Abandoning Silos for Integration: Implementing Enterprise Risk Management and Risk Governance

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This book is dedicated to my fantastic parents Lena and Allen Henderson.

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September, 2014
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Chapter 1. Introduction to Abandoning Silos for Integration: Implementing Enterprise Risk Management and Risk Governance

1.1 Introduction

Thirty years ago risk management was typically based within the corporate treasury, and a low-level employee would focus only on purchasing insurance and perhaps hedging interest rates and foreign exchange rate exposures (Nocco & Stulz, 2006). This is also reflected in the wave of empirical studies in risk management in the 1990s where determinants of hedging and derivative use were in focus (Gay & Nam, 1998; Géczy, Minton, & Schrand, 1997; Howton & Perfect, 1998; Mian, 1996; Nance, Smith, & Smithson, 1993; Samant, 1996; Tufano, 1996). Traditional risk management activities were approached in "silos" where firms perhaps considered a more varied number of organizational risks but in isolation and without much thought to the interrelation between risks and confined the risk management activities to various departments (Bowling & Rieger, 2005).

However, firms began to abandon the "silo" approach for more integrated risk management as they faced a broader scope of risks arising from factors such as globalization, industry consolidation, and deregulation (Liebenberg & Hoyt, 2003). Simultaneously, there was a shift to view risks in a portfolio, an increased tendency to quantify risk, and a growing view that risks were also possible opportunities (CAS, 2003). Flaws and failures in the risk management systems during the financial crisis also stimulated a push for a new type of risk management. Three common failures of risk management – failure to get the right information to the right people, failure to connect the benefits of risk management to its costs, and failure to exploit efficiency and strategic opportunities created by risk management – can be addressed in large part through more attention to integration (Culp, 2001). In order to succeed in the integration of risk management, more structure, organization, accountability, and communication in the risk management system was necessary.

Occurring at the same time as the push for integration in the risk management system was the change in corporate governance standards to also include risk

management (Kleffner, Lee, & McGannon, 2003). Financial disclosures with more severe reporting and control requirements, focus from ratings agencies on risk management, regulatory requirements like those of the Sarbanes-Oxley Act of 2002 (section 404 in particular), and, most recently, the financial crisis all put new requirements on firms in terms of corporate governance and risk management.

Enterprise risk management (ERM) evolved to meet the needs for a more advanced, sophisticated, and integrated approach to risk management (Simkins & Ramirez, 2007). The supporting structure of the enterprise risk management system became a natural solution to pushes toward better governance in the risk management system, and ERM began growing in importance because of this increased attention to risk management in the context of corporate governance (Altuntas, Berry-Stölzle, & Hoyt, 2011).

As ERM gained more momentum in trade press and industry and with regulators and rating agencies, the interest spread to the research field. Empirical studies on determinants of enterprise risk management implementation began being published around the early 2000s, with a majority of the studies being published in the last ten years.

However, ERM is not a straight-forward subject matter. Practically and empirically there has been no real consensus about what an ERM firm looks like. ERM frameworks provide a variety of conceptualizations of ERM and empirically there have been numerous ways of measuring and identifying ERM implementation. There has been a somewhat stagnant and inconsistent development of the theoretical foundations of ERM. All of this resulting in empirically inconsistent evidence on the determinants and value of ERM.

The purpose of this dissertation is to approach the inconsistencies and lack of consensus by answ**e**ring three questions about the implementation of enterprise risk management:

- What does ERM implementation look like?
- Why do firms implement enterprise risk management?
- What effect does enterprise risk management implementation have on the firm?

The following sections of this chapter provide a brief summary of the enterprise risk management field of study, from ERM's definition, operationalization of ERM in empirical work, theoretical foundations of ERM, to many of the empirical studies on ERM. In Section 1.5., after a brief

introduction to the methodology, the survey which is used in order to approach two of the main questions from this dissertation is described and some descriptive statistics of the responses are provided. The chapter concludes with a summary of the articles which make up the dissertation.

1.2 Defining Enterprise Risk Management

The most commonly cited definition of enterprise risk management comes from the Committee of Sponsoring Organizations (COSO) (2004) ERM Integrated Framework which says that ERM is:

> *A process, affected by any entity's board of directors, management, and other personnel, applied in a strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives (pg. 2).*

This definition reflects some of the fundamental concepts of ERM: it is ongoing, affected by people at all levels, related to the strategy of the organization, includes taking a portfolio view of risk, is designed to identify potential threats, and provides assurance to management and the board (COSO, 2004). COSO (2004) states that their definition of ERM is purposefully broad so that the framework can be applied across organizations, industries, and sectors.

This is one of many working definitions of enterprise risk management. However, there exists some consensus regarding what ERM is: firm's take a portfolio view of risk instead of managing in silos, they take into account strategic and more qualitative risks, and the focus is not solely on the downside of risk but also opportunity (Bromiley, McShane, Nair, & Rustambekov, 2014). For Culp (2001) there are similarly three distinguishing characteristics of ERM: the consolidation of exposure types, the view of risk through a common lens, and the consolidation of the risk management process organizationally across internal systems, processes, and people. Essentially, it comes down to integration; there are three dimensions to integration: integration of the risks themselves, integration of risk

management with the strategy of the firm, and integration of the risk management system organizationally.

Sometimes the best way to create a definition for something is to look at what it is not first. These three dimensions of integration can also be seen in three of the ten common misconceptions about ERM outlined in Fraser and Simkins (2007): risk management is *not* an end unto itself, independent of business objectives, risk management *cannot* be decentralized and done piecemeal, and one skill set is *not* enough. In order to remedy these mistakes, a firm must integrate risk management with strategy, integrate risks across the firm, and integrate people.

The concept of integration is rather ambiguous. Integration of risks essentially means that the firm should consider events from all areas of the firm and not in isolation. There should be consolidation between financial and business risks (Culp, 2001). Perhaps this involves calculating or considering correlations or portfolio effects of combined risks. This is also related to strategic integration which refers to the importance of evaluating risks and opportunities that will have a direct impact on the objectives of the firm. As a concrete example of implementing integration in terms of risk and strategy, imagine a portfolio view on risk. One might map the expected frequencies of occurrence of a number of different firm events from all areas of the firm (for example, insufficient funds available to business units, suppliers failing to deliver on commitments, or impacts of patent infringement or R&D leaks) and their impact on operating earnings (COSO, 2004). This is a way for the company to assess risks from across the whole firm. This also is an example of how risk management should be integrated with the strategy of the firm. The impact on operating earnings is a way to make sure the risk analysis is tied to the objectives of the firm.

In order to accomplish the integration of strategy and risk management and the integration of firm-wide risks, the organization of the risk management system is essential. Holistically integrating the risk management organization means including individuals from all levels of the firm and across the firm. For example, centralization of the risk management system ensures that one type of risk does not get excessive attention and resources at the expense of less well understood risks (Fraser & Simkins, 2007). This integration is reinforced by an organizational structure, the distribution of authority and responsibility, and the establishment of processes and procedures - essentially, governance of the risk management system. Risk governance (risk management-related corporate governance mechanisms), like the chief

risk officer position, is a structural tool used to support the process of integrating risks into a single message to senior executives (Aebi, Sabato, & Schmid, 2011).

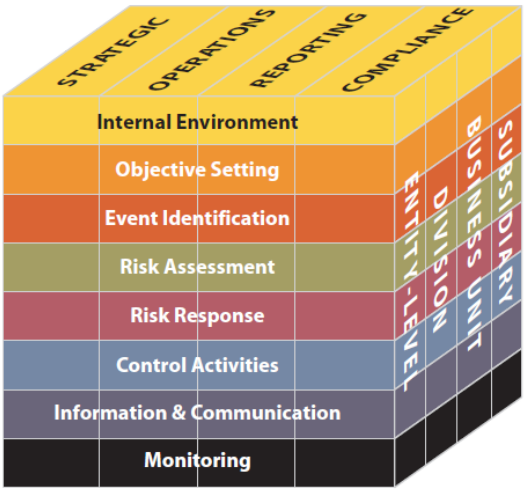
Essentially, enterprise risk management is the management of integrated risks in a strategy setting supported by risk governance. ERM is really synonymous with integration, but what does ERM's integration look like in firms?

1.2.1 What Enterprise Risk Management Looks Like

There are a substantial number of frameworks intended to guide in the implementation of ERM: The Committee of Sponsoring Organizations of the Treadway Commission (COSO) ERM – Integrated Framework, Joint Australia/New Zealand 4360-2004 Standards, ISO 31000-2009, the Turnbull Guidance, the Casualty Actuarial Society Framework, the International Association of Insurance Supervisors Framework, and Basel II. All of which have their own working definitions of ERM and steps for how ERM should be implemented.

COSO (2004) depicts the relationship between their eight ERM components, the objectives of the firm, and the entity units in their three-dimensional cube found below in Figure 1. The four objectives are: strategic, operations, reporting, and compliance.

Figure 1. COSO (2004) Enterprise Risk Management Cube



The concept behind the COSO ERM framework is to provide a model for firms to assess their risk-related activities at all levels and how they impact one another. Some examples of the more tangible aspects of these components are: a risk management philosophy and risk appetite (internal environment), objectives and inventory of opportunities (objective setting), inventory of risks (event identification), assessment of inherent and residual risks (risk assessment), risk responses and a risk portfolio perspective (risk response), outputs, indicators and reports (control activities), and monitoring (Moeller, 2007).

The Casualty Actuarial Society (CAS) (2003) conceptualizes ERM instead on two dimensions: one dimension spanning the types of risk included (hazard, financial, operational and strategic) and the other dimension the various risk management process steps. Where the risk management process steps are: establish context, identify risks, analyze/quantify risks, integrate risks, assess/prioritize risks, treat/exploit risks, and monitor and review.

There are probably an endless number of ways to practically conceptualize ERM. Each framework is trying to be better, more useful, and easier to apply than the next.

However, these conceptualizations are fairly broad and open. It is hard to get a sense for what an ERM firm looks like. In fact, implementation may look different for different firms. As COSO (2004) says, their eight components will not function identically in every firm; for example, implementation in small firms may be less formal and less structured. This breadth makes empirically operationalizing ERM a challenge. However, looking at the empirical operationalization does shed some light on what ERM looks like or at least its distinguishing characteristics.

Empirically Operationalizing Enterprise Risk Management

Many studies use the hiring of a chief risk officer (CRO) as a proxy for ERM implementation (Beasley, Pagach, & Warr, 2008; Liebenberg & Hoyt, 2003; Pagach & Warr, 2011). Part of integrating organizationally is achieved by hiring a CRO; Culp (2001) suggests that every firm should designate a chief risk officer. This will help to eliminate any ambiguity about the risk management process and the person held responsible. The CRO should have three characteristics: well informed about the risk tolerances and risk management objectives, adequate understanding of the nature of the risk exposures facing the firm, and independence from the areas of the firm that are vested with risk taking responsibility. This independence also means that

the CRO should not be reporting to the CFO but instead report directly to the chief executive or the board of directors (Culp, 2001). However, ERM does not necessary prescribe the implementation of a CRO; some companies assign the role to another senior officer like the chief audit executive and others find the importance and breadth of scope requires a separate function (COSO, 2004).

Early announcements of positions of chief risk officer (CRO) focused on the positions role to identify, assess, report and support the management of risks and recognize and evaluate total corporate risk, but the perceived responsibility of the CRO changed in post-Enron corporate America into a role intended to put the accountability of risk management in place (Liebenberg & Hoyt, 2003).

Aebi et al. (2011) hand-collect variables from publically available information and take a more comprehensive look at the CRO function and other dimensions of banks' risk governance, like: CRO in the executive board, risk committee, number of meetings of the risk committee, number of directors in the risk committee, percent of independent directors in the risk committee, CRO reports to board, and CRO reports to CEO. Aebi et al. (2011) however do not explicitly say they are proxying enterprise risk management but instead focus on risk governance's effect on bank performance.

Many empirical studies rely on public searches similar to the studies mentioned above. Hoyt and Liebenberg (2011) and Eckles, Hoyt, and Miller (2014) search financial reports, newswires, and other media for search strings of the following ERM related terms: "enterprise risk management," "chief risk officer," "risk committee," "strategic risk management," "consolidated risk management," "holistic risk management," and "integrated risk management." Desender (2011) evaluates all publicly available information for information about 70 detailed dimensions of ERM. Gordon, Loeb, and Tseng (2009) develop an ERM index based on COSO's four objectives: strategy, operations, reporting, and compliance. Their index measures the achievement of all four objectives in one metric. Strategy achievement is for example measured by how the firm's sales deviate from industry sales, and operations achievement is measured by sales over total assets and sales over number of employees.

Two studies, McShane, Nair, and Rustambekov (2011) and Baxter, Bedard, Hoitash, and Yezegel (2013), use the Standard and Poor's ERM quality

rating. S&P analysts evaluate companies' ERM programs and place them into four categories: weak, adequate, strong, or excellent (Baxter et al., 2013). Similarly, Farrell and Gallagher (2014) use the Risk and Insurance Management Society (RIMS) Risk Maturity Model survey (RMM) which produces a 1–5 maturity scale assessment for each of the seven ERM attributes (ERM based approach, ERM process management, risk appetite management, root cause discipline, uncovering and identifying risks, performance management, and business resilience and sustainability) as well as a final ERM maturity score.

Another method of operationalizing ERM involves surveying firms about their ERM implementation. Altuntas et al. (2011) surveyed all German property-liability insurers on a comprehensive set of dimensions of ERM, specific ERM activities, and when ERM activities were initiated. They ask, for example, about risk identification methods, quantitative versus qualitative evaluation of risks, risk management tools, responsibility for risk management implementation, and the risk management culture. Beasley, Clune, and Hermanson (2005a and 2005b) surveyed IIA's Global Audit Information Network (GAIN), primarily chief audit executives, to obtain data related to ERM deployments and other organizational characteristics. Their analysis in the 2005a study focuses on the question regarding the firm's stage of ERM implementation from a five - complete ERM in place - to a one – no plans exist to implement ERM. Gates, Nicolas, and Walker's (2012) survey questions measured the following components of ERM: objective setting, risk identification, risk reaction, oversight, information and communication, internal environment, management, and performance. Arena, Arnaboldi, and Azzone (2011), Colquitt, Hoyt, and Lee (1999), and Kleffner at al. (2003) also survey firms about their enterprise risk management implementation.

Overall, there have been many different ways to operationalize ERM. From public information searches, the chief risk officer (CRO) and risk committee stand out as key characteristics of ERM implementation. More detailed operationalization of ERM varies in terms of the dimensions considered to be part of ERM. Surveys tend to take into account more of the complexities of ERM, but survey responses for the scale of ERM implementation are easiest to include in empirical analyses. Survey responses on more complex aspects are generally examined with more basic descriptive statistics.

1.3 Theoretical Foundation for Enterprise Risk Management

Given that ERM's place in academics is fairly recent, with the majority of studies being published in the last decade, the theoretical foundations have yet to be fully established. There is no rigorous discussion of the theories underlying enterprise risk management. The theories referenced most often in the ERM literature are presented briefly below.

Theory related to traditional capital market imperfection motives for traditional risk management is the most commonly referred to in enterprise risk management literature (Altuntas et al., 2011; Liebenberg & Hoyt, 2003; Pagach & Warr, 2011; Eckles et al., 2014; Bromiley et al., 2014; McShane et al., 2011; Beasley et al., 2008; Hoyt & Liebenberg, 2011; Gates et al., 2012). Liebenberg and Hoyt (2003) refer to theories that motivate traditional risk management activities such as hedging and corporate insurance demand because at the time documented evidence regarding various aspects of ERM was limited to the trade press and industry surveys and there was a lack of academic literature regarding the determinants of ERM. However, Pagach and Warr (2011) refer to the same theories in their study published eight years later.

Related to this, Beasley et al. (2008) and Baxter et al. (2013) refer to Stulz's (1996) argument that any potential value-creating role for risk management is in the reduction or elimination of "costly lower-tail outcomes."

The theoretical ability of a firm to better allocate resources proposed by Meulborek (2002) is referred to by Liebenberg and Hoyt (2003) and Hoyt and Liebenberg (2011):

> *Firms that engage in ERM should be able to better understand the aggregate risk inherent in different business activities. This should provide them with a more objective basis for resource allocation, thus improving capital efficiency and return on equity (pg. 797).*

Often links are made between ERM and theories of corporate governance (Baxter et al., 2013; Altuntas et al., 2011; Desender, 2011; Beasley et al., 2005a; Aebi et al., 2011), management control (Baxter et al., 2013; Altuntas

et al., 2011; Gates et al., 2012), the auditing function (Beasley et al., 2005a), management studies (Bromiley et al., 2014), and agency theory (Desender, 2011; Beasley et al., 2008).

Eckles et al. (2014), Beasley et al., (2008), Farrell and Gallagher, (2014), and McShane et al. (2011) apply modern portfolio theory to ERM. McShane et al. (2011) argue that ERM can increase firm value because the risk of an aggregate portfolio should be less than the sum of the individual risks if the risks are not 100% correlated, especially if natural hedges exist.

Strategy and strategic management are loosely referred to in a mixed practical and theoretical way by Gates et al. (2012), Bromiley et al. (2014), Gordon et al. (2009), and McShane et al. (2011). Similarly there is a mix between practical and theoretical argumentation about ERM's link to disclosure and information (Liebenberg & Hoyt, 2003; Bromiley et al., 2014).

More practical argumentation is common, referring to practical aspects like regulation (Baxter et al., 2013; Beasley et al., 2005a; Beasley et al., 2008; Gates et al., 2012; Liebenberg & Hoyt, 2003) and the Sarbanes-Oxley Act of 2002 in particular (Aebi et al., 2011; Beasley et al., 2005a; Desender, 2011; Eckles et al., 2014; Fraser & Simkins, 2010; Beasley et al., 2008).

Two papers in particular have attempted to build a theoretical foundation for ERM. Nocco and Stulz (2006) discuss the value creation of ERM in terms of "macro" and "micro" benefits. They argue that ERM can create long-run competitive advantages for a firm by helping the firm maintain access to the capital markets and other resources (macro) and by creating a "way of life" for managers and employees at all levels of the company which relates to the risk management ideals of the firm (micro). ERM should also reduce the probability of financial distress as managing risk should be less costly than holding more equity.

Ai, Brockett, Cooper, and Golden (2011) take a mathematical approach to ERM operationalization. They employ a risk-constrained optimization approach to study capital allocation decisions when ERM is implemented.

> *Given the decision maker's risk appetite, the problem of holistically managing enterprise-wide hazard, financial, operational, and real project risks is treated by maximizing the expected total return on capital, while*

trading off risks simultaneously in Value-at-Risk type of constraints (p 29).

Their approach explicitly quantifies the concepts of risk appetite and risk prioritization while taking into consideration the firm's default and financial distress avoidance indicated by the target credit rating.

1.4 Previous Enterprise Risk Management Literature

The theories presented above are the foundation for empirical testing and investigation of ERM. There are three essential streams of ERM literature: case studies on ERM, ERM characteristics/determinants, and firm effects/value of ERM. Given perhaps the relatively early stages of the topic in academia and the many ways there are to measure or identify ERM firms, the results are rather inconclusive. The following sections present results from previous studies of ERM.

1.4.1 Case Studies

Fraser, Shoening-Thiessen, and Simkins (2008) find that more work needs to be done in the areas of research of ERM and specifically case studies. They highlight the importance of developing case studies with practitioners and the importance of knowledge in both theory and practice. For a review of case studies Harrington, Niehaus, and Risko (2002), Stroh (2005), and Acharyya and Johnson (2006) see Iyer, Rogers, Simkins, and Fraser (2010).

The most cited case study on ERM is Aabo et al.'s (2005) study of Hydro One, which describes the process of the successful implementation of ERM at Hydro One Inc., a Canadian electric utility company. They began implementation with the hiring of a CRO, and through implementation they achieved a lower cost of debt, improved corporate governance, and gained a competitive advantage over peers regarding the identification of risk, to name a few benefits.

1.4.2 Firm Characteristics/Determinants

Among the first to investigate the characteristics and extent of integrated risk management were Colquitt, Hoyt, and Lee (1999). They find through their survey data that the role of the risk manager was in evolution; risk managers were beginning to deal with a broad spectrum of risks. This broad view of

risk affected the structure of risk management within organizations and the risk management tools used.

In order to investigate how widely practiced ERM actually was in Canadian firms, Kleffner, Lee, and McGannon (2003) surveyed members of the Canadian Risk and Insurance Management Society and found that 31% had adopted ERM, and they did so because of the influence of the risk manager, encouragement from the board of directors, and compliance with the Toronto Stock exchange guidelines. Deterrents to ERM implementation were found to be the organizational structure and resistance to change.

