical Holdings Co	7,06	7,48
NRG Energy Inc	5,06	6,26
Olam International Ltd	9,91	3,99
Panasonic Co	0,59	6,10
Petronas Gas Bhd	16,71	2,32
Pfizer Inc	8,83	8,37
PPL Co	7,21	5,61
Siemens AG	11,18	11,69
Tata Global Beverages Ltd	8,60	15,99
Telia Company AB	12,48	15,46
Toyota Motor Co	3,77	8,53
Statistical information		
Mean	8,79	8,79
Variance	19,98	17,89
Observations	19	19
F-Test (Two-Sample for Variances)		
df	18	18
F	1,12	N/A
P(F<=f) one-tail	0,41	N/A
F Critical one-tail	2,22	N/A
T-Test (Two-Sample, Equal Variances)		
Hypothesized Mean Difference	0	N/A
df	36	N/A
t Stat	0,00	N/A
P(T<=t) one-tail	0,50	N/A
t Critical one-tail	2,03	N/A

Table 5. *Return On Capital Employed (ROCE) analyzed for statistical significance with F-test and T-test.*

ERM-company	$RROE_{ERM}$	ROE_{IND}
Calpine Co	5,67	8,65
Canadian Pacific Railway Ltd	16,54	7,36
Coca-Cola Amatil Ltd	20,50	−13,16
General Electric Co	11,57	14,02
General Motors Co	16,06	36,94
Hydro One Ltd	10,05	−3,05
Lowe's Companies Inc	14,94	11,48
McDermott International Inc	2,27	7,93
Mitsubishi Chemical Holdings Co	7,33	5,01
NRG Energy Inc	6,23	11,66
Olam International Ltd	10,17	5,59
Panasonic Co	−3,98	2,33
Petronas Gas Bhd	18,09	9,81
Pfizer Inc	14,91	10,86
PPL Co	11,45	7,92
Siemens AG	14,62	9,35
Tata Global Beverages Ltd	6,70	1,74
Telia Company AB	14,25	16,35
Toyota Motor Co	3,27	6,30
Statistical information		
Mean	10,56	8,27
Variance	38,51	91,14
Observations	19	19
F-Test (Two-Sample for Variances)		
df	18	18
F	0,42	N/A
P(F<=f) one-tail	0,04	N/A
F Critical one-tail	0,45	N/A
T-Test (Two-Sample, Equal Variances)		
Hypothesized Mean Difference	0	N/A
df	36	N/A
t Stat	0,88	N/A
P(T<=t) one-tail	0,19	N/A
t Critical one-tail	1,69	N/A

Table 6. *Return On Equity (ROE) analyzed for statistical significance with F-test and T-test.*

ERM-company	$RROA_{ERM}$	ROA_{IND}
Calpine Co	5,76	3,64
Canadian Pacific Railway Ltd	7,07	7,00
Coca-Cola Amatil Ltd	7,97	−14,32
General Electric Co	2,59	6,91
General Motors Co	4,55	8,54
Hydro One Ltd	5,08	1,50
Lowe's Companies Inc	7,45	6,78
McDermott International Inc	1,38	5,68
Mitsubishi Chemical Holdings Co	2,47	2,94
NRG Energy Inc	2,49	3,82
Olam International Ltd	4,61	4,81
Panasonic Co	−0,92	2,35
Petronas Gas Bhd	14,51	3,81
Pfizer Inc	7,05	5,32
PPL Co	4,30	3,42
Siemens AG	4,98	4,57
Tata Global Beverages Ltd	4,41	7,06
Telia Company AB	7,86	12,55
Toyota Motor Co	1,95	3,14
Statistical information		
Mean	5,03	4,19
Variance	11,09	26,68
Observations	19	19
F-Test (Two-Sample for Variances)		
df	18	18
F	0,42	N/A
P(F<=f) one-tail	0,04	N/A
F Critical one-tail	0,45	N/A
T-Test (Two-Sample, Equal Variances)		
Hypothesized Mean Difference	0	N/A
df	36	N/A
t Stat	0,6	N/A
P(T<=t) one-tail	0,55	N/A
t Critical one-tail	2,03	N/A

Table 7. *Return On Assets (ROA) analyzed for statistical significance with F-test and T-test.*

ERM-company	$RROD_{ERM}$	ROD_{IND}
Calpine Co	2,36	3,09
Canadian Pacific Railway Ltd	8,28	5,03
Coca-Cola Amatil Ltd	9,38	-7,91
General Electric Co	2,43	13,1
General Motors Co	4,96	12,78
Hydro One Ltd	5,40	-1,94
Lowe's Companies Inc	13,34	11,23
McDermott International Inc	2,67	12,65
Mitsubishi Chemical Holdings Co	3,01	7,91
NRG Energy Inc	2,22	3,33
Olam International Ltd	2,86	13,7
Panasonic Co	-1,83	6,82
Petronas Gas Bhd	70,83	9,91
Pfizer Inc	9,06	12,85
PPL Co	3,76	2,88
Siemens AG	6,09	4,86
Tata Global Beverages Ltd	11,67	11,7
Telia Company AB	13,71	21,62
Toyota Motor Co	2,90	6,50
Statistical information		
Mean	9,11	7,90
Variance	241,01	43,67
Observations	19	19
F-Test (Two-Sample for Variances)		
df	18	18
F	5,52	N/A
P(F<=f) one-tail	0,00	N/A
F Critical one-tail	2,22	N/A
T-Test (Two-Sample, Unequal Variances)		
Hypothesized Mean Difference	0	N/A
df	24	N/A
t Stat	0,31	N/A
P(T<=t) one-tail	0,38	N/A
t Critical one-tail	1,71	N/A

Table 8. *Return On Debt (ROD) analyzed for statistical significance with F-test and T-test.*