While the previous studies approached the investigation of ERM on a survey/descriptive level, one of the first empirical studies addressing the subject of ERM is Liebenberg and Hoyt (2003). This is also one of the most cited ERM studies. They use the hire of a chief risk officer (CRO) in order to identify ERM implementers; this indicator has continued to be a popular way to identify ERM firms. They find that there is an absence of systematic difference between firms that signal their use of ERM and other firms of a similar size and industry. They do find evidence that firms with higher leverage are more inclined to appoint CROs.

Beasley et al. (2005a) survey firms regarding their level of ERM implementation and find that the level is positively related to the presence of a CRO, the CRO's apparent support for ERM, board independence, presence of a Big Four auditor, entity size, and industry (banking, education, and insurance).

Another measure of ERM was developed by Gordon et al. (2009); their ERM index is based on how well firms manage their strategy, operations, reporting, and compliance objectives. For example, they measure strategy as the firm's sales and beta relative the industry. They find that the relationship between ERM and firm performance is contingent on the match between ERM and five firm-specific factors: environmental uncertainty, industry competition, firm size, firm complexity, and board of directors' monitoring.

Altuntas et al. (2011) survey German property-liability insurers regarding the implementation of specific components of ERM. They find, for example, that firms that indicated they employ an ERM framework generally have better corporate governance and have an organizational structure for risk management in place. ERM firms also tend to have a risk management department which has the right to inspect other departments, higher levels of

influence of the risk management department on the firm, and an IT system in place for risk management.

In order to empirically take into account the complexity of ERM, Desender (2011) measures ERM based on the public information available on 70 dimensions of ERM. He then empirically investigates the relationship between board composition and the degree of enterprise risk management. He finds that board independence by itself is not sufficient to induce higher levels of ERM. Board independence is only significantly related to ERM when the position of CEO and chairman are held by two different individuals. He argues that this relationship may exist because CEOs do not favor ERM implementation and can better withstand pressure from the board to implement when they are occupying the seat of chairman.

Using the more simplistic identifier of a CRO hire, Pagach and Warr (2011) find that firms with CROs are larger, more volatile, and have greater institutional ownership. In addition, the firm is more likely to hire a CRO when the CEO has incentives to take risk. Banks with lower levels of Tier 1 capital are also more likely to hire a CRO.

Baxter et al. (2013) investigate company characteristics associated with variation in ERM quality, as measured by Standard & Poor's ERM ratings for financial service companies during 2006-2008. They find that larger and more diversified companies have higher quality programs which they attribute to the focus of ERM on integration of unrelated parts of the firm. They also find that higher quality ERM is associated with better corporate governance, less audit-related risk, presence of risk officers/committees, and boards with longer tenure.

Methods of measurement and identification switch back and forth between using public data and surveying firms, and there is no consistent approach or results regarding the firm characteristics related to ERM implementation. The size of the firm does play a clear role and the management and ownership, industry, and structure and governance in varying forms also seem to effect a firm's decision to implement ERM. However, no clear story about the implementation of ERM emerges.

1.4.3 Firm Effects/Value

The firm characteristics/determinants studies show some evidence of the underlying motivations for ERM, but one of the most prominent questions regarding motives is of course if the process of implementing ERM is in the

end value creating. A review article by Kraus and Lehner (2012) investigate the nexus between ERM and value creation. They identify 25 studies (including conference submissions, electronic articles, and reports), of which 13 are published journal articles, which investigate the relationship between ERM and value creation. In 78% of the investigations, a positive impact between ERM and value could be detected; 17% find nothing and 5% even find evidence of a negative impact. While it seems most evidence is in favor of the argument that ERM is value creating, the opposing evidence must be kept into consideration.

Beasley et al. (2008) test firm characteristics associated with abnormal returns when firms announce the appointment of a CRO. Univariate abnormal returns for the announcement are found to be insignificant. However, they identify that for nonfinancial firms announcement returns are positively associated with firm size and the volatility of prior period earnings and negatively associated with cash on hand relative to liabilities and leverage. For financial firms, fewer associations are found; perhaps because they have implemented ERM prior to the hire of a CRO or because of the regulatory or agency pressure to implement ERM.

Risk governance, like the presence of a chief risk officer (CRO) in the executive board or the line of reporting of the CRO, is a key characteristic of ERM implementation. Though not commonly studied distinctly from ERM, Aebi et al. (2011) investigate whether risk governance is related to banks' stock returns and return on equity (ROE) during the crisis period. They find robust evidence that banks where the CRO reports directly to the board of directors perform significantly better than banks where the CRO reports to the CEO providing evidence of the importance of risk governance to bank performance. They do not make the explicit connection between risk governance and enterprise risk management and instead focus only on risk governance as a distinct concept.

One of the studies with the strongest level of support for the value creation argument is Hoyt and Liebenberg (2011). They find that insurers engaged in ERM are valued roughly 20 percent higher than other insurers. They identify ERM implementers by doing a word search for key ERM terms (for example, enterprise risk management, chief risk officer, risk committee, strategic risk management, consolidated risk management, holistic risk management, and integrated risk management) in publically available information.

McShane et al. (2011) find that insurance firms show a positive relationship between Standard &Poor's ERM ratings and firm value but only as the rating increases over the first three levels of traditional risk management. They find that there is no additional value from ERM levels.

On the contrary, Gates et al. (2012) survey firms regarding their stage of ERM implementation as well as regarding their implementation of components of the COSO ERM framework. They then use a structural model to find that ERM components can lead to an increase in perceived performance, measured by survey.

Baxter et al. (2013) also use S&P ERM ratings and investigate the association of ERM quality with performance and market response. They find that ERM is positively associated with operating performance and earnings response coefficients. They attribute this finding to increased investor perception of credibility and persistence of earnings as a result of governance factors.

Using the same method of ERM identification as Hoyt and Liebenberg (2001), Eckles et al. (2014) find that firms adopting ERM experience a reduction in stock return volatility. They also find that the reduction in return volatility for ERM implementing firms becomes stronger over time and that operating profits per unit of risk (ROA/return volatility) increase after ERM adoption.

Most recently, Farrell and Gallagher (2014) use the RIMS RMM ERM maturity scale and investigate the effect of ERM maturity on Tobin's Q. They find a significant and positive impact of ERM on value with a magnitude of 25%, similar to Hoyt and Liebenberg (2011). They also find that the most important aspects of ERM from a value perspective are the level of top-down engagement and the ERM culture throughout the firm.

While the majority of evidence suggests ERM is value creating, the variety of measurements and identification methods used and the opposing results are concerning. It is unclear which measures best capture ERM implementation and provide the most reliable results in terms of if ERM can create value in a firm.

1.5 Methodology

As mentioned previously, the purpose of this dissertation is to explore what an ERM firm looks like, identify motives for ERM implementation, and determine if ERM has an effect on the firm.

The definition proposed in Section 1.2 is that enterprise risk management is the management of integrated risks in a strategy setting supported by risk governance. How that integration looks in a firm is not so straight forward.

From the discussion on what ERM looks like, one can conclude that empirically and practically ERM is difficult to identify and measure. Practical frameworks are numerous and broad in order to be able to accommodate a wide variety of firms. Operationalizing ERM is a challenge, and measures and identification of ERM are either simplified to a few characteristics, like the hiring of a CRO, or are based on lists of detailed dimensions which are inconsistent across studies. One way to approach this question in a new way is by exploring what the integral parts of ERM are based on how firms actually implement dimensions of ERM.

The theoretical foundation of ERM is ad hoc, stagnant, and inconsistent. Because of this and the variety of ERM measures, there is empirically inconsistent evidence on the determinants of ERM. Approaching the conceptualization of ERM in a new way and "sorting" the theories accordingly can give new insight as to why firms implement ERM. Similarly, empirically there is inconsistent evidence on the value of ERM. Investigating ERM's effect on a specific channel of value creation is a new approach to the question of ERM's value for a firm.

The dissertation applies new methodologies, a new conceptualization of ERM, and a new way to measure the success of ERM in order to approach the three questions in a new way. The first two articles use a survey on firms' implementation of detailed dimensions of ERM in an attempt to get as close to as many firms as possible. The survey is presented in the next section.

1.5.1 The Survey

Given the complexity of ERM, the closer the measure is to the firm, the more likely that the measurement is accurate and truly reflects the implementation of ERM. In order to get as close to the firm as possible, two of the articles use a detailed questionnaire to survey firms regarding their ERM implementation.

About the Survey

The questionnaire used in the survey focused on identifying a firm's level of implementation of a number of dimensions of risk management. The questionnaire was based on a set of dimensions found in Desender (2011); additional input regarding necessary dimensions of proper ERM implementation was received from two members of the COSO board and from a thorough review of ERM frameworks and literature. The dimensions were then transformed into questionnaire questions designed to assess the degree of implementation of each dimension in the firm from zero to three, zero being that the dimension is non-existent in the firm and three being that the dimension is robustly implemented in the firm.

The questionnaire was sent to the Chairman of COSO, a consultant of ERM implementation, and a researcher with experience in questionnaire use for comments. The questionnaire was also pre-tested on two practitioners. The final version of the questionnaire included changes based on the comments from the aforementioned individuals. Minor changes were also made based on the recommendations of Sinitor[1], specialists in data collection, who helped distribute the questionnaire. A copy of the questionnaire can be found in Appendix 1.1.

The questionnaire did not draw attention to its focus on ERM in order to ensure that respondents were not influenced by the mention of ERM but instead answered with a more general consideration to their risk management practices. Respondents were instructed to answer the questionnaire in relation to the firm's 2010 risk management practices.

The questionnaire was presented to all (676) firms listed at the start of 2011 on two major Nordic stock exchanges, either NASDAQ OMX or Oslo Börsen, with headquarters in a Nordic country (Sweden, Norway, Finland or Denmark). Iceland and associated territories are excluded do to their small number of companies. Sinitor attempted to contact the firms in the population directly by telephone and gave a brief introduction to the survey; the CEO, CFO, or an individual knowledgeable about risk management was targeted because of the important role they play in implementing enterprise risk

[1] Formally Anthill Stockholm.

management. Willing respondents were offered the questionnaire in Swedish, Norwegian, Danish, Finish, and English; they then received an e-mail with a link and filled out the questionnaire online. The final response rate for the survey was 22.6% with 153 responses.

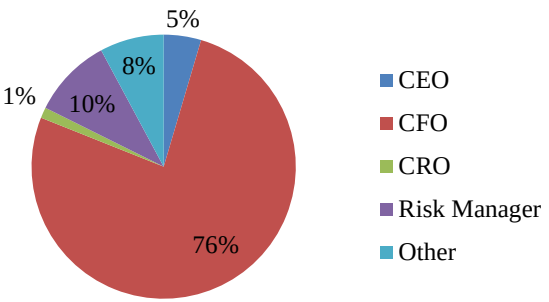
Because the survey was administered via the web, respondents could start and stop the survey as they pleased. It is therefore difficult to say how long respondents actually took. For those that took less than a day to submit responses after initiating the survey (60 out of 153), the average response time was an hour and 46 minutes.

Descriptive Statistics from the Survey

Given the importance that the survey reached individuals knowledgeable about risk management, the respondent's position at the firm is of utmost importance. The target group of CEO and CFO are often difficult individuals to reach. As can be seen in Figure 2, approximately 92% of respondents held the position of CFO, CEO, CRO, or risk manager at the firm; the remaining respondents were for example part of the accounting function, treasury or audit. Of the 153 respondents, 115 (75%) stated that they were "very familiar" (highest level of familiarity given) with the organization of risk management at the firm. 32 (21%) said they had "working knowledge", only 6 (4%) said they had "some familiarity" and none said they had no familiarity at all.

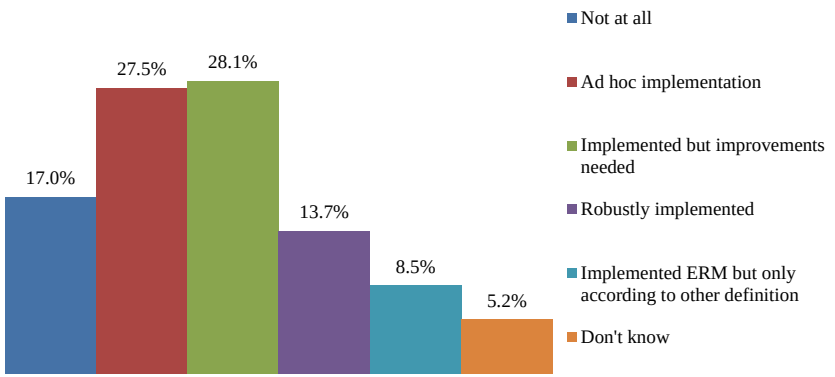
A path analysis of respondent type to question response reveals that in most cases question responses are not affected by respondent. The occurrence of significant effects is so few that it is deemed as not of concern.

Figure 2. Survey Respondent Positions



As far as ERM implementation goes, only 17.0% stated that they had no implementation of ERM what so ever (5.2% didn't know) (See Figure 3). Of those 26 firms with no implementation, 20 had no plans to implement, 1 had plans to implement, and 5 did not know if there were plans to implement. The remaining 77.8% had ERM implemented to some degree. 8.5% had ERM implemented but not according to the COSO definition given in the survey. Of those that identified with the COSO definition of ERM, "implemented but improvements needed" was the degree of implementation stated most often. While it is clear that firms identify as ERM implementers and ERM is widely implemented, only 13.7% identified the firm as having "robustly implemented" ERM.

Figure 3. Respondent Firms' Degree of ERM Implementation Given the COSO Definition



Of the 119 firms that had ERM implemented to some degree, The COSO ERM framework was the most followed established framework with 33 (27.7%) firms stating they followed COSO (See Table 1). However, almost half of the firms were implementing ERM based on an internally created framework. Of the firms that had ERM implemented to some degree, 25 (21.0%) stated that they used more than one framework in order to guide their ERM implementation.

Table 1. ERM Frameworks Followed by Respondent Firms

ERM Framework	# of firms	%
Internally created framework	56	47.1
COSO's ERM Integrated Framework	33	27.7
Basel II	12	10.1
ISO 31000-2009	12	10.1
International Association of Insurance Supervisors Framework	3	2.5
the Turnbull Guidance	1	0.8
Casualty Actuarial Society Framework	1	0.8
Joint Australia/New Zealand 4360-2004 Standards	1	0.8
Other	19	16.0

The hiring of a chief risk officer (CRO) tends to be a common identifier for ERM implementation. However, of the 153 respondent firms, only 18 firms had a CRO (See Figure 4). Table 2 divides the firms based on their response to level of ERM implementation and shows the respective numbers of CROs for each group. Of the 21 firms with "robustly implemented" ERM, 5 (23.8%) had a CRO; 2 (4.8%) of the 42 firms with "ad hoc implementation" had CROs. None of the firms with no degree of ERM implementation reported having a CRO.

Figure 4. Respondent Firms with Chief Risk Officers

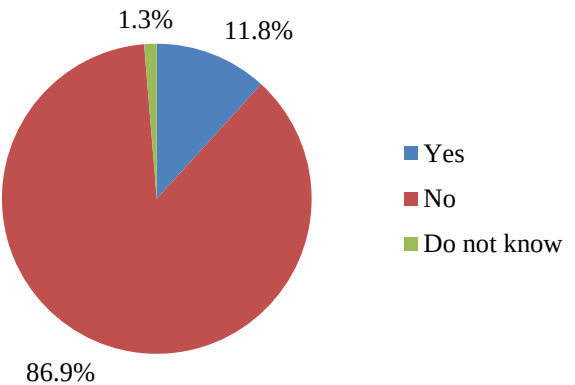


Table 2. Number of Chief Risk Officers in Respondent Firms Grouped by Degree of ERM Implementation

Degree of ERM Implementation	# with CROs
Not at all	0
Ad hoc implementation	2
Implemented but improvements needed	8
Robustly implemented	5
Implement ERM but only according to other definition	2
Don't know	1
Total	18

Respondents were asked to what degree the firm took into consideration a number of different risks and/or opportunities: financial, strategic, compliance, technology, economic, and reputation. Firms on average took the most consideration of financial and economic risks and opportunities with an average level of 2.8 (from 0 to 3) (See Table 3). Firms with "robustly implemented" ERM on average took more consideration of all risks besides financial risks; the degree of financial risk consideration was relatively stable across different levels of ERM implementation.

Table 3. Average Degree of Consideration for Different Risks and/or Opportunities by Respondent Firms Grouped by Degree of ERM Implementation

Degree of ERM Implementation	Average Degree of Consideration of Risks and/or Opportunities					
	Fin.	Strat.	Comp.	Tech.	Econ.	Rep.
Not at all	2.8	2.3	2.3	2.2	2.5	2.2
Ad hoc implementation	2.9	2.5	2.3	2.3	2.8	2.3
Implemented but improvements needed	2.9	2.6	2.5	2.3	2.7	2.4
Robustly implemented	2.8	2.7	2.6	2.4	2.9	2.8
Implement ERM but only according to other definition	2.9	3.0	2.8	2.9	2.9	2.8
Don't know	3.0	2.6	2.4	2.7	3.0	2.6
All	2.8	2.6	2.4	2.4	2.8	2.4

The majority of the survey was dedicated at establishing the degree of implementation of a number of different risk management dimensions throughout the firm.

Table 4 shows the average level of implementation (from 0 to 3) of non-risk related dimensions for firms with ERM "not at all" implemented, ERM "robustly implemented", and all the firms from the sample. In all but one case (channels of communication…), the "robustly implemented" ERM firms have on average higher levels of implementation than the average levels for non-ERM firms and for all respondent firms.

Table 5 shows the average levels of implementation for risk management specific dimensions. "Robustly implemented" ERM firms have on average higher levels of implementation for each dimension compared to non-ERM firms and the average for all respondent firms. The differences in average implementations for non-ERM and ERM firms are much greater for the risk management related dimension than the non-risk management related dimensions. The largest difference in implementation level is for the board level committee with responsibility for risk management oversight. A board committee in charge of risk management is one of the key dimensions for ERM firms. Internal risk assessment of the firm's risk management and a formal written risk management philosophy show the second largest discrepancies in average level of implementation. Centralization of the risk management function shows a surprisingly low level of implementation despite its argued importance for integration of risk management.

Table 4. Average Level of Implementation of Non-Risk Related Enterprise Risk Management Dimensions for Non-ERM, ERM, and All Respondent Firms

Non-Risk Management Related ERM Dimensions	ERM Not at all Implemented	ERM Robustly Implemented	All Firms	
Code of conduct/ethics	2.1	2.6	2.2	*
Training in ethical values for employees of all levels	1.4	2.0	1.7	*
Monitoring of the firm's internal environment, processes, and control activities	1.7	2.5	2.1	*
Documentation and record to verify the use of policies and procedures	1.7	2.2	1.9	*
Channels of communication with customers, vendors, and other external parties	2.0	2.0	2.1	
System to ensure that policies and procedures that are in place to manage the achievement of the firm's objectives/plan are functioning and effective	1.8	2.4	2.0	*
Channels of communication to report suspected breaches of laws, regulations, and other improprieties	1.6	2.1	1.8	
Independent verification procedures to ensure the use of policies and procedures	1.5	1.9	1.7	
Authorization procedures in place to ensure appropriate individuals review the use of policies and procedures	2.0	2.4	2.1	
Performance goals set to assess whether the firm is achieving its objectives	2.1	2.9	2.4	*
Written document describing the role, structure, and responsibilities of the board	2.7	3.0	2.8	*
Formal business objectives/plan in place to execute the strategy to pursue the mission	2.2	2.8	2.4	*
Formal strategy to pursue the mission	2.3	2.8	2.4	*
Formal mission (vision/purpose) statement	2.6	2.9	2.6	*

Table 4. cont.

Non-Risk Management Related ERM Dimensions	ERM Not at all Implemented	ERM Robustly Implemented	All Firms	
Compensation policies intended to align the interests of managers and shareholders	2.4	2.6	2.2	
Formally defined audit committee responsibilities	2.3	3.0	2.4	*
Formally defined responsibilities for executive management (authority and accountability)	2.4	2.9	2.6	*
Performance targets for employees of all levels	1.2	2.1	1.8	*
Formally defined remuneration policies of executive management	2.8	3.0	2.6	
Formally defined standards for hiring and firing of executive management	2.2	2.6	2.2	
Ongoing training, coaching, and educational programs available to employees on all levels	1.2	2.3	1.7	*

* Statistically significant difference in means between ERM Not at all Implemented and ERM Robustly Implemented.