4.3.2 Hypothesis 2: $VaR_{ERM} < VaR_{IND}$

Previous literature shows that ERM brings evidences of positive value-contributions in terms of lowered; Profit volatility (Hoyt & Liebenberg, 2011) and Earnings Per Share volatility (Singapurwoko, 2011). This study finds statistical significance between the ERM and IND groups at a 95% confidence interval. ROCE-VaR is as low as 9,69 from the ERM-group compared to the industry at a high 17,04. A statistical significance is also confirmed by this study onto the ROE-VaR measure - a low 15,35 compared to 28,81 for the ERM-group and IND-group respectively. A third significance is found by the ROD-VaR with an astonishing low 11,03 for the group of ERM-companies in contrast to 32,12 for the IND-companies. Neither ROA-VaR, nor OPM-VaR is significant. The former is thus in contrast with Hoyt and Liebenberg (2012) as well as Singapurwoko's (2011) findings due to the difference of 7,05 for ERM and 11,89 for IND - more specific details are listed in table 9-13. However, the previous research can be criticized from an over-emphasized weight on upside outcomes, rather than risk (Kroll & Kaplansky, 2001) as defined in this study by the VaR. Thus, are three out of five risk-attainment measures for the ERM-group significantly different from the IND-group and determines a positive value of ERM.

ERM-company	OPM VaR_{ERM}	OPM VaR_{IND}
Calpine Co	8,11	8,52
Canadian Pacific Railway Ltd	19,65	9,21
Coca-Cola Amatil Ltd	9,82	101,62
General Electric Co	16,50	4,30
General Motors Co	5,21	2,08
Hydro One Ltd	2,79	8,49
Lowe's Companies Inc	1,32	7,29
McDermott International Inc	17,91	17,70
Mitsubishi Chemical Holdings Co	4,10	8,82
NRG Energy Inc	20,68	9,16
Olam International Ltd	0,36	13,83
Panasonic Co	4,84	7,76
Petronas Gas Bhd	4,36	26,8
Pfizer Inc	6,20	12,95
PPL Co	19,68	7,00
Siemens AG	5,45	6,55
Tata Global Beverages Ltd	0,01	3,72
Telia Company AB	6,91	6,24
Toyota Motor Co	3,66	5,48
Statistical information		
Mean	8,29	14,08
Variance	48,61	480,70
Observations	19	19
F-Test (Two-Sample for Variances)		
df	18	18
F	0,10	N/A
P(F<=f) one-tail	0,00	N/A
F Critical one-tail	0,45	N/A
T-Test (Two-Sample, Equal Variances)		
Hypothesized Mean Difference	0	N/A
df	36	N/A
t Stat	-1,10	N/A
P(T<=t) one-tail	0,14	N/A
t Critical one-tail	2,03	N/A

Table 9. *Operating Profit Margin (OPM) analyzed for statistical significance with F-test and T-test.*

ERM-company	ROCE VaR_{ERM}	ROCE VaR_{IND}
Calpine Co	16,89	5,07
Canadian Pacific Railway Ltd	7,04	13,66
Coca-Cola Amatil Ltd	9,39	63,16
General Electric Co	6,05	12,14
General Motors Co	10,72	8,74
Hydro One Ltd	0,65	5,57
Lowe's Companies Inc	9,43	33,83
McDermott International Inc	47,99	20,38
Mitsubishi Chemical Holdings Co	9,90	11,44
NRG Energy Inc	10,88	5,98
Olam International Ltd	6,65	31,36
Panasonic Co	21,85	23,38
Petronas Gas Bhd	2,82	11,27
Pfizer Inc	3,59	20,25
PPL Co	2,75	4,29
Siemens AG	5,28	13,29
Tata Global Beverages Ltd	2,46	8,31
Telia Company AB	5,82	18,51
Toyota Motor Co	4,01	12,86
Statistical information		
Mean	9,69	17,03
Variance	112,89	195,24
Observations	19	19
F-Test (Two-Sample for Variances)		
df	18	18
F	0,58	N/A
P(F<=f) one-tail	0,13	N/A
F Critical one-tail	0,45	N/A
T-Test (Two-Sample, Unequal Variances)		
Hypothesized Mean Difference	0	N/A
df	34	N/A
t Stat	-1,82	N/A
P(T<=t) one-tail	0,08	N/A
t Critical one-tail	2,03	N/A

Table 10. *Return On Capital Employed (ROCE) analyzed for statistical significance with F-test and T-test.*

ERM-company	ROE VaR_{ERM}	ROE VaR_{IND}
Calpine Co	22,15	9,98
Canadian Pacific Railway Ltd	13,79	33,53
Coca-Cola Amatil Ltd	20,45	38,36
General Electric Co	14,74	26,47
General Motors Co	16,24	54,73
Hydro One Ltd	3,52	14,38
Lowe's Companies Inc	16,16	40,77
McDermott International Inc	47,99	46,45
Mitsubishi Chemical Holdings Co	19,11	13,51
NRG Energy Inc	19,77	31,08
Olam International Ltd	13,63	32,08
Panasonic Co	35,72	34,99
Petronas Gas Bhd	4,23	25,32
Pfizer Inc	14,95	21,16
PPL Co	7,99	8,62
Siemens AG	10,24	33,59
Tata Global Beverages Ltd	5,41	17,75
Telia Company AB	6,15	27,71
Toyota Motor Co	6,27	18,01
Statistical information		
Mean	15,71	27,82
Variance	122,27	156,58
Observations	19	19
F-Test (Two-Sample for Variances)		
df	18	18
F	0,78	N/A
P(F<=f) one-tail	0,30	N/A
F Critical one-tail	0,45	N/A
T-Test (Two-Sample, Unequal Variances)		
Hypothesized Mean Difference	0	N/A
df	34	N/A
t Stat	-3,16	N/A
P(T<=t) one-tail	0,00	N/A
t Critical one-tail	2,03	N/A

Table 11. *Return On Equity (ROE) analyzed for statistical significance with F-test and T-test.*

ERM-company	ROA VaR_{ERM}	ROA VaR_{IND}
Calpine Co	13,53	2,65
Canadian Pacific Railway Ltd	4,26	10,71
Coca-Cola Amatil Ltd	7,98	64,11
General Electric Co	3,62	7,14
General Motors Co	2,87	9,90
Hydro One Ltd	1,23	4,75
Lowe's Companies Inc	2,84	14,21
McDermott International Inc	36,21	14,18
Mitsubishi Chemical Holdings Co	5,94	5,28
NRG Energy Inc	13,73	3,40
Olam International Ltd	5,31	14,95
Panasonic Co	11,29	11,00
Petronas Gas Bhd	3,77	6,33
Pfizer Inc	6,73	12,10
PPL Co	2,22	2,27
Siemens AG	2,93	7,75
Tata Global Beverages Ltd	3,22	3,41
Telia Company AB	3,88	24,96
Toyota Motor Co	2,52	6,46
Statistical information		
Mean	7,06	11,87
Variance	63,61	191,15
Observations	19	19
F-Test (Two-Sample for Variances)		
df	18	18
F	0,33	N/A
P(F<=f) one-tail	0,01	N/A
F Critical one-tail	0,45	N/A
T-Test (Two-Sample, Equal Variances)		
Hypothesized Mean Difference	0	N/A
df	36	N/A
t Stat	-1,31	N/A
P(T<=t) one-tail	0,10	N/A
t Critical one-tail	1,69	N/A

Table 12. *Return On Assets (ROA) analyzed for statistical significance with F-test and T-test*

ERM-company	ROD VaR_{ERM}	ROD VaR_{IND}
Calpine Co	8,97	3,97
Canadian Pacific Railway Ltd	6,26	222,75
Coca-Cola Amatil Ltd	10,62	6,60
General Electric Co	1,98	15,35
General Motors Co	4,62	16,43
Hydro One Ltd	0,50	9,98
Lowe's Companies Inc	7,79	51,05
McDermott International Inc	47,72	41,64
Mitsubishi Chemical Holdings Co	8,53	13,77
NRG Energy Inc	6,15	5,11
Olam International Ltd	3,94	43,82
Panasonic Co	20,26	26,15
Petronas Gas Bhd	48,33	28,65
Pfizer Inc	4,04	59,36
PPL Co	2,28	3,85
Siemens AG	4,05	6,53
Tata Global Beverages Ltd	8,47	8,99
Telia Company AB	9,78	31,93
Toyota Motor Co	5,33	13,82
Statistical information		
Mean	11,03	32,09
Variance	188,29	2420,38
Observations	19	19
F-Test (Two-Sample for Variances)		
df	18	18
F	0,08	N/A
P(F<=f) one-tail	0,00	N/A
F Critical one-tail	0,45	N/A
T-Test (Two-Sample, Unequal Variances)		
Hypothesized Mean Difference	0	N/A
df	21	N/A
t Stat	-1,80	N/A
P(T<=t) one-tail	0,09	N/A
t Critical one-tail	2,08	N/A

Table 13. *Return On Debt (ROD analyzed for statistical significance with F-test and T-test.*

4.3.3 Hypothesis 3: $HPRI_{ERM} > HPRI_{IND}$

Existing literature are inconclusive regarding the value of ERM (Baxter et. al. 2013; Mackay & Moeller, 2007; Lam, 2001) and are too focused on firm performance when evaluating its value (Gordon et al. 2009). From the findings in table 14, this study proves that ERM-companies are significantly more efficient at providing performance in relation to their risk-attainment through a strategic, holistic enterprise risk management. The mean value for the different groups differ, ERM-companies have a mean of 1,3658 whilst the IND group have a mean of 0,5553. The null-hypothesis is rejected and thus the HPRI-mean for ERM-companies is larger than the industry, within the level of a 95% significance. The HPRI is based upon previous performance research (Churchman, Ackoff & Arnoff, 1957; Nocco & Stulz, 2006; Gordon et al. 2009; Hoyt & Liebenberg, 2011). It also finds its roots in the COSO's (2016) explicit, phrasal formulation of a maximal ERM value; as being reached when the management's strategy and objectives are in line with accomplishing optimal balance between time, profits and related risks. The aggregation rate of this paper, namely the HPRI, therefore provides both the research field and the COSO-F a proposed tool in finding the value of ERM.

ERM-company	$HHPRI_{ERM}$	$HPRI_{IND}$
Calpine Co	0,48	1,27
Canadian Pacific Railway Ltd	1,35	0,15
Coca-Cola Amatil Ltd	1,15	-0,18
General Electric Co	0,87	0,87
General Motors Co	0,76	0,88
Hydro One Ltd	5,29	0,43
Lowe's Companies Inc	1,59	0,30
McDermott International Inc	0,11	0,35
Mitsubishi Chemical Holdings Co	0,50	0,54
NRG Energy Inc	0,45	0,76
Olam International Ltd	1,06	0,24
Panasonic Co	-0,04	0,22
Petronas Gas Bhd	2,59	0,29
Pfizer Inc	1,94	0,43
PPL Co	1,48	1,43
Siemens AG	1,56	0,54
Tata Global Beverages Ltd	2,01	1,00
Telia Company AB	2,07	0,68
Toyota Motor Co	0,73	0,51
Statistical information		
Mean	1,37	0,56
Variance	1,41	0,16
Observations	19	19
F-Test (Two-Sample for Variances)		
df	18	18
F	8,85	N/A
P(F<=f) one-tail	0,00	N/A
F Critical one-tail	2,22	N/A
T-Test (Two-Sample, Unequal Variances)		
Hypothesized Mean Difference	0	N/A
df	22	N/A
t Stat	2,79	N/A
P(T<=t) one-tail	0,01	N/A
t Critical one-tail	2,07	N/A

Table 14. *Holistic Performance Risk Indicator (HPRI) analyzed for statistical significance with F-test and T-test.*

5. DISCUSSION & CRITICAL REFLECTION

This chapter discusses the testing of the hypothesis and links the sub-hypotheses presented in the previous chapter together with the problematization. The discussion starts by an adhesion of the hypothesis analysis and how it relates to previous literature. Thereafter is a theoretical contribution brought up in relation to the ERM field, together with practical utilization.