Table 5. Average Level of Implementation of Risk-Related Enterprise Risk Management Dimensions for Non-ERM, ERM, and All Respondent Firms

Risk Management Related ERM Dimension	ERM Not at all Implemented	ERM Robustly Implemented	All Firms	
Determined correlations and portfolio effects of combined risks	0.5	1.6	1.2	*
Board level committee with responsibility for risk management oversight	0.4	2.2	1.4	*
Allocated risk owners who have primary responsibility and accountability for managing risk within their respective areas	0.5	1.9	1.6	*
Centralized department or staff function dedicated to risk management	0.5	1.6	1.1	*
Internal risk assessment group or internal audit function given the responsibility to evaluate the ongoing effectiveness of the firm's risk management	0.4	1.9	1.2	*
A senior manager designated with the responsibility to oversee risk and risk management	1.0	2.2	1.6	*
Determined quantitative impacts risks may have on key performance indicators	1.2	2.1	1.7	*
Risk tolerances (formal guidelines or measures used at appropriate levels to assess whether the firm will accept risk)	0.7	1.8	1.4	*
Formal written risk management philosophy (policy) (a set of shared beliefs and attitudes characterizing how the firm considers risk in everything it does and delineates the responsibility of management and the board)	1.0	2.5	1.8	*
Formal written statement of the firm's risk appetite (the amount of risk specified at the board level that the firm is willing to accept in pursuit of value)	0.8	1.8	1.4	*
Risk response plan for all of the significant events the firm has identified	1.0	2.4	1.7	*

Table 5. cont.

Risk Management Related ERM Dimension	ERM Not at all Implemented	ERM Robustly Implemented	All Firms	
Communication to all stakeholders, internal and external, of the importance of risk management	1.1	2.2	1.8	*
Frequent and structured updates of risk-related information	1.3	2.4	1.7	*
Assessment of the firm's risk management function done by an independent/external party	0.8	1.4	1.2	*
Alternative risk responses for each significant event	1.1	2.0	1.5	*
Formal policies about how risk should be managed	1.6	2.7	2.1	*
Formal report submitted to board level at least annually on the current state of risk and effectiveness of risk management	2.0	2.9	2.3	*
Key risk indicators or indicators aimed at emerging risks (not historical performance)	1.5	2.2	1.8	*
Verification of the completeness, accuracy, and validity of risk-related information	1.2	2.3	1.7	*
Centralized technology-enabled process to obtain risk-related information	0.7	1.5	1.1	*

* Statistically significant difference in means between ERM Not at all Implemented and ERM Robustly Implemented.

1.6 Summary of the Articles

1.6.1 Article 1: An Exploratory Study of Enterprise Risk Management: Pillars of ERM[2]

Multiple frameworks for implementation of ERM contribute to an overall uncertainty regarding the essential components of ERM. This uncertainty carries forward to empirical studies of ERM where results regarding value creation are inconclusive. There exists no real consensus about what the principal components of ERM are; this has led to identification and measurement methods that are inconsistent. By using inconsistent indicators and measures of ERM implementation, it is impossible to compare ‘‘apples to apples’’ and arrive at conclusive and convincing results regarding ERM’s ability to create value. This is an exploratory study of ERM aimed at determining the integral components of ERM based on how firms actually implement ERM dimensions. The result is the identification of four discrete components, or pillars, of ERM implementation; two prerequisite components related to the general internal environment and control activities of the firm, one component identifying risk management activities of the firm, and one component with the defining attributes of ERM implementation. All four components must be implemented to have well-implemented ERM, but only one separates ERM firms from non-ERM firms. The resulting four components challenge existing frameworks to adapt to better reflect how firms implement ERM and can have a valuable impact on identifying and measuring ERM, leading to more informative empirical studies on the value creating abilities of ERM.

[2] Adapted from: Lundqvist, S. A. (2014). An Exploratory Study of Enterprise Risk Management Pillars of ERM. *Journal of Accounting, Auditing & Finance*, 29(3), 393-429.

1.6.2 Article 2: Why Firms Implement Risk Governance – Stepping Beyond Traditional Risk Management to Enterprise Risk Management

Stakeholders of firms have pushed for enterprise risk management (ERM) as a response to flawed risk management and corporate governance systems (Kirkpatrick, 2009). Previous studies explaining why ERM is implemented have been informative but overly simplified. The basic argument presented in this study is that ERM should be seen as a composition of traditional risk management and risk governance, each with their respective determining factors. Implementation of risk governance is the active step beyond traditional risk management to ERM. This study addresses the complexity of ERM by dividing it into its traditional risk management and risk governance components and investigating the determinants of these components separately but simultaneously. Based on a survey of 145 firms, empirical evidence suggests that the level of risk governance in a firm is related to the size of the firm, leverage and dividend payments, and the chief executive officer's influence on the board; this may suggest that motives for corporate governance, like the need for governance, existing governance, and the control a chief executive office has over governance decisions, determine the decision to take the step towards implementing ERM. This study is a step toward clarifying the existing ad hoc theoretical foundations of ERM and implies that firms are implementing ERM in accordance with stakeholder desires for better governance of the risk management system.

1.6.3 Article 3: Risk Management Quality and Credit Risk

Determinants of credit risk are often limited to quantitative and retrospective aspects of the firm, ignoring important qualitative firm characteristics that better reflect future activities of the firm. One important factor that has been ignored is the importance of risk management quality to a firm's credit risk. Quality of risk management is defined as a well governed risk management system. Theoretically, quality of risk management reduces credit risk through the reduction of the probability of financial distress, agency risk, and information risk. We operationalize the concept of quality of the risk management system by employing an enterprise risk management (ERM) framework. ERM has arisen as a solution to past risk management flaws, is supported by credit rating agencies and regulators, and exemplifies quality by combining risk management with risk governance mechanisms. We construct a novel measure of risk management quality by searching annual reports for word combinations related to a number of ERM dimensions. In our sample of 78 of the world's largest banks, we find evidence that the quality of risk management significantly decreases the credit default spread of a firm, and that after controlling for corporate governance, risk management quality has no significant effect on firm credit ratings.

Appendix 1.1: The Survey[3]

Welcome to the survey! It takes around 15 minutes to answer.

Your computer's screen resolution, settings and browser can affect how the questions are shown. You may need to scroll to the right or downwards to be able to see the entire question or all responses.

Click on the arrow ('Next') down to the right to proceed in the survey.

Language

Please, choose the language of the survey.

- Svenska
- Norsk
- Dansk
- UK English
- Suomea

What is your title/position?

[3] Adapted from HTML version of the survey.

Please read each question carefully and choose from the answers provided or fill in the blanks for open-ended questions. Please answer based on the firm's activities in 2010.

To what degree are you familiar with the organization of risk management and risk management activities at the firm?

- ○ Not applicable/The firm does not have any risk management or risk management activities
- ○ Not at all
- ○ Some familiarity
- ○ Working knowledge
- ○ Very familiar
- ○ Don't know

To what degree are the following dimensions <u>implemented</u> (as applicable: carried out, understood, applied, enforced, embraced, and/or followed-through) throughout the firm?

	Does not exist/Not at all	Ad hoc implementation	Implemented but improvements needed	Robustly implemented	Don't know
Code of conduct/ethics	○	○	○	○	○
Training in ethical values for employees of all levels	○	○	○	○	○
Compensation policies intended to align the interests of managers and shareholders (i.e., balance short- and long-term)	○	○	○	○	○

	Does not exist/Not at all	Ad hoc implementation	Implemented but improvements needed	Robustly implemented	Don't know
Formally defined remuneration policies of executive management	○	○	○	○	○
Formally defined standards for hiring and firing of executive management	○	○	○	○	○
Ongoing training, coaching, and educational programs available to employees of all levels	●	○	○	○	○
Performance targets for employees of all levels	○	○	○	○	○
Formally defined responsibilities for executive management (authority and accountability)	○	○	○	○	○
Formally defined audit committee responsibilities	○	○	○	○	○
Written document describing the role, structure, and responsibilities of the board	○	○	○	○	○

	Does not exist/Not at all	Ad hoc implementation	Implemented but improvements needed	Robustly implemented	Don't know
Formal mission (vision/purpose) statement					
Formal strategy to pursue the mission					
Formal business objectives/plan in place to execute the strategy to pursue the mission					
Performance goals set to assess whether the firm is achieving its objectives/plan					
System to ensure that policies and procedures that are in place to manage the achievement of the firm's objectives/plan are functioning and effective.					

To what degree are the following activities implemented throughout the firm?

	Does not exist/Not at all	Ad hoc implementation	Implemented but improvements needed	Robustly implemented	Don't know
Authorization procedures in place to ensure appropriate individuals review the use of policies and procedures					
Independent verification procedures to ensure the use of policies and procedures					
Channels of communication to report suspected breaches of laws, regulations, and other improprieties					
Channels of communication with customers, vendors, and other external parties					
Documentation and record to verify the use of policies and procedures					
Monitoring of the firm's internal environment, processes, and control activities					

To what degree are the following events (risks or opportunities) considered when determining significant events affecting the firm's ability to achieve its objectives?

Please also answer the questions regarding further consideration of the events and mark the example events if the firm takes them into consideration to any degree.

To what degree does the firm consider financial risks and/or opportunities?

- ○ Not considered
- ○ Very little consideration
- ○ Moderate consideration
- ○ Significant consideration
- ○ Don't know

Which of the following risks and/or opportunities does the firm consider?

- ☐ The extent of liquidity
- ☐ Interest rate
- ☐ Foreign exchange rate
- ☐ The cost of capital
- ☐ Access to capital markets
- ☐ The use of long-term debt instruments
- ☐ Other:
- ☐ Don't know

The likelihood that financial risks and/or opportunities will affect the firm's ability to achieve its objectives

- Not considered
- Very little consideration
- Moderate consideration
- Significant consideration
- Don't know

The potential impact that financial risks and/or opportunities will have on the firm's ability to achieve its objectives.

- Not considered
- Very little consideration
- Moderate consideration
- Significant consideration
- Don't know

To what degree does the firm consider <u>strategic</u> risks and/or opportunities?

- Not considered
- Very little consideration
- Moderate consideration
- Significant consideration
- Don't know

Which of the following risks and/or opportunities does the firm consider?

- [ ] Customer concentration
- [ ] Product expansion
- [ ] Acquisition aggressiveness
- [ ] Manufacturing location concentration
- [ ] Other:
- [ ] Don't know

The likelihood that strategic risks and/or opportunities will affect the firm's ability to achieve its objectives.

- ○ Not considered
- ○ Very little consideration
- ○ Moderate consideration
- ○ Significant consideration
- ○ Don't know

The potential impact that strategic risks and/or opportunities will have on the firm's ability to achieve its objectives

- Not considered
- Very little consideration
- Moderate consideration
- Significant consideration
- Don't know

To what degree does the firm consider <u>compliance</u> risks and/or opportunities?

- Not considered
- Very little consideration
- Moderate consideration
- Significant consideration
- Don't know

Which of the following risks and/or opportunities does the firm consider?

- [ ] Compliance with regulation
- [ ] Compliance with industry codes
- [ ] Compliance with voluntary codes
- [ ] Compliance with recommendation of Corporate-Governance
- [ ] Other:
- [ ] Don't know

The likelihood that compliance risks and/or opportunities will affect the firm's ability to achieve its objectives

- ○ Not considered
- ○ Very little consideration
- ○ Moderate consideration
- ○ Significant consideration
- ○ Don't know

The potential impact that compliance risks and/or opportunities will have on the firm's ability to achieve its objectives

- ○ Not considered
- ○ Very little consideration
- ○ Moderate consideration
- ○ Significant consideration
- ○ Don't know

To what degree does the firm consider technology risks and/or opportunities?

- ○ Not considered
- ○ Very little consideration
- ○ Moderate consideration
- ○ Significant consideration
- ○ Don't know

Which of the following risks and/or opportunities does the firm consider?

- ☐ Data management systems (software)
- ☐ Computer systems (hardware)
- ☐ The privacy of information held on customers
- ☐ Other:
- ☐ Don't know

The likelihood that technology risks and/or opportunities will affect the firm's ability to achieve its objectives.

- Not considered
- Very little consideration
- Moderate consideration
- Significant consideration
- Don't know

The potential impact that technology risks and/or opportunities will have on the firm's ability to achieve its objectives

- Not considered
- Very little consideration
- Moderate consideration
- Significant consideration
- Don't know

To what degree does the firm consider economical risks and/or opportunities?

- Not considered
- Very little consideration
- Moderate consideration
- Significant consideration
- Don't know

Which of the following risks and/or opportunities does the firm consider?

- [ ] The nature of competition
- [ ] Business cycle
- [ ] Inflation
- [ ] Other:
- [ ] Don't know

The likelihood that economical risks and/or opportunities will affect the firm's ability to achieve its objectives

- ○ Not considered
- ○ Very little consideration
- ○ Moderate consideration
- ○ Significant consideration
- ○ Don't know

The potential impact that economical risks and/or opportunities will have on the firm's ability to achieve its objectives

- ○ Not considered
- ○ Very little consideration
- ○ Moderate consideration
- ○ Significant consideration
- ○ Don't know

To what degree does the firm consider reputation risks and/or opportunities?

- ○ Not considered
- ○ Very little consideration
- ○ Moderate consideration
- ○ Significant consideration
- ○ Don't know

Which of the following risks and/or opportunities does the firm consider?

- ☐ Environment
- ☐ Ethics
- ☐ Health and safety
- ☐ Other:
- ☐ Don't know

The likelihood that reputation risks and/or opportunities will affect the firm's ability to achieve its objectives

- ○ Not considered
- ○ Very little consideration
- ○ Moderate consideration
- ○ Significant consideration
- ○ Don't know

The potential impact that reputation risks and/or opportunities will have on the firm's ability to achieve its objectives

- Not considered
- Very little consideration
- Moderate consideration
- Significant consideration
- Don't know

To what degree are the following risk management dimensions implemented throughout the firm?

	Does not exist	Ad hoc implementation	Implemented but improvements needed	Robustly implemented	Don't know
Determined correlations and portfolio effects of combined risks					
Determined quantitative impacts risks may have on key performance indicators					
Formal report submitted to board level at least annually on the current state of risk and effectiveness of risk management					
Key risk indicators or indicators aimed at emerging risks (not historical performance)					

	Does not exist	Ad hoc implementation	Implemented but improvements needed	Robustly implemented	Don't know
Centralized technology-enabled process to obtain risk-related information	○	○	○	○	○
Verification of the completeness, accuracy, and validity of risk-related information	○	○	○	○	○
Formal policies about how risk should be managed	○	○	○	○	○
Risk response plan for all of the significant events the firm has identified	○	○	○	○	○
Alternative risk responses for each significant event	○	○	○	○	○
Communication to all stakeholders, internal and external, of the importance of risk management	○	○	○	○	○
Assessment of the firm's risk management function done by an independent/external party	○	○	○	○	○
Frequent and structured updates of risk-related information	○	○	○	○	○

	Does not exist	Ad hoc implementation	Implemented but improvements needed	Robustly implemented	Don't know
Formal written risk management philosophy (policy) (a set of shared beliefs and attitudes characterizing how the firm considers risk in everything it does and delineates the responsibility of management and the board)					
Formal written statement of the firm's risk appetite (the amount of risk specified at the board level that the firm is willing to accept in pursuit of value)					
Risk tolerances (formal guidelines or measures used at appropriate levels to assess whether the firm will accept risk)					

To what degree are the following risk management organizational dimensions implemented throughout the firm?

	Does not exist	Ad hoc implementation	Implemented but improvements needed	Robustly implemented	Don't know
Board level committee with responsibility for risk management oversight	○	○	○	○	○
A senior manager designated with the responsibility to oversee risk and risk management	○	○	○	○	○
Centralized department or staff function dedicated to risk management	○	○	○	○	○
Internal risk assessment group or internal audit function given the responsibility to evaluate the ongoing effectiveness of the firm's risk management	○	○	○	○	○
Allocated risk owners who have primary responsibility and accountability for managing risk within their respective areas	○	○	○	○	○

Please answer the following yes/no questions about the firm's risk management organization.

Does anyone at the firm hold the title Chief Risk Officer (CRO)?

- ○ Yes
- ○ No
- ○ Do not know

Does the Chief Risk Officer (CRO) have the highest responsibility for overseeing the centralized risk management function?

- ○ Yes
- ○ No
- ○ Do not know

If the firm does not have a CRO, but has a centralized risk management function, please specify what the title of the person in charge of that function is.

☐ Don't know/no opinion

Is the CRO (or equivalent position) independent of risk taking activities and decisions?

- Yes
- No
- Do not know

A frequently cited definition of Enterprise Risk Management (ERM) is "a process, affected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.

To what degree does the firm implement ERM according to the above definition?

- Not at all
- Ad hoc implementation
- Implemented but improvements needed
- Robustly implemented
- Implement ERM but only according to other definition
- Don't know

Does the firm follow any of the following ERM frameworks (mark those which apply)?

- [ ] COSO's ERM Integrated Framework
- [ ] Joint Australia/New Zealand 4360-2004 Standards
- [ ] ISO 31000-2009
- [ ] the Turnbull Guidance
- [ ] Casualty Actuarial Society Framework
- [ ] International Association of Insurance Supervisors Framework
- [ ] Basel II
- [ ] Internally created framework
- [ ] Other:
- [ ] Don't know

What lead the firm to implement ERM (mark those which apply)?

- ☐ Encouragement from the Board of Directors
- ☐ Encouragement from executive management
- ☐ Competition or other industry-related pressures
- ☐ Shareholder pressure
- ☐ Regulation compliance
- ☐ Compliance with stock exchange guidelines
- ☐ The need for more effective internal audit control
- ☐ The recent financial crisis
- ☐ Other:
- ☐ Don't know

Does the firm have any plans to implement ERM?

- ○ Yes
- ○ No
- ○ Do not know

What are the main challenges the firm has faced in implementing ERM (mark those which apply?

- [ ] Resistance from the Board of Directors
- [ ] Need for internal control and review systems
- [ ] Embedding risk management within company culture
- [ ] Difficulty in quantifying risks
- [ ] Timeliness and quality of information
- [ ] Difficulty in integrating risk management with other business processes
- [ ] Lack of necessary knowledge and skills within the organization
- [ ] Corporate priorities are often conflicting
- [ ] Availability of information
- [ ] Unclear who is responsible for managing risk
- [ ] Organizational culture which is resistant to change
- [ ] Other:
- [ ] Don't know

What has held the firm back from implementing ERM (mark those which apply)?

- [ ] Resistance from the Board of Directors
- [ ] Need for internal control and review systems
- [ ] Embedding risk management within company culture
- [ ] Difficulty in quantifying risks
- [ ] Timeliness and quality of information
- [ ] Difficulty in integrating risk management with other business processes
- [ ] Lack of necessary knowledge and skills within the organization
- [ ] Corporate priorities are often conflicting
- [ ] Availability of information
- [ ] Unclear who is responsible for managing risk
- [ ] Organizational culture which is resistant to change
- [ ] Other:
- [ ] Don't know

Once the survey is complete, a summary of the findings will be available to participants. If you are interested in the status of risk management activities in similar or other industries in the Nordic countries, these results would be of particular importance to you. If you are interested in the summary after participation, please confirm here that we may re-use this e-mail address in the future. It will only be used in order to send out the summary report.

- ○ Yes, at the same address the survey was sent to
- ○ Yes, but on this address instead: _____
- ○ No

Thank you for participating in the survey!

All answers will be kept confidential and will be under no circumstances handed over to a third-party. No personal information will be saved in the database.

Results

Your response, as well as the responses of others, will allow us to research the value created through certain risk management activities and organizational approaches. Moreover it will explore the value of implementing Enterprise Risk Management (this study is informed by the COSO Enterprise Risk Management - Integrated Framework, for more information go to www.coso.org). It can also provide an informative profile of risk management and enterprise risk management activities of firms in Nordic countries.

Contact us

If you have any questions or would like more information on the study, please contact one of us:

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Chapter 2. An Exploratory Study of Enterprise Risk Management: Pillars of ERM[4]

2.1 Introduction

There is a consensus that enterprise risk management's (ERM) popularity in discussions of modern risk management practices has resulted from a response to increased pressure on organizations to holistically manage risk. New demands on corporations for reporting purposes imposed by, for example, The Sarbanes-Oxley Act of 2002 (SOX) are often argued to have had a significant impact in changing the face of risk management (Beasley, Clune, & Hermanson, 2005; Desender, 2011; Beasley, Pagach, & Warr, 2008). Ratings agencies have also helped put focus on the emergence of ERM; in May 2008, Standard and Poor's Ratings Services announced its intention to include ERM assessment in ratings of non-financial firms (Standard & Poor's, 2008). And with companies facing a broader scope of risks arising from globalization, industry consolidation, and deregulation (Liebenberg & Hoyt, 2003), ERM has risen as a coping mechanism for the pressures placed on firms to have effective risk management. Still, despite its rising popularity, knowledge of ERM is beset by uncertainties and inconsistencies.