5.1 Theoretical contributions

Based on previous research, there exist a need for analyzing the value of ERM (Hoyt & Liebenberg, 2003) by giving ERM a clear definition (Gordon et al., 2009) in combination with a robust identification of ERM-companies (Lundqvist, 2014) within neglected industries (Bromiley et al., 2014) providing more risk-attainment measures (Linsmeier & Pearson, 2000) whilst attempting a comparative aggregation-rate (Nocco & Stulz, 2006). With these premises, the current literature is criticized for being inadequate in achieving conclusive measures of the value of ERM (Hoyt & Liebenberg, 2003) and allows this paper to provide the literature field with several theoretical contributions.

The first theoretical contribution derives from Bromiley et al.'s (2014) meso-analysis proposal, to which this study undertakes companies having adopted ERM-processes within other industries than the financial sector. This paper finds new discoveries in terms of ERM-value set in new contexts by 14 different industries constituting of 731 companies to within which 19 ERM-companies operate. There mere presence of these industries extends the literature by adding new understanding to the value of ERM within general industries and different business environments. This is set against a robust identification of ERM-companies as proposed by Lundqvist's (2014) four pillars of ERM implementation, to which the most important constitutes the ERM keywords; "CRO" and "Chief Risk Officer" throughout database searches. From another perspective, this paper provides further advancements to be made given the combination of previous keywords set in a new meso-level of analysis. This study has successfully been able to find 19 companies in 9 different countries having a CRO within non-financial industries and thus constitutes 170 years of CRO data which no previous study has done.

The second contribution derives from analyzing the value of ERM within this new industrial context. This is done by different measurements categorized as performance, risk and aggregative indicators. Same performance indicators have been used as previous research, i.e. ROE (Lam, 2001), OPM (Eckles, Hoyt & Miller, 2014), ROA (Baxter et al. 2013; (Lin et al., 2012). This is done to enable a comparison with previous research whilst adding the new performance measures ROD and ROCE to further the field at an analytical level. However, all the performance measures show no significant difference between ERM-companies against the IND-index at a 95% level of confidence. This finding is in line with Pagach & Warr (2010) and Lin et al. (2012) and confirms that traditional performance indicators alone, do not determine the value of ERM.

The third theoretical contribution, arises from considering volatility when analyzing the performance of the companies. This paper provides more risk-attainment measures as proposed by Linsmeier and Pearson (2000) and agrees that ERM bring evidences of positive value-contributions in terms of lowered volatility. However, this study does so by criticizing previous literature for over-emphasized weight on upside outcomes, rather than risk (Kroll & Kaplansky, 2001) which is defined by VaR in this paper. The risk-attainment measures ROCE-VaR, ROE-VaR and ROD-VaR are all significantly lower for the ERM-companies compared against its IND counterparts. Interestingly, the data in this paper covers years of recession; to which the

ERM-companies remained at a significantly lower downside risk and provides the research field with the ERM as valuable during cycles of recessions.

The fourth theoretical contribution, derives from Nocco and Stulz's (2006) proposal to test a comparative, aggregation-rate. This paper finds that the HPRI is significantly higher for ERM-companies using a 95% confidence interval compared against the IND counterpart. This is in line with Baxter et al. (2013) findings of the Z-score. The HPRI in this paper therefore contributes with a comparative aggregation-rate based upon efficiency between risk and performance onto an otherwise single-measured research field.

5.2 Practical contributions

From the theoretical discussion above, contributions reveal that there is statistical difference between the ERM and IND groups during times of recession. This is why the paper recommends practitioners to implement ERM processes along with a strategical CRO - at listed companies, within all general and different industries. The effects of such a recommendation come with the benefit of faster responses to unforeseen uncertainties and to more coherently align them with business objectives. From a meso-perspective, the rapid technology development could influence companies to transform into new operative models. Having this in place could proactively make a business and its stakeholders less worrisome and instead more strategically driven to leverage the value gained from ERM.

A last practical implication comes with the use of HPRI as a tool used for strategic decision-making in order to maximize the value of ERM. It allows a company to quantify its risk-attainment, whilst considering fluctuating profit over time. The HPRI can moreover act as a benchmark with comparative advantages against industry competition.

6. CONCLUSION

This chapter concludes the paper by starting from the problematization and resulting in key findings.

This paper investigates whether Enterprise Risk Management (ERM) is valuable to listed companies within non-financial industries. While previous studies have covered the financial industry, this paper performs a meso-analysis of 14 new industries. Many contributions within the literature are too focused on single performance and risk measures as determinants for the value of ERM and are moreover inconclusive in providing its value. This paper captures all previously used measures, whilst adding new ones in three different categories; performance, risk and aggregation - with the hypothesis that each category can measure the value of ERM.

Findings from 731 companies in 14 industries, proves no statistical significance for the KPIs and contributes the literature field with evidence that traditional performance indicators alone, do not determine the value of ERM. Moreover, proves three out of five risk-attainment measures for the ERM-group to be significantly different from the competitors and determines a positive value of ERM. This study furthermore proves that ERM-companies are significantly more efficient at providing performance in relation to their risk-attainment by using the HPRI measurement. This paper recommends practitioners to implement ERM processes along with a strategical CRO. Having ERM in place could proactively make business and stakeholders less worrisome and instead more strategically driven to leverage its value.

This paper concludes that ERM is valuable for non-financial industries which can benefit from having enterprise risk management at a strategical decision level. The benefit arises from proactive and faster response-times to unforeseen uncertainties, whilst more coherently align them with business objectives. Further conclusions can be made that ERM does not increase firm performance. It does however stabilize a company through economic crises and can be a more efficient way to strategically compete.

7. LIMITATIONS & FUTURE RESEARCH

This chapter discusses the limitations of the study as well as future recommendations.

Suggestions for future research arise from limitations and findings of this paper. Further research could take advantage of the meso-level analysis provided within this paper in order to find unique, disregarded industries. Moreover, can future studies use the statistical difference-in-difference (DID) technique, emphasizing on specific events and allow for testing of the ERM-group against its IND-counterpart. The DID is on the one hand limited to a specific event, but would on the other hand eliminate any results based upon existing differences. Lastly, can the HPRI be tested by the hypothesis that it is a better indicator than risk-attainment measures when evaluating ERM.

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APPENDIX

Here below follows a list of all analyzed companies ordered by their respective industry.

CALPINE CO
AES CORP
ALLTELE
ALLIANT ENERGY CORP
AMERICAN ELECTRIC
BLACK HILLS CORPORATION
CMS ENERGY CORP
CONSOLIDATED EDISON
DOMINION RESOURCES
DTE ENERGY CO
DYNEGY INC
EDISON INTERNATIONAL
EL PASO ELECTRIC CO
ENTERGY CORPORATION
EVERSOURCE ENERGY
EXELON CORPORATION
FIRSTENERGY CORPORATION
GREAT PLAINS ENERGY
HAWAIIAN ELECTRIC
IDACORP, INC
NEXTERA ENERGY
NORTHWESTERN CORP
ORMAT TECH INC
PG&E COMPANY
PINNACLE WEST CAPITAL
PNM RESOURCES, INC.
PORTLAND GEN ELEC
PUBLIC SVC ENTRPRISE GR
SOUTHERN CO
UNITIL CORPORATION
WESTAR ENERGY, INC.
XCEL ENERGY INC

CANADIAN PACIFIC RAILWAY LTD
ALGOMA
CANADIAN NATIONAL
CARGOJET
CLARKE
DISCOVERY AIR INC
ENTREC
GRAND POWER LOGIS
HNZ GROUP
LOGISTEC
MULLEN GROUP
TRANSFORCE
WESTSHORE TERMINALS

COCA-COLA AMATIL LTD
AUSTRAINIAL VINTAGE
BRAND NEW VINTAGE
BYTE POWERGROUP
REFRESH FROUP
GAGE ROADS
TREASURY WINE

GENERAL ELECTRIC CO
3M COMPANY
ACTUANT CORPORATION
APTARGROUP
BALL CORPORATION
BEMIS COMPANY INC
CARLISLE COMPANY
DANAHE CORPORATION
EATON CORPORATION
GRAPHIC PACKAGING
GREIF INC
HARSCO CORPORATION
HONEYWELL INTERNATIONAL
ITT INC
LANDEC CORPORATION
MULTI-COLO CORPORATION
MYERS INDUSTRIES
NACCO INDUSTRIES
OTTER TAIL CORPORATION
OWENS-ILLINOIS INC
PACKAGING CORPORATION
PARKER-HANNIFI CORPORATION
PRESS CORPORATION LT
RAVEN INDUSTRIES INC
SEALED AIR CORP

GENERAL MOTORS CO
AMERICAN AXLE & MFG
AUTOLIV, INC.
BORGWARNER INC
DELPHI AUTOM
GENUINE PARTS CO
HARLEY-DAVIDSON INC.
LEAR CORP
MODINE MFG CO.
STANDARD MOTOR
STONERIDGE, INC.
SUPERIOR INDUSTRIES
TENNECO INC.
TITAN INTERNATIONAL
TOWER INTERNATIONAL
VISTEON CORP
WABCO HOLDINGS INC.

HYDRO ONE LTD
ALTERRA POWER
ALGONQUIN POWER
ATLANTIC POWER CORP
BORALEX INC
BROOKFIELD RENEWABLE
CAPITAL POWER
EMERA INC
FORTIS INC
INNERGEX RENEWABLE
MAXIM POWER CORP
NORTHLAND POWER
POLARIS INFRASTR
SYNEX INTERNATIONAL
TRANSALTA CORP
TRANSALTA RENEWABLES

LOWE'S COMPANIES INC
1-800-FLOWERS.COM
AARON'S, INC.
ABERCROMBIE & FITCH
ADVANCE AUTO PARTS
AMERCO
AMERICAN PUBLIC
AMERICA'S CAR-MART
ASBURY AUTOMOTIVE
ASCENA RETAIL
ATA INC - ADR
AUTONATION INC
BARNES & NOBLE
BEACON ROOFING SUP
BED BATH & BEYOND
BEST BUY CO INC
BIG 5 SPORTING GOODS
BIG LOTS, INC.
BIRKS GROUP INC
BON-TON STORES INC
BOWLIN TRAVEL
BRIDGEPOINT ED
BUCKLE INC
CABELA'S INC
CALERES INC
CAPSTONE COS