As attention to enterprise risk management increased, a number of frameworks emerged to help guide firms in their implementation of ERM. The number of frameworks developed contributes to an overall uncertainty regarding the essential components of ERM. Each framework identifies different components in varying number and definition; and while the underlying ideas of ERM are consistent, dissatisfaction with existing guidance in ERM implementation is apparent. Beasley, Branson, and Hancock (2010) find that the COSO ERM framework, one of the most cited

[4] Adapted from: Lundqvist, S. A. (2014). An Exploratory Study of Enterprise Risk Management Pillars of ERM. Journal of Accounting, Auditing & Finance, 29(3), 393-429.

and debated frameworks, is considered to be ambiguous and overly theoretical in nature by individuals who are involved in leading ERM.

This uncertainty carries forward to empirical studies of ERM[5] where results regarding value creation of ERM and its determinants are inconclusive. Of particular concern are the inconclusive results regarding the potential value creation of ERM; this of course is a key motivation for implementation of ERM which requires considerable time, resources, and commitment. There exists no real consensus about what an ERM firm "looks like" and/or what the integral components of ERM are; this has led to measurement and identification methods that are inconsistent and imperfect. By using inconsistent measures of ERM implementation, it is impossible to compare "apples to apples" and arrive at conclusive and convincing results regarding ERM's ability to create value.

Previous identifiers of ERM are often limited to simple proxies of implementation, like a chief risk officer (CRO) hire (Liebenberg & Hoyt, 2003; Beasley et al., 2008; Pagach & Warr, 2010 and 2011), or measures of ERM dependent on survey information (Beasley et al., 2005). Both methods ignore the complexities of implementing ERM and assume imprecise identifiers are sufficient to represent the integral parts of ERM. More complex attempts at measuring ERM implementation, using public information or survey data, differ across studies. In order to better identify ERM firms, measure ERM implementation, create comparability between firms, and identify true value creation capabilities, it is important to take a step back and first determine what ERM really is and what the essential components are.

This is an exploratory study of ERM aimed at determining the integral components of ERM based on how firms actually implement ERM dimensions. Components are broader pieces of ERM which are made up of a group of detailed dimensions; component and factor are used interchangeably throughout the text. 151 Nordic firms responded to a comprehensive questionnaire aimed at capturing completeness of ERM implementation by

[5] Liebenberg & Hoyt, 2003; Desender, 2011; Beasley et al., 2008; Pagach & Warr, 2010 and 2011; Hoyt & Liebenberg, 2011; Gordon, Loeb, & Tseng, 2009; Beasley et al., 2005; Gates et al., 2012; McShane, Nair, & Rustambekov (2011)

assessing the level of implementation of 59 different dimensions. A survey covering a wide-range of ERM aspects is crucial for capturing the complexities of ERM which have often been disregarded in previous studies. Few other ERM studies have firm-level information on ERM implementation in such detail.

The responses to the questionnaire are then analyzed using exploratory factor analysis (EFA) in order to identify an underlying factor structure which explains covariation in the responses. The resulting factors are four discrete components; the pillars of ERM. Two prerequisite components are related to the general internal environment and control activities of the firm. The prerequisite components are not directly associated with risk management; firms that demonstrate no risk management activities could still implement these two components in a robust way, for example if they have strong governance in place. One component identifies the risk management activities of the firm in terms of the degree which types of risks are considered. This risk assessment and identification component distinguishes between firms that are actively managing different risks of the firm and those that are not, but this component provides no information on the organization of these risk management activities. The fourth component has the defining attributes of ERM implementation and is related to the holistic organization of risk management. This component contains the dimensions that are characteristic of ERM implementation and holistic organization of risk management, for example: formal written statement of risk appetite, correlating and determining portfolio effects of combined risks, having a senior manager assigned the responsibility of overseeing risk and risk management, and a formal risk management report submitted to board level regularly. All four components must be implemented in order to have well implemented ERM, but only one separates ERM firms from non-ERM firms.

The importance or "weight" of the suggested components to efficient ERM implementation is investigated based on the feedback from seven experts in ERM. In addition to the factor structure suggested through the process of EFA, four a priori models are evaluated with confirmatory factor analysis (CFA) for their fit to the survey responses.

The resulting four pillars challenge existing frameworks to adapt in order to better reflect how firms implement ERM, either by simplifying existing frameworks or providing better guidance to help firms achieve intended implementation. The resulting components also have a valuable impact on identifying and measuring ERM; for example, the common ERM proxy of

Chief Risk Officer (CRO) generally understates the number of ERM firms. This can lead to better and more informative empirical studies on value creating abilities of ERM.

The chapter is organized as follows. Section two presents a discussion of ERM frameworks with a focus on the COSO ERM Framework. Section three discusses previous flaws and inconsistencies in measuring and identifying ERM firms as well as the inconclusive results of previous empirical studies on ERM. Section four states the methodology used in the study: survey, factor analysis, and expert weighting. Section five presents the empirical results. And finally, section six concludes the study.

2.2 Enterprise Risk Management Frameworks and Previous Studies

2.2.1 Frameworks for Enterprise Risk Management

Though there are a number of working definitions of enterprise risk management, there does exist some consensus regarding what the purpose of ERM is: firm's take a portfolio view of risk instead of managing in silos, they take into account strategic and more qualitative risks, and the focus is not solely on the downside of risk but also opportunity (Bromiley, McShane, Nair, & Rustambekov, 2014). In order to manage the complex integration of risks across the firm, more structure, organization, accountability, and communication in the risk management system is necessary.

In turn, a number of frameworks intended to guide firms in their implementation of enterprise risk management have been developed. Some of the most prominent and frequently mentioned frameworks are: COSO's ERM Integrated Framework, the Joint Australia/New Zealand 4360-2004 Standards, ISO 31000-2009, the Turnbull Guidance, the Casualty Actuarial Society Framework, the International Association of Insurance Supervisors Framework, and Basel II. ISO 31000-2009 is said to incorporate best practices from COSO, PMI (Project Management Institute), the Australian and New Zealand Standard, and other leading international risk management standards (Fraser & Simkins, 2007). Each framework identifies its own specific component structure in varying number and definition and ERM implementation process.

Since its release in 2004, the COSO ERM Framework has been discussed extensively and often plays a central role in defining ERM. Following events

like Enron, a heightened concern and a call for risk management prompted COSO to update its original internal control framework from 1992, leading to the creation of the COSO ERM Framework (Pang & Shi, 2009). Many of the dimensions and underlying ideas of ERM mentioned in the COSO framework are also relevant for other existing ERM frameworks. Existing ERM frameworks tend to be conceptually similar, but they differ in their structural representations, pertaining mostly to how dimensions or aspects of ERM are grouped – how they define the components of ERM.

COSO presents eight components of enterprise risk management. (1) The internal environment pertains to the governance and structure, culture, and philosophy of risk management, including the firm's risk appetite. The firm's risk appetite is argued in much of the literature to be a central aspect of enterprise risk management and a key to its success. Many authors, frameworks, and even practitioners address the importance of establishing, communicating, and understanding the firm's risk appetite (Blakely, 2009; COSO, 2004; Drew & Kendrick, 2005; Fraser & Simkins, 2007; Kirkpatrick, 2008; Recent Trends in ERM and Literature Review, 2007; SOA; Stulz, 2008). (2) The objective setting covers the strategic objectives of the firm's operations, reporting, and compliance activities. (3) Event identification involves determining significant events that may affect the firm's ability to achieve its objectives. Events are both internal and external factors such as: external economic events, natural environmental events, political events, social factors, internal infrastructure events, internal process-related events, and external and internal technological events (Moeller, 2007). (4) Risk assessment is the consideration of the extent to which potential risk events may affect an organization's ability to achieve its objectives. The dimensions underlying this component are more "quantitative" evaluations of the risks the firm faces. (5) Risk response concerns the existence of formal policies in place to determine how risk should be responded to and managed. There are four general responses: avoiding, accepting, reducing, and sharing risk (COSO, 2004). (6) Control activities are policies and procedures in place to ensure that identified risk responses are carried out. (7) Information and communication is the process or unit of the framework that links together each of the other components. Finally, (8) monitoring is essential to ensure that ERM is working effectively on a continuous basis. COSO defines the effectiveness of enterprise risk management based on an assessment of whether the eight components are present and functioning properly, making proper implementation of the eight components the criteria for effective risk management. In order for the components to be present and functioning as

prescribed there can be no material weakness, and all risks need to be brought into the perspective of the firms risk appetite (COSO, 2004).

In COSO's 2001 "Report on ERM", 26.5% of respondents responded "significant or a great deal" to the perception that the COSO ERM Framework contains overly vague guidance, and 44.6% responded "significant or a great deal" to the perception that the framework is overly theoretical (Beasley et al., 2010). In general, criticisms of ERM tend to focus on this ambiguity which leads to difficulties in implementation.

Ambiguity and confusion resulting from flawed and inconsistent guidance is a symptom of the lacking consensus about what ERM really is and competing attempts to define its components in the best way. This lack of consensus exists in empirical studies of ERM as well. Inconsistencies and flaws in identification and measurement methods of ERM firms result in a lack of resolution regarding ERM's ability to create value.

2.2.2 Previous Studies on Enterprise Risk Management

In current ERM research, there are two main methodological ways of identifying and measuring enterprise risk management implementation in firms; researchers either search publically available information or they use surveys to obtain the information straight from the firm. Inconclusive results regarding the value creating ability of ERM and its determinants can in part be a result of the inherent flaws in the methods used as well as the inconsistencies between identification and measurement; these inconsistencies stem partially from a lack of agreement about what ERM really is and what the integral components of ERM are.

Many researchers using public information searches use simple proxies to identify ERM implementation, like the existence of a Chief Risk Officer (CRO) or similarly a senior risk officer (Liebenberg & Hoyt, 2003; Beasley et al., 2008; Pagach & Warr, 2010 and 2011; Hoyt & Liebenberg, 2011). Beasley et al. (2008) assume that hiring a CRO implies that the firm is implementing ERM and will use corporate resources toward the effort. However, firms may hire a CRO in order to signal to shareholders an intent to implement ERM but then not follow through with the implementation or poorly implement ERM. The hiring of an individual does not necessarily accurately represent a well-implemented and effective ERM system. Therefore, such a proxy may be too superficial to robustly identify an ERM firm. On the contrary, it may be possible that firms who have implemented

ERM have not hired a CRO; COSO (2004) states that some firms choose to assign the role of risk officer to another senior officer, CFO for example. This makes the hire of a CRO unnecessary for ERM implementation.

Some studies use multiple ERM dimensions to measure ERM implementation but still search publicly available information (Desender, 2011; Gordon et al., 2009). Desender (2011) searches all publicly available information, 10-Ks, proxy statements, and company websites, for information about 70 dimensions of ERM spanning specific types of controls, risk, and related ERM practices. Gordon et al. (2009) have a similar measurement strategy where they define variables used to create an ERM index (strategy, operation, reporting, and compliance); variable data is collected from publically available information, for example: sales, number of employees, material weakness in disclosures, announcements of financial restatements, and auditor fees. Because the measures themselves are so different, they need to be evaluated and/or developed from a more consistent definition of ERM. While both these studies take into consideration a number of ERM dimensions and acknowledge ERM's complexity, both suffer from concerns regarding under reporting.

The main methodological flaw of using publically available information is the amount of reporting done on complex aspects of ERM. A major obstacle to empirical research in ERM is the difficulty in identifying firms engaging in ERM. Firms typically do not disclose whether they are managing risks in an integrated manner. Much of their risk management disclosure and discussion relates to specific risks and not whether they are managed in an integrated way (Liebenberg & Hoyt, 2003). Additionally, a number of ERM dimensions, for example those associated with COSO's internal environment component, are not specific to the implementation of enterprise risk management. Therefore, firms may have efficiently implemented ERM dimensions in the firm without consciously trying to implement ERM. This could in turn mean that they do not report on such dimensions. Underreporting of ERM practices then creates inaccuracies in the evaluations of ERM implementation by deflating measures of ERM and ultimately affecting the results of studies.

Beasley et al. (2005) survey firms in order to bypass the incompleteness and under reporting worries related to public information searches. They ask firms directly through survey about their level of ERM implementation. This is a case of oversimplification and an over reliance on a firm's own definition of ERM and the perception of ERM implementation in the firm. Given that

the level of ERM implementation is dependent on a single answer with no additional information or "controls" for bias, this measure of ERM implementation is problematic. Firms may also want to be perceived as better implementers than they are; direct questions about ERM implementation therefore may be more affected by a desire to window-dress. Gates et al. (2012) also survey firms regarding their stage of ERM implementation as well as regarding components of the COSO ERM framework in order to investigate ERM's effect on the perception of performance. This approach is one of the more thorough, but the list of dimensions is brief and the COSO components are assumed to be relevant components of ERM for firm implementation.

An example of a more comprehensive measure of ERM implementation is the use of the risk management rating from Standard and Poor's; McShane et al. (2011) use this measure in order to investigate the value creation of ERM. At this time, this measure only exists for insurance companies, and because of its newness, it should be evaluated further for its appropriateness in studies of ERM. It also relies on S&P's definition of ERM which should be aligned with the definition accepted in general.

Table 6 is a summary of many of the empirical studies on value creation and determinants of ERM as well as the method of identification/measurement and brief summary of the results. Out of ten studies, at least five of them identify and measure ERM in a different way (more than five if one considers the measures in detail). This means that few of these studies are comparing "apples to apples". A firm being defined as an ERM implementer because of announcing a senior risk officer hire announcement will likely be different than a firm identified as an ERM firm using the ERM Index developed by Gordon et al. (2009). This could explain the inconclusive results from ERM studies.

Of the six studies on ERM's ability to create value, four find support. In these six studies, six different methods of identification/measurement of ERM are used, five of which use searches of publically available information. Two studies use the announcement of a CRO or senior risk officer announcement. The former, an event study, finds a positive shareholder reaction to the announcement of a CRO in firms with little financial slack or large nonfinancial firms with volatile earnings, greater amounts of intangible assets, low leverage, and low amounts of slack (Beasley et al., 2008). Pagach and Warr (2010) find, on the other hand, that financial performance does not change as a result of adopting ERM. Using Gordon et al.'s (2009) ERM

Index shows that ERM is in fact value creating contingent on a number of firm characteristics. Inconclusive results like these are worrisome because the argument that ERM is value creating is of importance for its continuing development and is a core motivator for firms choosing to devote resources to its implementation.

The results from determinants studies are not as straight-forward in the sense that many of the studies include different test variables for ERM determinants, but some of the results show inconsistencies across studies. Liebenberg and Hoyt (2003) find that financial leverage is positively associated with ERM implementation, but Hoyt and Liebenberg (2011) find, using a broader set of indicators, that ERM has a negative relation to leverage. Because financial distress is a traditional motive for implementing risk management, inconclusive results like these are troublesome; the difference in measurement technique can contribute to the inconclusive results.

Overall, results from current research are inconclusive regarding ERM's ability to create value and its determinants. Contributing to this is the fact that research employs a number of different indicators and measures of ERM implementation, each with its own flaws. In order to remedy this, there needs to be a common conceptualization of ERM leading to an agreed upon method to measure ERM implementation.

Table 6. Summary of Empirical Studies on Enterprise Risk Management

		Author(s)	Identifier/Measure	Findings	
Public Information Search	Value Creation	Beasley et al. (2008)	CRO announcement	Positive shareholder reaction	
		Gordon et al. (2009)	ERM index	ERM and firm performance contingent on contextual variables	
		Pagach and Warr (2010)	Senior risk officer announcement	No support	
		McShane et al. (2011)	S&P risk management rating	No support	
		Hoyt and Liebenberg (2011)	ERM keywords	ERM premium =20% of firm value	Size, inst. ownership, reinsurance use, and leverage
	Determinants	Liebenberg and Hoyt (2003)	CRO announcement	Financial leverage	
		Desender (2011)	Multiple dimensions	CEO on the board, board indp. when there is separation of CEO and chairman, size, and Big Four auditor	
		Pagach and Warr (2011)	Senior risk officer announcement	Size, leverage, and fewer growth options	
Survey	Value	Gates et al. (2012)	Survey response	Better perceived performance	
	Det.	Beasley et al. (2005)	Survey response (0-4)	CRO, board indep., and CEO or CFO involvement	

2.2.3 Purpose of this Study

ERM is a complex and ambiguous system. Frameworks have been developed in order to guide in the difficult task of implementing ERM; however, all frameworks differ in structure and some are considered ambiguous. There is a lack of consensus on what the components of ERM are. Empirically there is no consensus regarding ERM's ability to create value and its determinants. Methodologically ERM identification is challenging; ERM implementation is not likely to be well disclosed in public data and surveys are often too direct and open to potential answering biases. There is also no generally accepted way to identify ERM implementers; so, measures of ERM differ greatly across studies and it is not possible to compare "apples to apples". Again, there is a lack of consistency in defining the components of ERM.

The purpose of this study is to explore what ERM "looks like" in a firm and what the components of ERM are based on how firms actually implement ERM. Closeness to the firm is essential to breaking down the complexity of ERM into its broad components.

2.3 Data and Methodology

In order to get as close to as many firms as possible, a survey methodology is used to collect information regarding the implementation of a wide-variety of ERM dimensions. Questionnaire responses are analyzed with exploratory factor analysis in order to determine the underlying factor structure of ERM. The final factor structure gives a picture of what ERM is based on how its dimensions are implemented. The factor structure developed is also compared to a priori factor models by analyzing their fit using confirmatory factor analysis. Finally, the importance of the developed components for efficient ERM implementation is assessed using expert weighting.

2.3.1 Survey

Survey Design

The questionnaire used in this study focuses on identifying a firm's level of implementation of a number of dimensions of risk management. While a significant portion of the survey is aimed at identifying implementation of ERM dimensions, the survey did not draw attention to its focus on ERM in order to ensure that respondents were not influenced by the mention of ERM

but instead answered with a more general consideration to their risk management practices.

The survey was based on a set of dimensions developed by Desender (2011) to construct an aggregate measure of ERM. Desender's original list of dimensions was developed using the COSO ERM Framework (2004) and prior work by Knechel (2002) that defined relevant control and risk management procedures. Desender's list of dimensions is one of the most comprehensive lists available regarding detailed ERM dimensions.

For the purpose of this study, Desender's list of dimensions was refined by better defining some elements and removing some dimensions. Dimensions from Desender's list that were either difficult to comprehend under the COSO framework context without more information or absent[6] in public information were removed from the list. Based on a careful review of existing literature, the list was developed further to be more complete and include aspects that were perceived missing from the original list. Input regarding necessary dimensions of proper ERM implementation was received from two members of the COSO board in order to refine and complete the survey.

The list of dimensions was then transformed into a questionnaire designed to assess the degree of implementation of each dimension in the firm. The questionnaire was sent to the Chairman of COSO, a consultant of ERM implementation, and a researcher with experience in survey use for comments. The survey was also pre-tested on two practitioners. The final version of the questionnaire included changes based on the comments from the aforementioned individuals. Minor changes were also made based on the recommendations of Sinitor[7] who helped distribute the survey.

Firms were asked to give the degree of implementation of each dimension on a scale from zero to three. Zero being that the dimension is non-existent in the firm and three being that the dimension is robustly implemented in the firm. With a more standard five item Likert-like scale, the questions were

[6] Items found in Desender (2011) to have an average of less than 10% of firms with information on the dimension in their publicly available information.

[7] Formally Anthill Stockholm.

deemed more difficult to answer during testing. Therefore, more reliability in the scale was chosen over the potential for additional variation.

The final version of the questionnaire is comprised of 59 dimensions. Included in the questionnaire are also two background questions, questions directed at the firm's perception of their implementation of ERM, and a number of questions addressing ERM specific concepts; explicit questions about ERM were left to the end of the questionnaire so as not to affect the firm's answers regarding more general dimensions. See Appendix 1 for the list of dimensions and summary statistics.[8]

Sample

The questionnaire was sent to firms listed on two major Nordic stock exchanges, either NASDAQ OMX or Oslo Börsen, and with headquarters in a Nordic country (Sweden, Norway, Finland, or Denmark). Iceland and associated territories are excluded due to their small number of companies. The number of firms contacted for the survey was 676: 173 in Denmark, 123 in Finland, 147 in Norway, and 233 in Sweden.

Nordic firms are targeted for this study in the hopes that individuals surveyed would have a positive response to the study as it is conducted by Lund University, a well-known university in the Nordic region, leading to higher response rates.

The Nordic countries have a lot in common economically. They are small, open economies with significant foreign trade. Being small and open countries generally means that they are particularly vulnerable to international economic fluctuations. The Nordic countries all industrialized relatively late but quickly, and they all currently perform well economically. The similarities between Nordic firms are likely to carry over to their risk management approaches as they are exposed to similar risks. Firms in Nordic countries are all also similar in their governance structure. There have been previous studies that have focused on risk management in Nordic firms, like the one done by Brunzell, Hansson, and Liljeblom (2011).

[8] A copy of the survey can be found in Appendix 1.1 of Chapter 1.

Survey Delivery and Response

The questionnaire was delivered with the help of Sinitor, specialists in data collection. The questionnaire was translated from English into Swedish, Finnish, Danish, and Norwegian and made into a web-based format. Firms were contacted directly by telephone, attempting to reach the CEO, CFO, or an individual knowledgeable about risk management. These individuals are targeted because of the important role they play in implementing enterprise risk management. ERM should be a top-down process, with the CEO and the senior executive team determining the parameters for the policies and the organizational structure for its effective implementation (Dickinson, 2001). The first attempt at getting a respondent was to contact the CEO. According to COSO (2004), the CEO has the ultimate ownership responsibility for ERM, sets the tone at the top that influences internal environment factors and other ERM components, and can influence the board of directors. This made the CEO the ideal candidate for the survey, as they should be able to answer questions specific to ERM but also should be knowledgeable about other areas of the firm as well, in the case where ERM is not being implemented. Because CEOs are in general difficult to reach, the next attempts to gain respondents were focused toward the CFO or a risk manager of some form, if such a position existed. CFOs tended to be more readily available than CEOs with 77% of respondents being CFOs. Additionally, firms generally have a CFO while a specified risk manager does not always exist. Only 18 firms (12%) reported that they had a Chief Risk Officer (only 2 of these answered the survey).

The final response rate was 22.6% with 153 responses. Two respondent firms have since delisted and are therefore eliminated from the study, leaving a final sample of 151 firms. This response rate is higher than the response rate (10%) from a survey regarding ERM from Beasley et al. (2005), but closer in line with the response rate (27%) from the ERM survey used in Gates et al. (2012) which also surveys firms on component level ERM implementation. The response is also slightly higher than the response rate (19.92%) from the survey of Nordic firm derivative use by Brunzell et al. (2011).

The distribution of respondent firms and the distribution of the surveyed firms are similar in respect to country representation, industry and market capitalization; therefore the respondent group is considered an adequate representation of the original sample and there is no expected non-response bias. Table 7 gives descriptive statistics for both the surveyed firms (population) and the respondent firms (sample).

Table 7. Descriptive Statistics for the Surveyed Firms and the Respondent Firms

		Surveyed		Respondent		Response
		#	%	#	%	Rate
Country	Denmark	173	26	32	21	18%
	Finland	123	18	26	17	21%
	Norway	147	22	37	25	25%
	Sweden	233	34	58	38	25%
	Total	676		153		22.6%
Industry	Industrial	491	73	119	79	
	Utility	15	2	3	2	
	Transportation	44	7	8	5	
	Bank/Save and Loan	43	6	8	5	
	Insurance	7	1	4	3	
	Other Financial	68	10	10	7	
	Other	8	1	1	1	
Market	Large	122	18	30	20	
Capitalization	Mid	189	28	39	26	
(thousands	Small	365	54	84	56	
U.S. $)	Mean	2002		1848		
	Median	173		167		
	Std. Dev.	6660		5403		
Total Assets	Mean	6286		4771		
(thousands	Median	287		277		
U.S. $)	Std. Dev.	44742		26974		

Notes: No statistically significant differences in mean values are found.

2.3.2 Determining the Underlying Factor Structure of Enterprise Risk Management

The responses to the questionnaire are intended to assess the degree of ERM implementation in the respondent firms by looking at implementation of many detailed dimensions. Responses are analyzed using exploratory factor analysis in order to suggest broader factors which are responsible for covariation in the responses. In order to test the fit of existing conceptualizations of ERM, the survey responses are also tested for their fit to a priori models of ERM using confirmatory factor analysis (CFA).

Exploring the Structure – Exploratory Factor Analysis

The purpose of exploratory factor analysis is to determine the number of latent variables (unobservable) that are needed to explain the correlations among a set of observed variables. The latent variables are referred to as factors, and the observed variables are referred to as factor indicators (Muthén & Muthén, 1998-2010). Questionnaire responses for each ERM dimension are therefore factor indicators, and the covariances of questionnaire responses are analyzed using EFA in order to determine the underlying factor structure of survey responses. Since the questionnaire responses as a whole represent ERM implementation, the resulting factors are the components of ERM based on how firms implement its dimensions.

EFA is used to explore underlying factor structures when there is no a priori specification of the number of factors and their loadings (Kim & Mueller, 1978). Unlike principal component analysis, factor extraction discriminates between shared and unique variance. Factors are extracted so that shared variance is partitioned from its unique variance and error variance to reveal an underlying factor structure where only the shared variance shows in the solution (Costello & Osborne, 2005).

This study uses robust weighted least squares estimation (WLSMV) with geomin oblique rotation. WLSMV estimation is the default estimator in Mplus when estimating exploratory factor analysis with ordered categorical variables. Given that the number of categories in each variable (four categories, response from zero to three) is less than recommended in order to be considered continuous and there are ceiling effects in the data, WLSMV is the recommended estimator. Ceiling effects are evident in the negative skew of numerous variables. Oblique rotation allows the final factors to correlate with each other. Varimax rotation, an orthogonal rotation method used more

frequently, finds factors that are uncorrelated. As the factors in this study are all themselves a part of enterprise risk management, it is unrealistic to believe they would not be correlated to some degree. The geomin rotation is the default oblique rotation in the Mplus software. Given that the missing data is assumed to be missing completely at random (MCAR)[9], all available observations are used to estimate each correlation, present pairwise treatment of missing data.

Confirming the Structure - Confirmatory Factor Analysis

The factor structure determined through the exploratory factor analysis is of course data driven. A factor structure which reflects the actual ERM implementation in firms addresses the purpose of the study which is to identify what ERM firms actually look like in order to in part remedy framework ambiguity and methodologically identify ERM firms better. However, there may be preconceived models of ERM which also fit the data.

The main use of confirmatory factor analysis in this study is to test the fit of other possible a priori models, like COSO's eight component model, and compare it to the model developed in the study. CFA is also used to test the fit of a simplified second order model (the final proposed ERM factor model) which is developed from the EFA.

Testing a Second-Order Factor Model

The result of the EFA analysis is an underlying component structure which reflects the implementation of ERM as it is done in firms. Each indicator loads on all of the resulting underlying factors when doing an exploratory factor analysis. In order to make a more parsimonious model, dimensions are allowed to only load on to one factor based on their highest loading from the EFA analysis unless a cross loading is theoretically sound; in other words, previously free parameters are fixed to zero except for the parameter with the highest loading in the EFA. Using CFA to test this simplified model yields modification indices and model fit statistics. The modification index provides

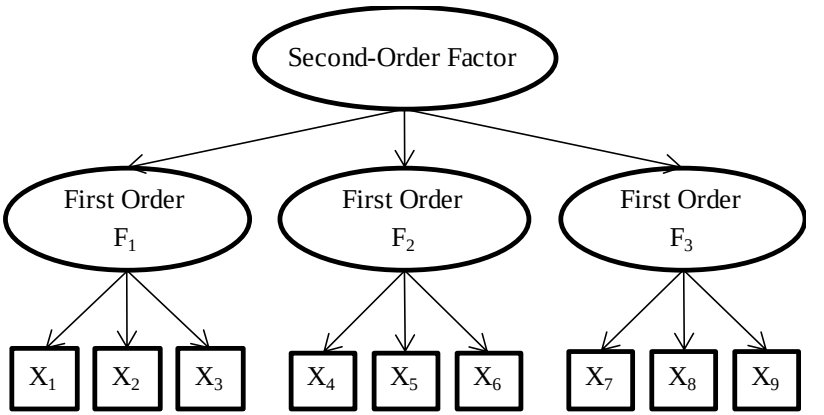
[9] Treating the variables as continuous, Little's Missing Completely at Random (MCAR) test results in not rejecting the null hypothesis that the data is missing completely at random, therefore supporting the assumption that missing data is MCAR.

suggested modifications to create a better fitting model based on estimates of the amount by which the overall model chi-square statistic would decrease if a particular fixed-to-zero parameter were freely estimated (Kline, 2011) (See the section on Goodness of Fit Statistics in Appendix 2 for more information on the chi-square statistic). Modifications are made to the model and included in the final model only if it makes theoretical sense. This results in the creation of a more parsimonious and well-fitting underlying factor structure.

Given that the underlying factors are themselves indicators of ERM, CFA is used in the last step to test the fit of a second-order factor model where the factors developed in the study are free to load onto a second-order ERM factor. See Figure 5 for a depiction of a second-order factor model.

In order to estimate the CFA models, WLSMV is used. The analysis is based on the estimation of ordered probit regressions for the factor indicators regressed on the factors (Muthén & Muthén, 1998-2010).

Figure 5. Second-Order Factor Model



Note: □ denotes observed variables; ○ denotes latent/unobserved variables

Testing A Priori Factor Models

In order to compare the ERM factor structure developed in this study with the fit of other possible a priori models, confirmatory factor analysis (CFA) is used. Table 8 shows the four a priori models tested using CFA. The four models are intuitive models which are developed when considering existing ERM frameworks.

The general CFA model is based on general groupings which appear to be consistent across a number of frameworks. These grouping are developed by comparing and finding similarities between leading ERM frameworks. On a general level, there seems to be a consistent division of components into three broad levels: 1) environment and firm context related components, 2) risk identification, assessment, and response components, and 3) some form of system evaluation. For the general model in Table 8, dimensions from the survey are divided into these three groups.

A grouping of dimensions into COSO's eight components is also tested; risk identification and risk assessment dimensions are combined to form one component because of convergence issues, therefore the model structure has seven factors not eight.

The third model separates dimensions into dimensions directly related to risk and dimensions which do not have a direct relation to risk. The final a priori model is a combination of the first and third model and separates the general components from the first model into both risk and non-risk related components.

WLSMV is used for all model estimations.

Table 8. A Priori Factor Models Tested with Confirmatory Factor Analysis

Model	Factors						
General	Environment:			Risk Related:		Monitoring:	
	d1-d12, d42-d46			d20-d31, d34, d36-d38		d13-d19, d32-d33, d35, d39-41, d47-d48	
COSO	Internal Environ.:	Objective Setting:	Risk Identif. and Assessment:	Risk Response:	Control Activities:	Information and Commun.:	Monitoring:
	d1-d10, d42-d46	d11-d12	d20-d31, d34	d36-d38	d13-d15, d18	d16-d17, d32, d35, d39	d19, d33, d40, d41, d47, d48
Risk Related	Not risk related:					Risk related:	
	d1-d19					d20-d48	
General/ Risk	General Environment:		Risk Related Environment:	Risk Related:	General Monitoring:	Risk Related Monitoring:	
	d1-d12		d42-d46	d20-d31, d34, d36-d38	d13-d19	d32-d33, d35, d39-41, d47-d48	

Notes: d is ERM dimension number; see Appendix 2.1 for full descriptions.

2.3.3 Expert Weighting of Determined Factors

The factor structure developed in this study is exploratory in nature. The questionnaire responses determine the resulting factor structure through the exploratory factor analysis. This factor structure shows how ERM is implemented by firms. The loadings of the underlying ERM factors on a second-order ERM factor give an implicit weight of importance of the underlying factors. However, these weights represent the importance given to the factors by the firm in the implementation process. They do not represent what the frameworks and ERM guidance intend for weights of importance for such factors.

Seven experts are asked to weight the factors developed in the study for their importance for effective and well implemented ERM. A similar expert weight approach is used in Ginnarakis, Galani, Georgia, and Litinas (2010) to create a corporate social responsibility (CSR) index, where eight experts are asked to rank indicators of CSR factors and then the rank reciprocal weighting approach is used to determine the weights of each indicator. In this study, experts are asked to give their opinion of how important the four factors are to having effective and well implemented ERM. Instead of ranking the factors, they were requested to give a weight of importance to each component between zero and one hundred, zero being not important at all and one hundred being the only item of importance. The four weights were required to sum to one hundred.

Experts include board members of COSO, members of the Swedish Risk Management Association (SWERMA), and individuals with extensive experience in ERM implementation consulting.

2.4 Results and Discussion

2.4.1 Underlying Factor Structure

Exploratory Factor Analysis

Before running the exploratory factor analysis, the dimensions are screened for evidence of multicollinearity. Correlation between dimensions increases with difficulty of question, with the general background dimensions showing less correlation than the specific risk management dimensions. This is expected given that the general dimensions cover a number of areas of the

firm and the risk management questions are more closely related and narrow in topic. Correlations between dimensions are seldom over 0.5 but many correlation coefficients are above 0.3. For dimensions with correlations over 0.8, one of the correlated dimensions is removed in order to eliminate redundant dimensions. Eleven dimensions are removed. Correlated dimensions were eliminated with the intention to maintain as much information as possible for the EFA but to also retain the dimensions that would be perceived as the simplest to answer. All dimensions pertaining to the consideration of potential impacts of risk events on the firm's ability to achieve its objectives were removed due to their correlation with the dimensions pertaining to the consideration of the likelihood that the risk events will affect the firm's ability to achieve its objectives.

After elimination of variables based on correlations, 48 dimensions of enterprise risk management remain for analysis. See Appendix 1 for a complete list of the dimensions and summary statistics.

Determining the number of factors to retain is one of the most significant decisions when conducting exploratory factor analysis. It is important to balance parsimony and simplicity of models with plausibility (Fabrigar, Wegener, MacCallum, & Strahan, 1999). Based on parallel analysis, fit statistics, and interpretability, the resulting factor structure from the exploratory factor analysis is a four factor model. Details regarding the factor retention decision can be found in Appendix 2.

The geomin rotated loadings for the four factor EFA model can be seen in Table 9. Loadings in bold, greater than 0.32, designate dimensions that are considered to load adequately on a factor. Dimensions that load at 0.32 or higher for two or more factors are considered to cross-load. Tabachnick and Fidell (2001) suggest 0.32 as a good rule of thumb for minimum loadings. They argue that 0.32 equates to approximately 10% overlapping variance with the other items in the factor.

The overall fit of the model is acceptable[10]; model fit statistics are: chi-square = 1309.300, chi-square p-value = 0.0000, root mean square error of approximation (RMSEA) = 0.046, Prob. RMSEA <= 0.05 = 0.414, the

[10] Models fit "good", "acceptable", "marginal" and "poor" in order best to worst (Browne & Cudeck, 1992).

Bentler Comparative Fit Index (CFI) = 0.935, and standardized root mean square residual (SRMR) = 0.077. (See the section on Goodness of Fit Statistics in Appendix 2 for more information on the fit statistics).

Dimensions with the highest loadings on the first factor are related to internal environment and object setting dimensions (as defined by the COSO ERM framework). Dimensions are for example: code of conduct, formally defined standards for hiring and firing executive management, training for employees of all levels, mission statement, and a strategy to pursue the mission. None of the internal environment dimensions that are specific to risk management load substantially onto this factor. Therefore, this factor is designated as a general internal environment and objective setting component; general meaning not having to do specifically with risk management and risk related dimensions but the more broad elements of the environment of the firm.

The second factor has the highest loadings for risk related dimensions that pertain to the firm's risk management environment (for example a formal risk management philosophy and/or a centralized department or staff function dedicated to risk management), monitoring, information and communication related to the risk management system, and a portfolio view on risk. These are dimensions fairly specific to enterprise risk management and its holistic nature. This factor is designated the holistic organization of risk management.

The dimensions with the highest loadings on the third factor relate to the risk identification and risk assessment of specific risks (financial, compliance, technology, economic, and reputation). These dimensions are specific to risk management activities but less indicative of ERM as they deal with a variety of risks but not specifically on a holistic level. The dimensions related to the third factor are not related in any way to how the risk management system is organized but what risks are taken into consideration.

Table 9. Geomin Rotated Loadings for the Four Factor Model

	Factor Loadings					Factor Loadings			
d	1	2	3	4	d	1	2	3	4
1	**0.33**	0.20	0.24	-0.13	25	-0.06	-0.03	**0.78**	0.23
2	**0.33**	0.23	0.20	-0.06	26	-0.02	-0.06	**0.78**	0.24
3	**0.71**	-0.06	-0.10	-0.10	27	-0.06	0.25	**0.43**	-0.23
4	**0.94**	0.01	-0.24	-0.03	28	0.10	0.31	**0.69**	-0.34
5	**0.71**	0.05	0.02	-0.04	29	0.07	0.29	**0.69**	-0.32
6	**0.38**	0.13	0.17	0.10	30	0.11	**0.66**	-0.01	-0.05
7	**0.36**	-0.01	0.16	0.03	31	0.13	**0.72**	0.03	-0.09
8	**0.75**	0.05	-0.05	-0.02	32	0.28	**0.57**	0.07	0.14
9	**0.50**	0.27	0.01	-0.06	33	0.15	**0.50**	0.08	0.22
10	**0.73**	0.13	-0.04	-0.15	34	-0.08	**0.75**	0.09	0.23
11	**0.71**	0.02	0.01	0.10	35	0.09	**0.62**	0.09	0.06
12	**0.69**	-0.02	0.09	0.14	36	0.24	**0.58**	0.14	0.12
13	**0.58**	0.01	0.15	0.30	37	0.02	**0.60**	0.32	0.17
14	0.23	0.24	0.02	**0.53**	38	-0.06	**0.72**	0.25	0.22
15	0.26	0.21	-0.07	**0.53**	39	0.28	**0.55**	0.09	-0.02

	Factor Loadings						Factor Loadings				
d	1	2	3	4		d	1	2	3	4	
16	**0.40**	0.15	0.09	**0.43**	*	40	-0.13	**0.62**	0.09	0.18	
17	**0.40**	-0.02	-0.04	**0.55**	*	41	0.21	**0.73**	-0.07	0.14	
18	0.26	0.12	-0.12	**0.66**		42	0.07	**0.82**	-0.07	0.01	
19	**0.46**	0.15	0.05	**0.43**	*	43	-0.11	**0.83**	-0.05	0.05	
20	0.21	0.08	**0.51**	-0.18		44	0.10	**0.58**	-0.07	-0.11	
21	**0.63**	-0.21	**0.41**	0.01	*	45	-0.08	**0.82**	-0.19	-0.09	
22	**0.62**	-0.29	**0.42**	0.05	*	46	-0.15	**0.88**	-0.05	0.03	
23	-0.01	0.22	**0.60**	0.00		47	0.11	**0.75**	-0.16	-0.10	
24	-0.04	0.22	**0.63**	-0.03		48	0.13	**0.62**	0.04	0.01	

Notes: Bold numbers are loadings greater than 0.32. * Dimension cross loads.

The fourth factor shows the highest loadings for the dimensions related to general control activities, monitoring, and information and communication that are not directly related to risk management.

Factor one and four are not directly related to risk or risk management. Two and three are related to risk management and the organization of the risk management system.

Some dimensions have loadings higher than 0.32 on more than one factor. These cross loadings are in line with the component designations discussed above in all cases but one. Dimensions 16, 17, and 19 cross load between factors one and four, and dimensions 21 and 22 cross load between factors one and three. Dimension 16 relates to the ethics of the firm given that if they have implemented this dimension there are communication channels in place to deal with breaches of law, regulations, and/or other improprieties. Dimension 19 addresses the monitoring of the internal environment. Dimension 16 and 19 are considered logical as cross loading elements given the factor designations above. While they do address non-risk related information and communication and monitoring, they also pertain to the general internal environment of the firm. Dimension 17 does not have the same logical interpretation for cross loading as it pertains to communication with external stakeholders and therefore has nothing to do with the internal environment or objective setting of the firm. This cross loading is therefore not included in the final model.

Dimensions 21 and 22 both address risk identification and risk assessment of strategic risk. It is therefore logical that it cross loads between the risk identification and risk assessment component (factor three) as well as the objective setting component (factor one).

Correlations of the resulting factors can be found below in Table 10. Given the size of some of the correlations, oblique rotation is deemed appropriate.