CAREER EDUCATION CO
CARMAX INC
CARRIAGE SERVICES
CATO CORPORATION
CHEMED CORPORATION
CHICO'S FAS INC
CHILDRENS PLACE INC
CHINA DISTANCE EDU
CHRISTOPHER & BANKS
CITI TRENDS, INC.
COLLECTORS UNIVERSE
CONN'S INC
COPART INC
COSTCO WHOLESALE
DESTINATION MATER
DESTINATION XL
DEVRY EDUCATION
DGSE COMPANIES INC
DILLARD'S INC
DOLLAR GENERAL CORP
DOLLAR TREE, INC
DSW INC.
EVINE LIVE INC
FINISH LINE INC
FOOT LOCKER, INC
FRED'S, INC.
GAIA INC
GAMESTOP CORPORATION
GAP INC
GENESCO INC.
GRAND CANYON EDU
GROUP 1 AUTOMOTIVE
GUESS? INC.
HAVERTY FURNITURE
HHGREGG, INC.
HIBBETT SPORTS INC.
HILLENBRAND, INC
HOME DEPOT, INC.
HSN, INC
ITT EDUCATIONAL SVCS
J C PENNEY COMPANY
KIRKLAND'S, INC.
KOHLS CORPORATION
LEARNING TREE INT'L
LITHIA MOTORS INC
LUMBER LIQUIDATOR
MACY'S INC
MARINEMAX INC
MATTHEWS INT'L CORP
MERCADOLIBRE INC
MONRO MUFFLER BR
NETFLIX INC
NEW ORIENTAL EDUCATION
NEW YORK & CO INC
NORDSTROM, INC.
O REILLY AUTOMOTIVE
OFFICE DEPOT, INC.
OVERSTOCK.COM, INC
PCM INC
PENSKE AUTOM
PERFUMANIA
PIER 1 IMPORTS, INC.
PRECISION AUTO CARE
PRICESMART, INC.
PROFIRE ENERGY, INC
PROVIDENCE SERVICE
RENT-A-CENTER, INC.
ROSS STORES, INC.
SERVICE CORPORATION
SHOE CARNIVAL, INC.
SHUTTERFLY, INC.
SIGNET JEWELERS LTD
SONIC AUTOMOTIVE INC
SOTHEBY'S
SP PLUS CORP
SPEED COMMERCE INC
STAMPS.COM INC.
STAPLES INC
STEIN MART, INC.
STONEMOR PARTNERS
STRAYER EDUCATION
SUBURBAN PROPANE
TAILORED BRANDS INC
TARGET CORP
TIFFANY & CO.
TJX COMPANIES
WAL-MART

MCDERMOTT INTERNATIONAL INC
ARCHROCK INC
ATWOOD OCEANICS INC
BAKER HUGHES INC
BRISTOW GROUP INC
CORE LABORATORIES
DIAMOND OFFSHORE DRILL
DRIL-QUIP INC
ENERGY TRANSFER PART
ENLINK MIDSTREAM
ENTERPRISE PRODUCTS
FLOTEK INDUSTRIES
GENESIS ENERGY
GEOSPACE
GULF ISLAND
GULFMARK OFFSHORE
HALLIBURTON
HELIX
HELMERICH & PAYNE
HORNBECK OFFSHORE
ION GEOPHYSICAL
MAGELLAN MIDSTREAM
MARTIN MID PART LP
MATRIX SERVICE CO
MITCHAM INDUSTRIES
NABORS INDUSTRIES
NATL OILWELL VARCO
NATURAL GAS SERV GRP
NEWPARK RESOURCES
NOBLE CORPORATION
OCEANEERING INTL
OILS STATES INTL
ONEOK PARTNERS LP
PARKER DRILLING CO
PATTERSON UTI ENERGY
PHI INC
PIONEER ENERGY
PLAINS ALL ALMER PIPE
ROWAN COMPANIES PLC
SCHLUMBERGER LIMITED
SEACOR HOLDINGS INC
SUNOCO LOGISTICS
SUPERIOR ENERGY SVCS
TESCO
TETRA TECHNOLOGIES
TIDEWATER INC
TRANSOCEAN LTD
WEATHERFORD INTERNATIONAL
WILLBROS GROUP INC
WILLIAMS COMPANIES

MITSUBISHI CHEMICAL HOLDINGS CO
ACHILLES CORP
ADEKA CORP
AGRO-KANESHO CO
AIR WATER INC
ARAKAWA CHEMICAL IND
ARISAWA MANUF
ASAHI KASEI
ASAHI ORGANIC
ASAHI RUBBER INC
ATECT CORP
BANDO CHEMICAL IND
BP CASTROL K.K

C. UYEMURA & CO LTD
CEMEDINE CO., LTD
CHEMIPRO KASEI
CHUGOKU MARINE PAINT
DAI NIPPON TORYO CO
DAICEL CORP
DAIICHI KASEI CO
DAIICHI KIGENSO KAGA
DAI-ICHI KOGYO
DAINICHISEIKA C & C
DAISHIN CHEMICAL CO
DAISO CO LTD
DAITO CHEMIX CORP
DENKA CO LTD
DIC CORPORATION
EARTH CHEM CO LTD
FUJIKURA KASEI CO.
FUJIKURA RUBBER LTD.
FUJIMORI KOGYO CO
FUKOKU CO LTD
FUMAKILLA LIMITED
GOO CHEMICAL CO. LTD
GUN EI CHEMICAL IND.
HARIMA CHEMICALS GP
HITACHI CHEMICAL CO.
HODOGAYA CHEMICAL CO
HOKKO CHEMICAL IND
HONSHU CHEMICAL IND
IHARA CHEMICAL IND
INANABATA & CO LT
ISE CHEMICAL CORP
ISHIHARA CHEMICAL CO
ISHIHARA SANGYO KAI
JAPAN PURE CHEMICAL
JAPAN U-PICA CO. LTD
JCU CORPORATION
JSP CORPORATION
JSR CORP
KANEKA CORP
KANSAI PAINT
KANTO DENKA KOGYO CO
KAOTSU GAS KOGYO CO
KATAKURA & CO
KAWAKAMI PAINT
KAWASAKI KASEI CHEMICAL
KIMOTO CO LTD
KINUMINE INDUSTRIES
KODAMA CHEMICAL
KOEI CHEMICAL
KONISHI CO LTD
KUIMAI CHEMICAL LTD
KURARAY CORP
KUREHA CORP
MANAC INCORPORATED
MARUO CALCIUM CO
MATSUMOTO YUSHI
MEC COMPANY
MEIWA CORP
MICS CHEMICAL
MIPOX CORP
MITSUI CHEMICAL INC
MORESCO CORP
NAGASE & CORP
NEW JAPAN CHEMICAL
NICCA CHEMICAL CO
NICHIBAN CO LTD
NIHON KAGAKU SANGYO
NIHON PARKERIZING
NIPPON CARBIDE IND
NIPPON CHEMICAL IND
NIPPON FINE CHEMICAL
NIPPON KAYAKU CO
NIPPON PAINT HOLDING
NIPPON PIGMENT CO
NIPPON SEIRO CO
NIPPON SHOKUBAI CO
NIPPON SODA LTD
NIPPON VALQUA IND
NISSAN CHEMICAL IND
NITTO DENCO CORP
NITTO KAKO CO LTD
NOF CORP
OKAMOTO IND
OKURA INDUSTRIAL CO
ONEX CORPORATION
OSAKA ORGANIC CHEMICAL
PARKER CORPORATION
PLA MATELS CORP
POWDERTECH CO LTD
RASA INDUSTRIES
RIKEN CORUNDUM CO
RIKEN TECHNOS CO LTD
RIKENGREEN CO LTD
SAKAI CHEMICAL
SAKAI TRADING CO
SAKATA INX CORP
SAKURA RUBBER CO
SANKEI CHEMICAL CO
SANYO CHEMICAL IND
SEIKO PMC CORP
SEKISUI PLASTICS CO
SHIKOKU CHEMICALS
SHIN-ETSU CHEMICAL
SHIN-ETSU POLYMER
SHOKO CO LTD
SHOWA CHEMICAL IND
SHOWA DENKO K.K
SHOWA NIKKA CO LTD
SOKEN CHEMICAL
SOMAR CORPORATION
ST CORP
STELLA CHEMIFA CO
SUGAI CHEMICAL IND
SUMITOMO BAKELITE CO
SUMITOMO CHEMICAL CO
SUMITOMO SEIKA
SUN A. KAKEN
T&K TOKA CO
TAIYO HOLDINGS
TAIYO NIPPON SANSO
TAKASAGO INTERNATIONAL CORP
TAKI CHEMICAL CO
TANAKA CHEMICAL CO
TAOKA CHEMICAL CO
TAYCA CORP
TERAOKA SEISAKUSHO
TITAN KOGYO K.K.
TOAGOSEI CO LTD
TOCALO CO LTD
TODA KOGYO CORP
TOHO ACETYLNE CO
TOHO CHEMICAL IND
TOHOKU CHEMICAL
TOKAI CARBON CO
TOKUYAMA CORP
TOKYO PRINTING INC
TOMOEGAWA CO LTD
TORAY IND
TOSOH CORP
TOYO GOSEI CO
TOYO INC SC
UBE IND
YASUHARA CHEMICAL
YUKI GOSEI KOGYO CO
YUSHIRO CHEMICAL
ZEON CORP

NRG ENERGY INC
AES CORP
ALLETE, INC
ALLIANT ENERGY CORP
AMERICAN ELECTRIC

BLACK HILLS CORP
CMS ENERGY CORP
CONSOLIDATED EDISON
DOMINION RESOURCES
DTE ENERGY CO
DYNEGY INC.
EDISON INTERNATIONAL
EL PASO ELECTRIC CO
ENTERGY CORPORATION
EVERSOURCE ENERGY
EXELON CORPORATION
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IDACORP, INC.
NORTHWESTERN CORP
ORMAT TECH INC
PG&E COMPANY
PINNACLE WEST CAPITAL
PNM RESOURCES, INC.
PORTLAND GEN ELEC
PUBLIC SVC ENTRPR GR
SOUTHERN CO
UNITIL CORPORATION
WESTAR ENERGY, INC.
XCEL ENERGEY INC

OLAM INTERNATIONAL LTD
ABR HOLDINGS LIMITED
AURIC PACIFIC GROUP
BUMITAMA AGRI LTD
CHEWS GROUP LTD
CHINA KANGDA FOOD
CHINA MINZHONG FOOD
DEL MONTE PACIFIC
DELFI LTD
ENVICTUS INTERNAT
GLOBAL PALM
GMG GLOBAL LIMITED
GOLDEN
GREEN BUILD
HANWELL HOLDINGS LTD
HLH GROUP LTD
HOSEN GROUP LTD
INDOFOOD AGRI
JAPFA LTD
JB FOODS LTD
KENCANA AGRI
KHONG GUAN FLOUR
LABIXIAOXIN SNACKS
LUZHOU BIO-CHEM
MEWAH INTL
ORIENTAL GROUP LTD
QAF LTD
QIAN HU CORPORATION
SINARMAS LAND LTD
SINO GRANDNESS FOOD
SUNMOON FOOD
SUPER GROUP
WILMAR INTERNATIONAL
YEO HIAP SENG LTD

PANASONIC CO
CASIO COMPUTER CO
DAIICHIKOSHO CO
FUNAI ELECTRIC CO
GLOBERIDE
HAPPINET CORPORATION
KAWAI MUSICAL INSTR
KONAMI CORP
KOYOSHA INC
MIROKU CORP
MIZUNO CORP
NIKON CORPORATION
NITTO SEIMO CO
NORITSU KOKI CO LTD
PIONEER CORP
SEGA SAMMY HOLDINGS
SHARP CORPOR
SHIMANO INC
SONY CORP
TAMRON CO LTD
TOMY CO LTD
YAMAHA CORP
YON EX CO., LTD
ZETT CORPORATION

PETRONAS GAS BHD
BRITE-TECH
KUMPULAN PERANGSANG
MMC CORP
PBA HOLDINGS
PUNCAK NIAGA
RANHILL HOLDINGS
SALCON BHD
TALIWORKS CORP
YTL POWER

PFIZER INC
ABBOTT LABORATORIES
ALLERGAN PLC
BRISTOL-MYERS SQUIBB
CHARLES RIVER LAB
ENZO BIOCHEM INC
JOHNSON & JOHNSON
LANNETT COMPANY, INC
LILLY (ELI) AND CO.
MERCK & CO INC
PERRIGO COMPANY PLC
PRESTIGE BRANDS HLDG

PPL CO
AES CORP
ALLETE, INC.
ALLIANT ENERGY CORP
AMERICAN ELECTRIC
BLACK HILLS CORP
CMS ENERGY CORP
CONSOLIDATED EDISON
DOMINION RESOURCES
DTE ENERGY CO
DYNEGY INC
EDISON INTERNATIONAL
EL PASO ELECTRIC CO
ENTERGY CORPORATION
EVERSOURCE ENERGY
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HAWAIIAN ELECTRIC
IDACORP, INC.
NORTHWESTERN CORP
ORMAT TECH INC
PG&E COMPANY
PINNACLE WEST CAPITAL
PNM RESOURCES, INC.
PORTLAND GEN ELEC
PUBLIC SVC ENTRPR GR
SOUTHERN CO
UNITIL CORPORATION
WESTAR ENERGY, INC.