Table 10. Estimated Factor Correlations for the Four Factor Model

Factor	1 General Internal Environment and Objective Setting	2 Holistic Organization of Risk Management	3 Specific Risk Identification and Risk Assessment Activities	4 General Control Activities and Information and Communication
1	1.000	-	-	-
2	0.461	1.000	-	-
3	0.332	0.321	1.000	-
4	0.098	0.232	0.151	1.000

Sample Suitability

A number of rules of thumb exist regarding necessary sample sizes for exploratory factor analysis. Comrey and Lee (1992) suggest that a sample size of 50 is very poor, 100 is poor, 200 is fair, 300 is good, 500 is very good, and 1000 is excellent. Based on this guide, the sample used in this study falls between poor and fair. However, sample size rules of thumb fail to take into account many of the complex dynamics of factor analysis (Henson & Roberts, 2006). MacCallum, Widaman, Zhang, and Hong (1999) find that sample size adequacy depends on features of the obtained data; having high communalities[11] and having factor saturation (four or more items defining a factor) requires smaller sample sizes for EFA. The sample is sufficiently large to provide a participant-to-factor ratio greater than 20:1, and a 3:1 participant-to-variable ratio, to yield a clear and stable factor structure. Communalities of the resulting factor structure are relatively high, only six of

[11] MacCallum et al. (1999) say greater than 0.60, but Costello and Osborne (2005) suggest 0.40 – 0.70 as more realistic communalities where communalities of less than 0.40 are either not related to the other items or that an additional factor should be explored

which fall below the 0.40 Costello and Osborn (2005) suggestion. There are also few substantial cross-loadings and several dimensions load strongly on each factor. Factor saturation is very high with at least six indicators, but up to 19, for each factor. Overall, a smaller sample, like the one in this study, can be argued as adequate.

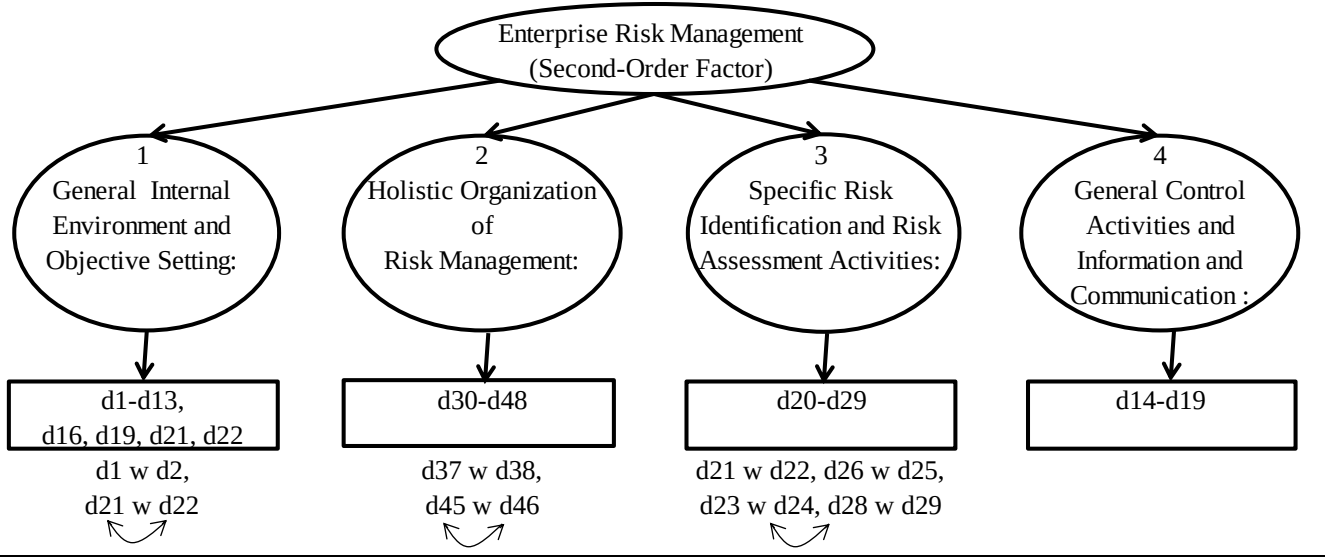
Confirmatory Factor Analysis

Second-Order Factor Model

The underlying component structure revealed by the EFA is a four factor structure. The model is however rather complex given that each dimension loads onto each factor. In a more parsimonious model, dimensions load onto only one factor based on their highest loading. The cross loadings discussed in the previous section that are theoretically substantive are also included in the model. Using confirmatory factor analysis, the model fit for the more parsimonious model can be obtained in addition to modification indices which suggest improvements that can be made for better model fit. (See Appendix 3 for more information on the modifications made to the model.) The parsimonious modified factor structure is then used in a second order factor structure. The four factors become indicators themselves for enterprise risk management. See Figure 6 for the modified second-order factor structure.

Each of the four factors load significantly onto the ERM factor at the 1% level. This model shows good fit and passes all fit tests excluding the chi-square fit test. However, chi-square values are strongly biased against models with a large number of measured variables (Chau & Hocevar, 1995). Given that this study uses 48 indicators for all models, this is a possible explanation for the large chi-square values and the resulting rejection of the null hypothesis. Model fit statistics are: chi-square = 1290.217, chi-square p-value = 0.0000, root mean square error of approximation (RMSEA) = 0.037, Prob. RMSEA <= 0.05 = 0.998, the Bentler Comparative Fit Index (CFI) = 0.960. (See the section on Goodness of Fit Statistics in Appendix 2 for more information on the fit statistics and Appedix 3 for fit statistics for specifications of the model with varying modifications).

Figure 6. Modified Second-Order Enterprise Risk Management Factor Structure



Note: □ denotes observed variables; ○ denotes latent/unobserved variables; d is ERM dimensions number; w is with modification (See Appendix 3 for more information on modifications); factors 1, 2, 3, and 4 are correlated.

Testing A Priori Factor Models

The a priori models tested using confirmatory factor analysis are intuitive factor structures developed based on the study of ERM frameworks (see Table 8).

Table 11 presents the fit statistics resulting from the confirmatory factor analysis of the four a priori models.

The RMSEA tests suggest acceptable fit of all the models. The chi-square test statistics and the CFI tests indicate poor fit of all the models. Good fit of the model is not suggested for any of the a priori models. (See the section on Goodness of Fit Statistics in Appendix 2.2 for more information on the fit statistics).

Based on some tests these models fit the data acceptably. However, model fit of the factor structure developed in this study is better. This is not a surprising result given that it is a data driven model with modifications to enhance fit. However, the final structure through EFA can to some extent be seen as a combination of the a priori models. The model developed in the study has a separation of risk/and non-risk dimensions like the a priori Risk Related model, broader groupings like the General model, and some incorporation of the COSO model.

Table 11. Confirmatory Factor Analysis Goodness of Fit Statistics for A Priori Factor Models

Model	# of Factors	Chi-Square Value	Degrees of Freedom	RMSEA Estimate	RMSEA 90 Percent C.I.			CFI
General	3	1926.712	1077	*0.072*	*0.067*	-	*0.077*	0.851
COSO	7	1809.125	1059	*0.068*	*0.063*	-	*0.074*	0.868
Risk Related	2	1825.556	1079	*0.068*	*0.062*		*0.073*	0.869
General/Risk	5	1693.916	1070	*0.062*	*0.057*		*0.068*	0.890

Notes: Italic numbers indicate values suggesting acceptable fit and bold numbers indicate values suggesting good fit, where good indicates better fit than acceptable. All Chi-square p-values are 0.000. All probabilities that RMSEA <=0.05 are 0.000.

2.4.2 Discussion of the Underlying Components of Enterprise Risk Management

The factor structure developed in this study identifies the four underlying components of ERM implementation – the pillars of ERM. See Figure 7 and Figure 8 for a detailed depiction of the model structure.

Two of the components, related to the general internal environment and control activities of the firm, can be viewed as "prerequisites" of ERM implementation. These components are necessary to have well-functioning and well implemented ERM but are not connected directly to risk management activities nor are they specific to ERM. Therefore, firms with no effort toward holistic risk management, or risk management at all for that matter, can have implemented these two prerequisite components robustly.

The specific risk identification and risk assessment activities identify efforts of the firm to manage certain types of risk: financial, compliance, technology, economic and reputation. This component is an indicator of risk management implementation in a more traditional sense because it says nothing about the organization of the risk management system. Therefore, firms that have robustly or well implemented risk specific identification and assessment may be implementing ERM, but they may also be implementing more traditional forms of risk management, like a less holistic silo-approach where risks are managed separately.

The holistic organization of risk management components is truly the ERM identifier. The dimensions that make up this component are the typical characteristics of ERM addressing the organizational and holistic nature of risk management as ERM prescribes: formal written statement of risk appetite, correlating and determining portfolio effects of combined risks, having a senior manager assigned the responsibility of overseeing risk and risk management, and a formal risk management report submitted to board level regularly.

Firms separate dimensions related to risk from non-risk specific dimensions. This separation is logical given that firms may implement the non-risk related items, for example a code of conduct, but may not be implementing any of the dimensions specific to ERM, for example a formal statement of risk appetite. Additionally, many of the non-risk related items have been the focus of other corporate management tools, like internal and management control, which were stressed for their importance prior to the introduction of ERM.

COSO, for example, had an internal control framework, preceding the ERM framework, which was published in 1992. Therefore, the degree of implementation of the non-risk related components can be related to the implementation of other management functions and not necessarily ERM implementation. Despite the fact that not all components are specific to ERM, using COSO's definition of effectiveness of enterprise risk management, all components being present and functioning properly are important to proper ERM implementation.

The idea that firms implement ERM by dividing between risk and non-risk related dimensions may help in the development of better ERM frameworks. Existing frameworks each have different components in varying number and definition; frameworks often have seven or eight components, twice as many as the number of components identified in this study. The complexity and ambiguity of frameworks makes following ERM implementation guidance complicated. 29% of the firms surveyed for this study stated that they were using more than one framework in order to guide their implementation of ERM. A number of firms also create their own internal frameworks for implementing ERM. Of those who were surveyed and knew which frameworks were followed for implementing ERM, 41% of firms said they used internally created frameworks solely or in combination with other frameworks

The need for more than one framework could be an indication that existing frameworks are to some degree incomplete, are difficult to follow, or conceptualize ERM in a way that is difficult for firms to relate to. Internally created frameworks may also be a result of frameworks which firms cannot identify with.

Theoretically separating risk related dimensions from those that are not directly related to risk and risk management could be a way to improve frameworks and adapt them to how firms are conceptualizing and implementing ERM. A more consolidated framework with broader component definitions may be necessary to better match guidance with how firms implement ERM. If the creators of the frameworks and the "experts" feel that the specificity and separation of ERM components is essential to effective implementation, then the findings of this study suggest that more precise definitions and distinctions between components may be necessary as firms currently do not implement ERM based on existing component definitions and instead implement on broader terms.

Figure 7. Pillars of ERM: Model of the Prerequisites and Risk Management Components

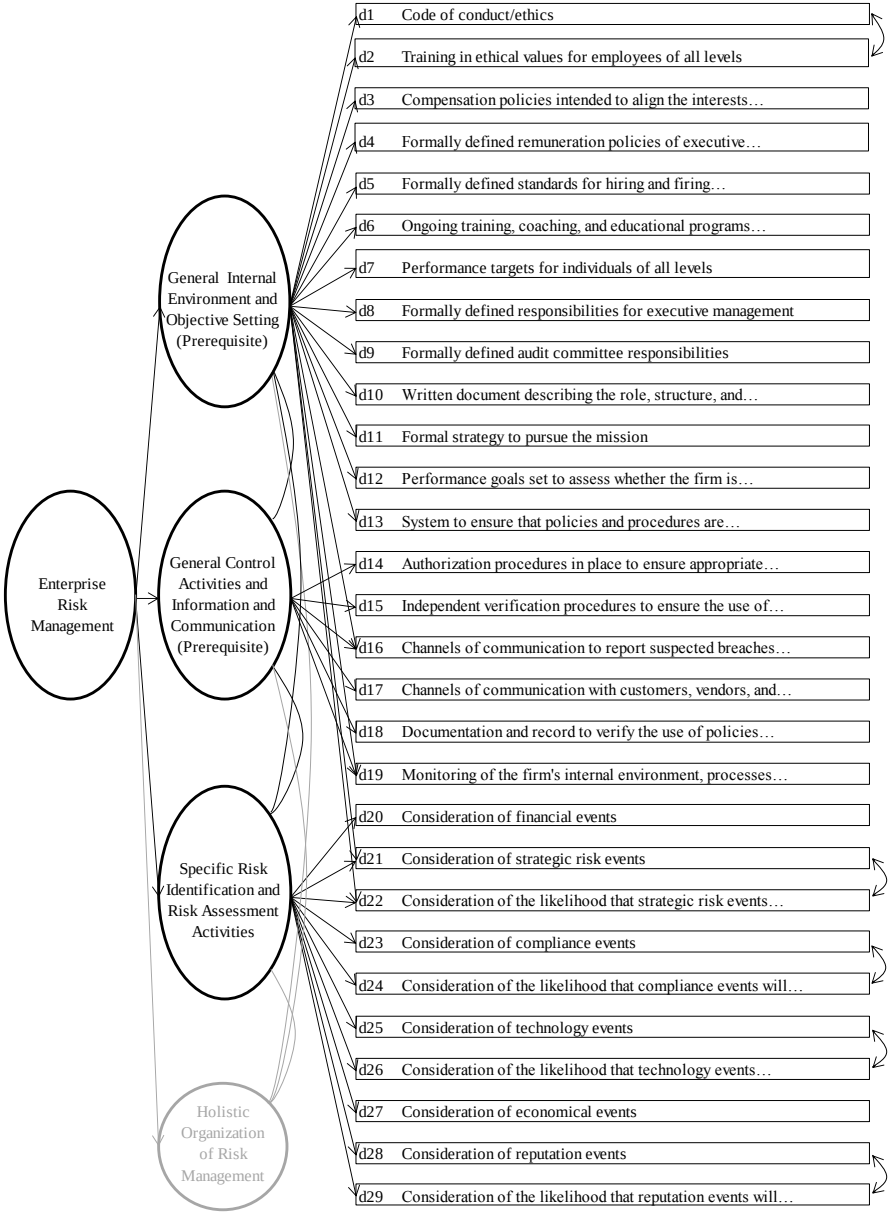
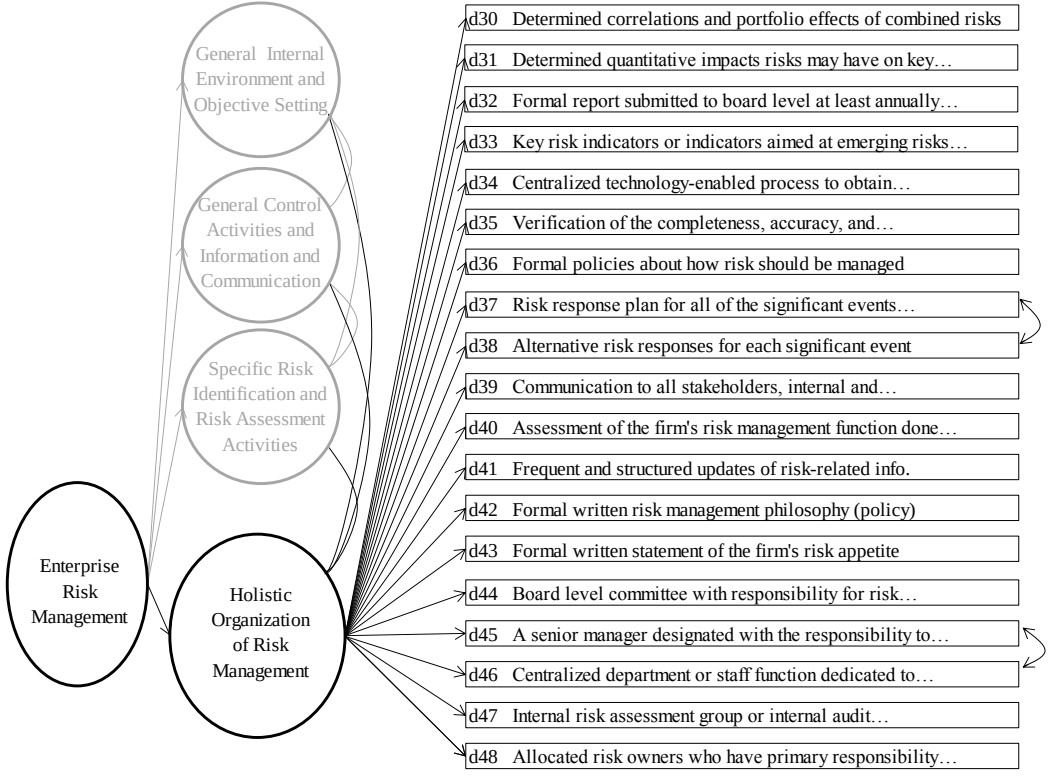


Figure 8. Pillars of ERM: Model of the Holistic Organization of Risk Management Component



The four components have important implications for research in ERM as well. Many researchers using public information searches use simple proxies to identify ERM implementation, like the existence of a Chief Risk Officer (CRO) position or similarly a senior risk officer. However, only 18 of the firms surveyed (1.2 %) reported that they had a CRO, but 73% of the 143 that responded regarding implementation of ERM said they had implemented ERM but improvement was needed, had robustly implemented ERM, or had implemented ERM but according to a definition other than COSO's. Assuming in this case responses to such questions accurately reflect ERM implementation, using a CRO would identify too few firms as ERM implementers.

Comparing to Other ERM Proxies

In order to provide a comparison between the component structure of ERM found in this study and existing measures of ERM, factor scores for the holistic organization factor as well as the second-order ERM factor are calculated. Factor scores are continues values for the latent variables estimated in confirmatory factor analysis. Mplus uses the regression method to calculate factor scores, also known as the modal posterior estimator. Holistic organization scores range from -1.91 to 1.94 with a mean of zero, and second-order ERM scores range from -1.12 to 1.22 with a mean of zero.

Firms are ranked (1 for the highest score and 151 for the lowest) based on their factor scores and then divided into ten groups. These ranked groups are then matched to three proxies similar to those used in existing literature: (1) the number of firms with a CRO, (2) the average level of implementation of a senior risk officer designated with the responsibility to oversee risk and risk management, and (3) the number of firms with a robustly implemented (level three) senior manager. Table 12 shows the groups ranked by either holistic organization scores or second-order ERM scores and the corresponding proxy value for each group.

Firms with higher factor scores generally have more CROs than firms with low scores. This does suggest that firms with more advanced ERM are in fact more likely to have a CRO. The same pattern can be seen for the average level of implementation and the number of firms with a robustly

implemented senior manager[12]. However, this does not suggest that using a CRO is a sufficient indicator on its own.

If the assumption is made that the 76 firms with the highest holistic organization scores are "true" ERM implementers, there is a misclassification of approximately 28% of firms using the CRO proxy; five of the 18 firms with CROs don't actually have high scores for holistic organization implementation. Not to mention, using a CRO as a proxy for ERM will result in a large loss of observations; only 18 of 149 firms have a CRO (49 of 150 have a robustly implemented senior manager).

15% of firms would be misclassified as ERM implementers using a robust senior manager as a proxy; 7 of 49 firms that said they had robust ERM are in the low score group. This misspecification becomes worse with more strict boundaries defining "true" ERM implementers.

By including more dimensions in a measure of ERM and allowing for different levels of ERM in the measure, more of ERM's complexity is accounted for. Since having a CRO or a senior risk manager is one of many dimensions of holistic organization and overall ERM, it alone does not provide robust information regarding a firm's ERM implementation.

[12] The level of implementation of a senior manager is a dimension of the holistic organization factor, so the proxy does directly affect the factor score.

Table 12. CRO and Senior Risk Manager Implementation of Firms Ranked by Holistic Organization or Second-Order ERM Factor Scores

	Chief Risk Officer (CRO)		Implementation of a Senior Manager Designated with the Responsibility to Oversee Risk and Risk Management			
	Number of Firms		Average Level		Number of Firms With Robust (3)	
All Firms	18		1.61		49	
	12.08%				32.67%	
Firm Rank:						
1-16	7	6	2.75	2.25	14	12
17-31	2	2	2.20	2.07	9	9
32-46	2	2	1.87	2.13	6	8
47-61	2	3	2.00	1.73	7	4
62-76	0	1	1.93	1.60	6	3
Total High	13	14	2.16	1.96	42	36
	17.57%	18.92%			55.26%	47.37%
77-91	3	1	1.60	1.90	2	4
92-106	1	3	1.47	1.80	2	5
107-121	1	0	0.80	1.21	1	1
122-136	0	0	0.93	0.73	2	2
137-151	0	0	0.40	0.67	0	1
Total Low	5	4	1.04	1.24	7	13
	6.67%	5.33%			9.46%	17.57%
Rank by:	Holistic Org.	ERM	Holistic Org.	ERM	Holistic Org.	ERM

Notes: Percentages are based on valid N for the top and bottom firms when removing "Don't know" responses. Valid N for CRO is 74 for top firms and 75 for bottom firms. Valid N for senior risk manager 76 for top firms and 74 for bottom firms.

Survey methodology has also been used to ask firms directly about their level of ERM implementation. These measures then rely heavily on a firm's own definition of ERM and the perception of ERM implementation in the firm and may be subject to greater bias based on a firm's desire to be perceived as an ERM implementer.

Table 13 shows the high score and low score groups ranked by holistic organization scores and second-order ERM scores and the average firm response to the degree ERM is implemented. Approximately 70% of firm's perceive themselves as being ERM implementers (score 2, 3, or other definition) even though their second-order factor scores are in the lowest group. Between 17% and 23% perceive themselves as having robustly implemented ERM despite having low scores. This suggests that a direct survey methodology is unreliable.

In order to get as close to as many firms as possible, survey methodology is a valid method. However, asking firms about the underlying dimensions of ERM may be a way of getting more information as well as potentially getting responses subject to less of a window-dressing bias.

Overall, for identifying ERM firms, some or all of the dimensions in the holistic organization component should be incorporated. Using a CRO hire or senior risk manager is shown to be insufficient given the large number of observations lost and the misclassification of firms which reflects that CROs may be hired for signaling purposes and that CROs are not always hired when implementing ERM. Therefore, incorporating multiple dimensions for identification can be a way to more robustly identify ERM firms.

Additionally, if intending to measure ERM implementation, stage, degree, or levels, asking firms directly about ERM may result in misclassification in part due to window-dressing bias. Asking about a number of underlying dimensions may be a way to avoid this flaw. In terms of measurement, all four components should be represented in the measure. The holistic organization component is not sufficient in that case since all of the four components should be implemented robustly. Because the prerequisite components and the risk management component load significantly on a second-order ERM factor, they are important to the assessment of quality or level of ERM implementation. However, these loadings represent the importance of the components to ERM implementation based on how firms have implemented ERM and do not represent the intended importance, as in how guidance and experts would weigh the components.

Table 13. ERM Implementation of Firms Ranked by Holistic Organization or Second-Order ERM Factor Score

	Robustly Implemented (3) COSO ERM		ERM but Improvements Needed (2) Robustly Implemented (3) COSO ERM, and ERM but According to Other Definition		No Implementation At All (0) of ERM	
# of Firms	43		105		13	
(N=143)	30.07%		73.43%		9.09%	
Firm Rank:						
High						
(1-76)	27	31	57	56	7	7
(N=72)	37.50%	42.47%	79.17%	76.71%	9.72%	9.59%
Low						
(77-151)	16	12	48	49	6	6
(N=71)	22.54%	17.14%	67.61%	70.00%	8.45%	8.57%
Rank by:	Holistic Org.	ERM	Holistic Org.	ERM	Holistic Org.	ERM

Notes: Percentages are based on valid N for each group.

2.4.3 Weights of the Determined Factors

The loadings of the four components on a second-order ERM factor give implicit weights of the importance of the factors for ERM implementation. Table 14 shows these implicit weights (factor loadings) estimated with confirmatory factor analysis of the second-order model; they are the normalized standardized factor loadings of the four factors on a second-order factor. Seven experts were also asked to weigh the importance of the four components for efficient and effect ERM implementation and the weights from those seven experts are also provided in Table 14.

The implicit weights from the normalized factor loadings are similar with no component standing out as having a much higher weight. The risk identification and assessment of specific events has the most weight for ERM implementation – based on the data collected. The least weighted component for ERM implementation is the holistic organization of risk management component, which was argued earlier to be the most characteristic factor of ERM.

Kendall's coefficient of concordance suggests that there is no agreement on the weights between experts ($p=0.25$). The average weights suggest that component one, three, and four have equal weight on the effectiveness and quality of ERM implementation. General aspects of control and information and communication that are not risk specific receive the lowest weight on average. Component one, three, and four are all weighted as the most important by more than one expert. Rankings suggest a large amount of discrepancy. Component three has the greatest dispersion in weights, followed by component one. Component two, on the other hand, is the most consistently ranked across experts.

Table 14. Model Implied and Expert Weights of Factors of ERM

	Weights (%)								
		Expert							
Factor	Model Implied	E1	E2	E3	E4	E5	E6	E7	Avg.
General Internal Environment and Objective Setting	26	50	25	30	20	15	15	35	27
General Control Activities and Information and Communication	23	35	20	25	15	10	15	10	19
Specific Risk Identification and Risk Assessment Activities	29	5	15	20	40	25	50	35	27
Holistic Organization of Risk Management	22	10	40	25	25	50	20	20	27

2.4.4 Discussion of the Importance of the Underlying Components for Enterprise Risk Management Implementation

Two conclusions can be taken from analyzing the result of the expert weighting survey: the four components are in fact discrete components that have importance for ERM implementation from one perspective or another and a lack of consensus of what ERM is and what is important to ERM implementation exists not only on framework level but also on the individual level, even for those considered experts.

Motivated by adopting COSO's definition of effective ERM for the four components in this study, all four components are argued to be important to ERM implementation; because each component receives relatively high weights from at least one expert, this definition of effective ERM is supported. The lack of agreement of which has the highest importance would suggest that the four components are in fact distinct from one another and all hold value in the implementation of ERM.

The lack of agreement also highlights the lack of consistency in defining what ERM looks like. Seven experts do not agree on which component holds the most weight in effective and well implemented ERM; this suggests that there are many different opinions and approaches to implementing ERM. While this is not necessarily surprising given the holistic and ambiguous nature of ERM, it highlights a problem and source of uncertainty regarding ERM implementation. Though ERM is not likely to ever become a fully prescriptive, crystal clear tool because of its culturally laden holistic nature, the inconsistencies in the expert weights suggest that a more concise and consistent way of conceptualizing ERM may be needed in order to aid firms in implementing ERM.

2.5 Conclusion

Based on the identified pillars, it would be advisable for frameworks to adapt to better fit how firms implement ERM, namely by altering components to reflect a separation of risk and non-risk related dimensions and by conceptualizing components on a broader level. By adapting frameworks to how ERM is actually implemented in firms, dissatisfaction and uncertainty about ERM implementation could be mitigated by creating guidance that can be better identified with by the user. Evidence from the expert weighting process suggests that there is little agreement on the actual importance of the components of ERM; this suggests the need of a more consistent definition of ERM and a more consistent set of implementation recommendations. The four pillars of ERM developed in this study can be used to create a consistent conceptualization on ERM based on how firms are actually implementing ERM dimensions. Future research should test the factor structure found in this study for other samples to confirm their relevance outside of the Nordic region, although it is not suspected that these pillars are country specific. Further analysis of the four components should focus on which, if any, of the components are value creating; this would shed more light on which

components are the most important for achieving the ultimate goal of value creation.

Many of the dimensions used in this study require direct contact with the firm in order to assess the level of implementation; therefore, studies using publically available information will not be effective in identifying true ERM implementation and/or measuring levels of implementation. A suggestion for future research is to investigate if and which dimensions can in fact be found in publically available information or proxyed with publically available information without altering the measurement of the components and ERM. The results also stress the methodological flaw of proxying ERM with single and/or oversimplified indicators. Based on the findings that the components are in fact four distinct components, representing only one component by using the existence of a CRO as an indication of ERM implementation is an incomplete measure; it results in the reduction in number of available observations as well as misclassification of firms. Multiple dimensions should be incorporated for robust identification purposes. When measuring ERM implementation levels, all four components should be represented in the measure since they all have a significant relationship to the overall level of ERM. Until more work can be done to reduce the number of necessary dimensions for identification or measurement or create more easily available proxies for the dimensions, it is suggested that the same survey methodology and resulting factor scores are used to identify and measure ERM implementation.

The four pillars of ERM implementation define what ERM is based on how firms implement ERM dimensions. ERM is all four components present and functioning properly at one time. With a consistent definition of what ERM is that reflects how firms understand implementation, better guidance can be developed to aid firms in the implementation process and better and more informative empirical studies on value creating abilities of ERM can be done.

Appendix 2.1: Questionnaire Dimensions and Summary Statistics

Q#		Dimension	Mean	Std.	Skew	Kurtosis
Q1.1	d1	Code of conduct/ethics	2.25	0.82	-1.01	0.59
Q1.2	d2	Training in ethical values for employees of all levels	1.66	0.92	-0.40	-0.61
Q1.3	d3	Compensation policies intended to align the interests of managers and shareholders (i.e., balance short- and long-term)	2.21	1.02	-1.11	0.03
Q1.4	d4	Formally defined remuneration policies of executive management	2.64	0.78	-2.30	4.44
Q1.5	d5	Formally defined standards for hiring and firing of executive management	2.21	1.04	-0.98	-0.41
Q1.6	d6	Ongoing training, coaching, and educational programs available to employees of all levels	1.70	0.87	-0.10	-0.71
Q1.7	d7	Performance targets for individuals of all levels	1.84	0.98	-0.36	-0.93
Q1.8	d8	Formally defined responsibilities for executive management (authority and accountability)	2.58	0.65	-1.56	2.44
Q1.9	d9	Formally defined audit committee responsibilities	2.43	0.95	-1.64	1.54
Q1.10	d10	Written document describing the role, structure, and responsibilities of the board	2.78	0.52	-2.61	7.50
Q1.11	*	Formal mission (vision/purpose) statement	2.63	0.67	-2.10	4.73
Q1.12	d11	Formal strategy to pursue the mission	2.45	0.71	-1.37	2.04
Q1.13	*	Formal business objectives/plan in place to execute the strategy	2.38	0.70	-1.03	1.11
Q1.14	d12	Performance goals set to assess whether the firm is achieving its objectives/plan	2.38	0.76	-1.15	0.95

Q#		Dimension	Mean	Std.	Skew	Kurtosis
Q1.15	d13	System to ensure that policies and procedures that are in place to manage the achievement of the firm's objectives/plan are functioning and effective.	2.06	0.73	-0.41	-0.12
Q2.1	d14	Authorization procedures in place to ensure appropriate individuals review the use of policies and procedures	2.13	0.88	-0.87	0.15
Q2.2	d15	Independent verification procedures to ensure the use of policies and procedures	1.69	0.98	-0.21	-0.95
Q2.3	d16	Channels of communication to report suspected breaches of laws, regulations, and other improprieties	1.78	1.08	-0.34	-1.17
Q2.4	d17	Channels of communication with customers, vendors, and other external parties	2.10	0.92	-0.79	-0.24
Q2.5	d18	Documentation and record to verify the use of policies and procedures	1.90	0.80	-0.31	-0.40
Q2.6	d19	Monitoring of the firm's internal environment, processes, and control activities	2.11	0.81	-0.52	-0.45
Q3.1	d20	Consideration of financial events	2.85	0.40	-2.59	6.33
Q3.1a	*	Consideration of the likelihood that financial events will affect the firm’s ability to achieve its objectives	2.74	0.50	-2.03	5.40
Q3.1b	*	Consideration of the potential impact that financial events will have on the firm’s ability to achieve its objectives	2.68	0.53	-1.71	3.58
Q3.2	d21	Consideration of strategic risk events	2.57	0.60	-1.23	1.50
Q3.2a	d22	Consideration of the likelihood that strategic risk events will affect the firm’s ability to achieve its objectives	2.57	0.57	-0.94	-0.11

Q#		Dimension	Mean	Std.	Skew	Kurtosis
Q3.2b	*	Consideration of the potential impact that strategic risk events will have on the firm's ability to achieve its objectives	2.53	0.63	-1.03	-0.01
Q3.3	d23	Consideration of compliance events	2.44	0.64	-0.71	-0.49
Q3.3a	d24	Consideration of the likelihood that compliance events will affect the firm's ability to achieve its objectives	2.26	0.68	-0.64	0.36
Q3.3b	*	Consideration of the potential impact that compliance events will have on the firm's ability to achieve its objectives	2.27	0.66	-0.49	-0.02
Q3.4	d25	Consideration of technology events	2.40	0.67	-0.79	0.15
Q3.4a	d26	Consideration of the likelihood that technology events will affect the firm's ability to achieve its objectives	2.27	0.79	-0.78	-0.19
Q3.4b	*	Consideration of the potential impact that technology events will have on the firm's ability to achieve its objectives	2.27	0.77	-0.78	-0.04
Q3.5	d27	Consideration of economical events	2.77	0.48	-1.98	3.21
Q3.5a	*	Consideration of the likelihood that economical events will affect the firm's ability to achieve its objectives	2.74	0.55	-2.24	5.25
Q3.5b	*	Consideration of the potential impact that economical events will have on the firm's ability to achieve its objectives	2.72	0.55	-1.79	2.31
Q3.6	d28	Consideration of reputation events	2.44	0.61	-0.59	-0.57
Q3.6a	d29	Consideration of the likelihood that reputation events will affect the firm's ability to achieve its objectives	2.35	0.66	-0.50	-0.69

Q#		Dimension	Mean	Std.	Skew	Kurtosis
Q3.6b	*	Consideration of the potential impact that reputation events will have on the firm's ability to achieve its objectives	2.33	0.69	-0.54	-0.80
Q4.1	d30	Determined correlations and portfolio effects of combined risks	1.17	1.00	0.37	-0.95
Q4.2	d31	Determined quantitative impacts risks may have on key performance indicators	1.72	0.94	-0.13	-0.94
Q4.3	d32	Formal report submitted to board level at least annually on the current state of risk and effectiveness of risk management	2.29	0.90	-1.18	0.55
Q4.4	d33	Key risk indicators or indicators aimed at emerging risks (not historical performance)	1.77	1.00	-0.37	-0.91
Q4.5	d34	Centralized technology-enabled process to obtain risk-related information	1.12	1.10	0.41	-1.22
Q4.6	d35	Verification of the completeness, accuracy, and validity of risk-related information	1.69	0.95	-0.35	-0.74
Q4.7	d36	Formal policies about how risk should be managed	2.11	0.86	-0.81	0.11
Q4.8	d37	Risk response plan for all of the significant events the firm has identified	1.72	0.96	-0.31	-0.82
Q4.9	d38	Alternative risk responses for each significant event	1.53	0.94	0.02	-0.86
Q4.10	d39	Communication to all stakeholders, internal and external, of the importance of risk management	1.79	0.97	-0.22	-1.01
Q4.11	d40	Assessment of the firm's risk management function done by an independent/external party	1.23	1.12	0.32	-1.28
Q4.12	d41	Frequent and structured updates of risk-related information	1.70	0.96	-0.26	-0.86

Q#		Dimension	Mean	Std.	Skew	Kurtosis
Q4.13	d42	Formal written risk management philosophy (policy) (a *set of shared beliefs and attitudes characterizing how the firm considers risk in everything it does and delineates the responsibility of management and the board*)	1.78	1.01	-0.44	-0.85
Q4.14	d43	Formal written statement of the firm's risk appetite (*the amount of risk specified at the board level that the firm is willing to accept in pursuit of value*)	1.40	1.08	0.09	-1.27
Q4.15	*	Risk tolerances (*formal guidelines or measures used at appropriate levels to assess whether the firm will accept risk)*	1.38	1.05	0.06	-1.20
Q5.1	d44	Board level committee with responsibility for risk management oversight	1.46	1.28	-0.03	-1.69
Q5.2	d45	A senior manager designated with the responsibility to oversee risk and risk management	1.61	1.22	-0.20	-1.54
Q5.3	d46	Centralized department or staff function dedicated to risk management	1.08	1.25	0.55	-1.41
Q5.4	d47	Internal risk assessment group or internal audit function given the responsibility to evaluate the ongoing effectiveness of the firm's risk management	1.21	1.14	0.31	-1.36
Q5.5	d48	Allocated risk owners who have primary responsibility and accountability for managing risk within their respective areas	1.56	1.18	-0.11	-1.49

Notes: * Removed for multicollinearity/consistency reasons

Appendix 2.2: Factor Retention Decision

Determining the number of factors to retain is one of the most significant decisions when conducting exploratory factor analysis. It is important to balance parsimony and simplicity of models with plausibility (Fabrigar, Wegener, MacCallum, & Strahan, 1999). This study employs four different tests for factor retention: Kaiser Criterion, scree test, parallel analysis, and goodness of fit statistics. Additionally, the number of factors retained is considered based on their interpretability. The analysis uses the questionnaire responses for the 48 dimensions of ERM reaming after elimination of dimensions for multicollineraity concerns.

Kaiser Criterion

The Kaiser criterion rule is to retain factors with eigenvalues greater than one. The eigenvalues for the sample correlation matrix are given in Table 15. Based on the Kaiser criterion, 11 factors should be retained.

The Kaiser criterion has been found to lead to substantial over factoring (Fabrigar et al., 1999). Fabrigar et al. (1999) state that they know of no study in which this rule works well for determining the number of factors to retain.

Table 15. Eigenvalues for the Sample Correlation Matrix

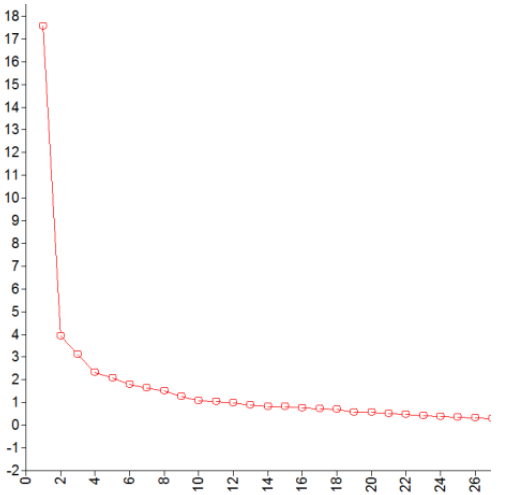
Factor #	Eigenvalues	Factor #	Eigenvalues
1	17.554	8	1.52
2	3.936	9	1.245
3	3.107	10	1.078
4	2.313	11	1.033
5	2.064	12	0.983
6	1.783	13	0.875
7	1.628	14	0.819

Scree Test

In comparison, the scree plot (Figure 9) suggests the retention of three to nine factors. The last substantial drop in magnitude of eigenvalues is unclear. This

speaks to the subjectivity of using the scree plot (Kaiser, 1970) since there is no clear definition of "substantial".

Figure 9. Scree Plot



Parallel Analysis

Hayton, Allen, and Scarpello (2004) argue that parallel analysis (PA) is one of the most accurate factor retention methods. PA involves constructing a number of correlation matrices of random variables based on the same sample size and number of variables in the real data set. Average eigenvalues from the random sets are then compared to those of the real data set. Factors corresponding to actual eigenvalues that are greater than the parallel average random eigenvalues should be retained (Hayton et al., 2004). A parallel analysis is done using 50 random samples with 151 cases and 48 variables. Resulting eigenvalues can be seen in Table 16 on the next page. The appropriate number of factors to retain, using the stricter criteria of the 95th percentile, is four.

Table 16. Random Sample Eigenvalues from the Parallel Analysis and Actual Sample Eigenvalues

	Factor #									
	1	2	3	4	5	6	7	8	9	10
Average Random Sample Eigenvalues	2.521	2.345	2.226	2.110	2.026	1.940	1.851	1.773	1.709	1.635
95th Percentile Random Sample Eigenvalues	2.675	2.481	2.312	2.209	2.114	2.016	1.925	1.823	1.761	1.680
Actual Sample Eigenvalues	**17.554**	**3.936**	**3.107**	**2.313**	2.064	1.783	1.628	1.520	1.245	1.078

Notes: Actual sample eigenvalues greater that the 95th percentile random sample eigenvalues are in bold.

Goodness of Fit Statistics

Goodness of fit statistics obtained for different factor models can be used in order to compare and decide on the proper number of factors to retain. Instead of analyzing the eigenvalues obtained, one can conceptualize the decision regarding the number of factors to retain as choosing the most appropriate model from a series of models with alternative factor numbers (Fabrigar et al., 1999). Relevant fit statistics are: chi-square test of model fit, root mean square error of approximation (RMSEA), the Bentler Comparative Fit Index (CFI), and standardized root mean square residual (SRMR).