SIEMENS AG
INDUS HOLDING
THYSSENKRUPP AG
VERALLIA DEUTSCHLAND

TATA GLOBAL BEVERAGES LTD
ADF FOODS LTD
AGRO TECH FOODS
ANDHRA SUGARS
AVANTI FEEDS LIMITED
BALRAMPUR CHINI

BANNARI AMMAN SUGARS
BRITANNIA INDUSTRIES
CCL PRODUCTS
DALMIA BHARAT SUGAR
DHAMPUR SUGAR
DHARANI SUGARS
DHUNSERI PETROCHEM
E.I.D. -PARRY INDIA
GODREJ SOAPS LIMITED
GOKUL REFOILS
GUJARAT AMBUJA EXP
HERITAGE FOODS LTD
JAY SHREE TEA
JAYANT AGRO
JVL AGRO INDUSTRIE
KARUTURI GLOBAL
KAVERI SEED CO
KRBL LIMITED
KWALITY LTD
LAKSHMI ENERGY
LT FOODS LIMITED
MCLEOD RUSSEL
POCHIRAJU INDUSTRIES
PONNI SUGARS
RAJSHREE SUGARS
RASOYA PROTEINS LTD
SAKTHI SUGARS LTD
SAKUMA EXPORTS
SANWARIA AGRO OILS
SITA SHREE FOOD
SKM EGG PRODUCTS
TATA COFFEE LTD
THIRU AROORAN
UGAR SUGAR
UNITED NILGIRI
UPPER GANGES
USHER AGRO LIMITED
UTTAM SUGAR MILLS
VADILAL INDUSTRIES
VENKY'S (INDIA)
VIPPY INDUSTRIES LTD
ZYDUS WELLNESS LTD

TELIA COMPANY AB
ALLTELE
DGC ONE
TELE2

TOYOTA MOTOR CO
AHRESTY CORPORATION
AISAN INDUSTRY CO
AISIN SEIKI CO LTD
AKEBONO BRAKE IND.
ALPHA CORP
ALPINE ELECTRONICS
ASKA CORPORATION
BRIDGESTONE CORP
CALSONIC KANSEI CORP
CHITA KOGYO CO., LTD
CHUO MALLEABLE IRON
CHUO SPRING CO. LTD.
CLARION CO LTD
DAYTONA CORPORATION
DENSO CORP
DIAMOND ELECTRIC MFG
EIDAI KAKO CO., LTD.
EXEDY CORPORATION
F.C.C. CO LTD
FINE SINTER CO., LTD
FUJI HEAVY INDS.
FUJI KIKO CO LTD
G-7 HOLDINGS INC
G-TEKT CORP
HARADA INDUSTRY CO.
HKS CO., LTD.
HONDA MOTOR CO., LTD
H-ONE COMPANY LTD
ICHIKOH INDUSTRIES
IKUYO CO., LTD.
IMASEN ELECTRIC IND.
JECO CO., LTD.
JTEKT CORP
KASAI KOGYO CO.
KAYABA INDUSTRY CO
KEIHIN CORPORATION
KOITO MFG. CO., LTD.
LEAD CO INC
MARUJUN CO., LTD.
MAZDA MOTOR CORP
METALART CORPORATION
MIKUNI CORPORATION
MITSUBA CORPORATION
MURAKAMI CORPORATION
MURAKI CORPORATION
MURO CORP.
MUSASHI SEIMITSU IND
NHK SPRING CO., LTD.
NICHIRIN CO., LTD.
NIFCO INC. -
NIHON PLAST CO., LTD -
NIKKI CO LTD
NIPPON PISTON RING -
NIPPON SEIKI CO.
NISHIKAWA RUBBER CO.
NISSAN MOTOR CO.
NISSAN SHATAI CO -
NISSIN KOGYO CO. LTD -
NITTAN VALVE CO.
NOK CORP -
NSK LTD. -
OGURA CLUTCH CO. LTD
PACIFIC INDUSTRIAL
PIOLAX, INC.
PRESS KOGYO CO., LTD
RIKEN CORPORATION
RYOBI LIMITED -
SAKURAI LTD.
SANDEN HOLDINGS
SANOH INDUSTRIAL CO.
SHOWA CORP
SNT CORP
SPK CORPORATION
STANLEY ELECTRIC CO.
SUMITOMO ELECTRIC
SUMITOMO RIKO CO LTD
SUMITOMO RUBBER IND.
SUZUKI MOTOR CORP
T. RAD COMPANY LTD
TACHI-S CO., LTD
TAIHO KOGYO CO., LTD
TANAKA SEIMITSU
TATSUMI CORPORATION
TBK COMPANY LTD
TEIN INC
TOKAI RIKA CO. LTD.
TOKYO RADIATOR MFG.
TOPRE CORP
TOYO TIRE & RUBBER
TOYODA GOSEI CO.
TPR CO
UNIPRES CORP
UNIVANCE CORP
U-SHIN LTD.
WEDS CO., LTD.
YAMAHA MOTOR CO.
YASUNAGA CORPORATION
YOKOHAMA RUBBER CO
YOKOWO CO., LTD.
YOROZU CORPORATION
YUTAKA GIKEN CO

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To risk or not to risk?

This paper covers 170 years of ERM experience, 9 international countries, 14 widespread industries and data from 731 global companies. We know the answer.