About Goodness of Fit Statistics

The chi-square test of model fit, also called the likelihood ratio statistic, is used to test the null hypothesis that the model holds exactly in the population with a given number of common factors (Fabrigar et al., 1999). The chi-square test has an exact-fit hypothesis which tests that there are no discrepancies between the population covariances and those predicted by the model; it is actually a "badness-of-fit" model. A chi-square value of zero indicates perfect fit between the data and the theoretical model. P-values from the chi-square test are ideally greater than 0.05 in order to *not* reject the exact-fit hypothesis at the 0.05 level (Kline, 2011).

Root mean square error of approximation (RMSEA) is an estimate of the discrepancy between the model and the data per degree of freedom for the model (Fabrigar et al., 1999). It is a measure of the overall difference between observed and predicted correlations. Values less than 0.05 constitute a "good fit" of the data to the model, values in the range of 0.05 to 0.08 suggest "acceptable fit", values between 0.08 and 0.10 are considered "marginal fit", and values greater than 0.10 are evidence of "poor fit" (Browne & Cudeck, 1992). Should the upper bound of the 90% confidence interval indicate "poor fit," the model warrants less confidence. The probability that RMSEA is less than 0.05 is an accept-support test where failure to reject this null hypothesis (that RMSEA <= 0.05) favors the researcher's model (Kline, 2011).

CFI, or the Bentler Comparative Fit Index, is an incremental fit index that measures the relative improvement in the fit of a model over that of a baseline mode (Kline, 2011). The baseline model in Mplus has uncorrelated outcomes with unrestricted variances and unrestricted means/thresholds. Values generally range from zero to one, and the suggested cut off for

considering a model a good fit is a CFI value greater than 0.95 (Muthén & Muthén, 1998-2004).

The standardized root mean square residual test of fit (SRMR) is a measure of the mean absolute correlation residual, the overall difference between the observed and predicted correlations (Kline, 2011). Hu and Bentler (1998) suggest that acceptable model fit is indicated by a SRMR <= 0.08.

Goodness of Fit Statistics for Varying Factor Structures

Table 17 shows the goodness of fit statistics for different factor structures.

None of the factor structures reported have p-values greater than 0.05 for the chi-square test, indicating poor fit of all models. Chi-square values are ignored given that Chau and Hocevar (1995) found that the chi-square test statistic is strongly biased against models with a large number of measured variables. Given that this study uses 48 indicators, this is a possible explanation for the large chi-square values and the resulting rejection of the null hypothesis.[13]

A model with only one factor shows acceptable fit according to the estimate value of RMSEA, but the upper bound of the confidence interval shows only marginal fit. The probability of RMSEA being less than 0.05 leads to a rejection of the close-fit hypothesis. With three factors, the close-fit hypothesis is not rejected and the estimated value and confidence interval suggest acceptable fit. Using CFI, good fit is suggested when the model has six factors. Acceptable fit, greater than 0.90, is suggested with a three factor model. Acceptable fit is suggested by the SRMR test for all models with four or more factors.

[13] By reducing the number of indicators for each factor, it is possible to get acceptable chi-square values.

Table 17. Exploratory Factor Analysis Goodness of Fit Statistics for Varying Factor Structures

# of Factors	Chi-Square Value	Degrees of Freedom	RMSEA Estimate	RMSEA 90 Percent C.I.			Prob. RMSEA <= .05	CFI	SRMR
1	2041.170	1080	*0.077*	*0.072*	-	0.082	0.000	0.831	0.124
2	1691.179	1033	*0.065*	*0.059*	-	*0.070*	0.000	0.884	0.103
3	1453.631	987	*0.056*	*0.050*	-	*0.062*	**0.057**	*0.918*	0.086
4	1309.300	942	*0.051*	**0.044**	-	*0.057*	**0.414**	*0.935*	*0.077*
5	1180.378	898	**0.046**	**0.038**	-	*0.053*	**0.844**	*0.950*	**0.068**
6	1079.583	855	**0.042**	**0.033**	-	**0.049**	**0.966**	**0.961**	**0.061**
7	996.178	813	**0.039**	**0.030**	-	**0.047**	**0.992**	**0.968**	**0.055**
8	921.836	772	**0.036**	**0.026**	-	**0.044**	**0.998**	**0.974**	**0.050**
9	843.956	732	**0.032**	**0.020**	-	**0.041**	**1.000**	**0.980**	**0.046**
10	787.577	693	**0.030**	**0.017**	-	**0.040**	**1.000**	**0.983**	**0.043**
11	734.497	655	**0.028**	**0.013**	-	**0.039**	**1.000**	**0.986**	**0.040**

Notes: Italic numbers indicate values suggesting acceptable fit and bold numbers indicate values suggesting good fit, where good indicates better fit than acceptable. All chi-square p-values are 0.000.

Interpretability

It is important to remember that the factor retention decision is a substantive issue as well as a statistical one (Fabrigar et al., 1999). The factors retained should suggest a model that is interpretable and theoretically sensible. Therefore, as a final aspect of the factor retention decision, the suggested factor structures that seem acceptable under the above factor retention procedures are considered based on their interpretability and theoretical sensibility. Because the results of the parallel analysis suggest a four factor model, interpretability of the three, four, and five factor models are considered. The goodness of fit statistics begin to show better fitting models at three factors, and the five factor structure is also looked at as it shows good fit in terms of the majority of the fit statistics.

For the three factor model, which shows acceptable fit using the goodness of fit tests, the factor structure (based on factor loadings) is weak, with a few cross-loadings, dimensions that do not load sufficiently on any factor (loadings less than 0.32), and otherwise low factor loadings (slightly above 0.32). (See Table 18) This model, though it shows acceptable fit and the scree plot potentially indicates three factors, is difficult to interpret in comparison to the four factor model and problematic given the weak factor structure. Therefore, the three factor model is not considered appropriate. Though the four factor model is chosen as superior in this study, the three factor model has a similar factor structure where the four factor model's first and fourth factors are combined into one. Therefore, should one argue for the three factor model, the resulting analysis would be similar.

The four factor model shows a relatively clear and strong factor structure and yields interpretable factors (See Table 19). Only a few factors have cross loadings (in which case the majority are reasonable and interpretable) and most dimensions show adequate loadings of 0.32 or higher, with most loadings being higher than 0.50. (See section 2.4.1 and 2.4.2 for further detail on this factor structure). 88% of the communalities are greater than 0.40, the cutoff suggested by Costello and Osborn (2005). Additionally, each factor has at least six defining items.

The five factor model becomes difficult to interpret and has a number of problematic cross loadings (See Table 20). The addition of the fifth factor creates a factor that is difficult to interpret given that the dimensions that load on the fifth factor are hard to relate to one another and additionally cross load

with other factors. The problem of interpretability and cross loading becomes further exacerbated with the addition of a sixth factor.

Summary of the Factor Retention Analysis

Based principally on the results from the parallel analysis, comparison of goodness of fit statistics, and interpretability, the resulting factor structure from the exploratory factor analysis is a four factor model.

Table 18. Geomin Rotated Loadings for the Three Factor Model

	Factor				Factor		
d	1	2	3	d	1	2	3
1	0.265	0.172	0.283	25	0.038	0.019	**0.758**
2	0.286	0.225	0.222	26	0.084	0.007	**0.741**
3	**0.634**	-0.092	-0.021	27	-0.108	0.195	**0.453**
4	**0.899**	-0.039	-0.153	28	0.009	0.219	**0.760**
5	**0.680**	0.018	0.062	29	-0.021	0.220	**0.751**
6	**0.382**	0.169	0.157	30	0.043	**0.656**	0.036
7	**0.338**	0.010	0.169	31	0.054	**0.701**	0.074
8	**0.689**	0.030	0.018	32	0.266	**0.622**	0.066
9	**0.441**	0.245	0.069	33	0.185	**0.571**	0.041
10	**0.653**	0.054	0.072	34	-0.038	**0.815**	0.063
11	**0.691**	0.059	0.020	35	0.068	**0.647**	0.098
12	**0.681**	0.032	0.090	36	0.231	**0.623**	0.134
13	**0.637**	0.113	0.084	37	0.039	**0.668**	0.283
14	**0.405**	**0.398**	-0.136	38	-0.023	**0.792**	0.210
15	**0.424**	**0.368**	-0.225	39	0.226	**0.555**	0.118
16	**0.519**	0.288	-0.025	40	-0.097	**0.672**	0.062
17	**0.559**	0.151	-0.194	41	0.179	**0.770**	-0.050

	Factor				Factor		
d	1	2	3	d	1	2	3
18	**0.483**	0.314	-0.317	42	0.012	**0.830**	-0.021
19	**0.570**	0.284	-0.046	43	-0.141	**0.847**	-0.026
20	0.165	0.036	**0.532**	44	0.000	**0.556**	0.007
21	**0.620**	-0.190	**0.404**	45	-0.176	**0.795**	-0.098
22	**0.692**	-0.257	**0.402**	46	-0.204	**0.893**	0.002
23	0.026	0.238	**0.553**	47	-0.006	**0.735**	-0.073
24	-0.005	0.224	**0.575**	48	0.081	**0.631**	0.080

Notes: Bold numbers are loadings greater than 0.32.

Table 19. Geomin Rotated Loadings for the Four Factor Model

	Factor					Factor			
d	1	2	3	4	d	1	2	3	4
1	**0.331**	0.197	0.242	-0.125	25	-0.063	-0.033	**0.776**	0.232
2	**0.328**	0.233	0.198	-0.056	26	-0.015	-0.060	**0.776**	0.240
3	**0.707**	-0.055	-0.096	-0.104	27	-0.056	0.249	**0.431**	-0.230
4	**0.940**	0.006	-0.243	-0.032	28	0.097	0.305	**0.692**	-0.342
5	**0.710**	0.045	0.017	-0.036	29	0.065	0.293	**0.686**	-0.315
6	**0.380**	0.130	0.167	0.103	30	0.112	**0.662**	-0.009	-0.053
7	**0.355**	-0.011	0.161	0.034	31	0.129	**0.716**	0.025	-0.086
8	**0.748**	0.046	-0.053	-0.017	32	0.275	**0.573**	0.069	0.140
9	**0.500**	0.268	0.009	-0.063	33	0.150	**0.504**	0.077	0.215
10	**0.731**	0.129	-0.043	-0.151	34	-0.083	**0.753**	0.092	0.231
11	**0.711**	0.021	0.011	0.103	35	0.089	**0.624**	0.089	0.057
12	**0.686**	-0.019	0.094	0.139	36	0.239	**0.582**	0.136	0.115
13	**0.579**	0.011	0.150	0.296	37	0.019	**0.600**	0.315	0.168
14	0.226	0.240	0.019	**0.534**	38	-0.062	**0.715**	0.249	0.222
15	0.257	0.212	-0.073	**0.534**	39	0.278	**0.550**	0.091	-0.023
16	**0.402**	0.152	0.094	**0.425**	40	-0.131	**0.618**	0.093	0.177

	Factor					Factor			
d	1	2	3	4	d	1	2	3	4
17	0.400	-0.023	-0.044	**0.552**	41	0.205	**0.726**	-0.068	0.135
18	0.259	0.124	-0.117	**0.656**	42	0.073	**0.819**	-0.068	0.014
19	**0.461**	0.149	0.054	**0.428**	43	-0.111	**0.830**	-0.051	0.053
20	0.206	0.077	**0.511**	-0.179	44	0.100	**0.577**	-0.066	-0.111
21	**0.630**	-0.208	**0.409**	0.010	45	-0.077	**0.817**	-0.187	-0.088
22	**0.619**	-0.285	**0.424**	0.050	46	-0.150	**0.880**	-0.045	0.025
23	-0.010	0.222	**0.604**	0.004	47	0.108	**0.752**	-0.164	-0.095
24	-0.040	0.221	**0.626**	-0.029	48	0.133	**0.619**	0.042	0.010

Notes: Bold numbers are loadings greater than 0.32.

Table 20. Geomin Rotated Loadings for the Five Factor Model

	Factor						Factor					
d	1	2	3	4	5	d	1	2	3	4	5
1	**0.412**	0.167	-0.125	0.181	0.045	25	**0.620**	0.042	-0.017	0.030	-0.684
2	**0.372**	0.208	-0.050	0.149	0.044	26	**0.613**	0.018	0.013	0.050	-0.609
3	**0.489**	-0.089	-0.013	0.074	**0.436**	27	-0.027	0.081	-0.151	**0.591**	-0.031
4	**0.664**	0.027	0.054	-0.112	**0.538**	28	0.163	0.054	-0.186	**0.844**	-0.003
5	**0.565**	0.010	0.046	0.093	**0.324**	29	0.163	0.084	-0.194	**0.770**	-0.049
6	**0.471**	0.149	0.094	-0.022	-0.047	30	-0.122	**0.604**	0.022	0.248	0.203
7	**0.606**	0.088	-0.063	-0.217	-0.132	31	-0.124	**0.645**	0.000	0.313	0.237
8	**0.630**	0.055	0.044	-0.052	**0.320**	32	0.170	**0.544**	0.190	0.107	0.057
9	0.181	0.143	0.096	**0.340**	**0.412**	33	0.050	**0.475**	0.260	0.105	-0.016
10	**0.509**	0.082	-0.058	0.151	**0.456**	34	-0.063	**0.770**	0.210	0.000	-0.177
11	**0.585**	0.002	0.187	0.012	0.229	35	0.037	**0.610**	0.068	0.119	0.003
12	**0.741**	0.015	0.166	-0.133	0.041	36	0.144	**0.535**	0.163	0.192	0.045
13	**0.585**	0.005	**0.352**	-0.032	-0.028	37	0.114	**0.559**	0.156	0.208	-0.220
14	0.081	0.207	**0.607**	-0.01	-0.091	38	-0.02	**0.680**	0.219	0.178	-0.227
15	-0.012	0.170	**0.643**	0.009	0.040	39	0.108	**0.477**	0.057	0.272	0.178

	Factor						Factor				
d	1	2	3	4	5	d	1	2	3	4	5
16	0.157	0.041	**0.579**	0.216	0.075	40	-0.119	**0.617**	0.169	0.045	-0.168
17	0.185	-0.065	**0.658**	-0.029	0.026	41	0.037	**0.728**	0.173	0.021	0.111
18	0.022	0.114	**0.739**	-0.114	-0.031	42	-0.031	**0.839**	0.021	-0.001	0.079
19	0.290	0.092	**0.518**	0.080	0.046	43	-0.216	**0.844**	0.052	0.035	0.007
20	**0.325**	-0.063	-0.122	**0.511**	-0.035	44	0.118	**0.627**	-0.148	-0.106	0.067
21	**0.814**	-0.238	-0.006	0.183	-0.021	45	0.087	**0.962**	-0.229	-0.416	-0.056
22	**0.776**	-0.343	0.061	0.226	-0.026	46	0.012	**0.938**	-0.060	-0.227	-0.179
23	0.076	0.020	0.116	**0.638**	-0.202	47	0.036	**0.800**	-0.119	-0.112	0.148
24	0.014	-0.002	0.097	**0.723**	-0.191	48	0.134	**0.631**	-0.004	0.015	0.013

Notes: Bold numbers are loadings greater than 0.32.

Appendix 2.3: Modifications to the Model

Significant improvements to the fit of the model can be made by including the theoretically sound modifications suggested by the confirmatory factor analysis modification index. All modifications made to the model involve allowing the error terms of certain dimensions to covary, "with" relationships. This means that something other than the underlying factor is jointly determining the respective dimensions' implementation. All modifications involved a significant change in chi-square values using chi-square difference testing adjusted for the WLSMV estimation method. Table 21 presents the modifications made to the model and the theoretical justification for respective modifications, and Table 22 presents the goodness of fit statistics for models as modifications are added.

Table 21. Theoretical Reasoning for Maintaining Modifications

	Modification	Reasoning
	Dimensions load onto only one factor based on their highest loading except theoretically reasonable cross-loadings	Parsimony
1	d1 with d2	Both dimensions pertain to the ethics in the firm
2	d22 with d21, d26 with d25	The consideration of events in general and the consideration of how those events affect the firm's ability to achieve its objectives are reasonably affected by similar factors
3	d23 with d24, d28 with d29	Consistency with previous modification
4	d38 with d37	Both dimensions pertain to risk response plans
5	d46 with d45	Both dimensions pertain to the oversight of risk management
	The four factors load onto a higher 2nd order ERM factor	

Table 22. Confirmatory Factor Analysis Goodness of Fit Statistics for Modified Factor Models

Model	Chi-Square Value	RMSEA Estimate	RMSEA 90 Percent C.I.			Prob. RMSEA <= .05	CFI
Exact EFA	1309.300	*0.051*	**0.044**	-	*0.057*	0.414	*0.935*
Parsimonious Model	1419.128	**0.046**	**0.040**	-	*0.053*	**0.814**	*0.939*
+ Modification 1	1408.974	**0.046**	**0.039**	-	*0.052*	**0.851**	*0.940*
+ Modification 2	1339.414	**0.041**	**0.034**	-	**0.048**	**0.985**	**0.952**
+ Modification 3	1336.296	**0.041**	**0.034**	-	**0.048**	**0.986**	**0.952**
+ Modification 4	1314.968	**0.040**	**0.032**	-	**0.046**	**0.994**	**0.956**
+ Modification 5 = **Final Factor Structure**	1290.399	**0.038**	**0.030**	-	**0.045**	**0.998**	**0.960**
2nd Order	1290.217	**0.037**	**0.029**	-	**0.045**	**0.999**	**0.960**

Notes: Italic numbers indicate values suggesting acceptable fit and bold numbers indicate values suggesting good fit, where good indicates better fit than acceptable.

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Chapter 3. Why Firms Implement Risk Governance – Stepping Beyond Traditional Risk Management to Enterprise Risk Management

3.1 Introduction

The recent financial crisis can partially be attributed to failures and weaknesses in corporate governance in firms; specifically, risk management systems failed in many cases due to these corporate governance flaws rather than technical risk estimation models and other traditional risk management techniques (Kirkpatrick, 2009). As a response, regulators, auditors, Boards and risk assessment agencies have pushed for more structured and integrated risk management as a way to increase control of the risk management system. The result is a push from many directions for the implementation of enterprise risk management (ERM)[14]. However, it is not clear if firms are implementing ERM on a superficial basis simply to appease stakeholders or if it is a thoughtful attempt to enhance the governance of the risk management system.

In previous research the motives for ERM implementation are based on an ad hoc collection of theories. There is no consistency or agreement regarding the underlying theoretical foundation for ERM. Some focus on the relationship between corporate governance and ERM (Desender, 2011). Others refer to traditional capital market imperfections motivating traditional risk management activities such as hedging and corporate insurance demand (Liebenberg & Hoyt, 2003; Pagach & Warr, 2011) or a mixture of motives for risk management, motives for corporate governance, and practical motives (Beasley, Clune, & Hermanson, 2005; Gordon, Loeb, & Tseng, 2009). Pulling from existing literature, there are however two general overarching theoretical motives that are applied when motivating ERM implementation: motives for traditional risk management activities and motives for corporate governance. When empirically testing for determinants,

[14] Also referred to as integrated risk management, holistic risk management, strategic risk management, and consolidated risk management.

ERM studies use all-encompassing proxies of ERM like the hiring of a CRO or similar risk management position (Liebenberg & Hoyt, 2003; Pagach & Warr, 2011), a survey response on the firm's level of implementation (Beasley et al., 2005), or an aggregated ERM score made up of a number of dimensions (Desender, 2011; Gordon et al., 2009). While these studies have been an informative first step, they fail to take into account the complex nature of ERM, and the motivations are practical and theoretically unorganized.

The basic argument of this study is that motives for ERM implementation can be better studied by more thoroughly addressing the complexity of ERM; the way to do this is by breaking ERM into its essential parts and identifying determinants of each part. ERM is principally synonymous with integration – taking a portfolio view of firm risks (Bromiley, McShane, Nair, & Rustambekov, 2014). Holistically managing a variety of risks requires a well governed system. ERM can fundamentally be seen as traditional risk management with the addition of risk governance[15]. A traditional risk management process entails individually or in a silo identifying risk, measuring risk, monitoring, and perhaps reporting on risk but with little formality, structure, or centralization; simple examples being an isolated group of individuals in the finance department hedging currency risk or a factory floor manager tracking incidents of injury on the job. Risk governance as used in this study refers to the direction and control of the risk management system. Risk governance provides the structure of the risk management system and specifies responsibilities, authority, and accountability in the risk management system as well as the rules and procedures for making decisions in risk management. Risk governance is the marriage of corporate governance and risk management, and it is the identifying component of an enterprise risk management system. Aebi, Sabato, and Schmid (2012) also define the risk management-related corporate governance mechanisms of ERM as risk governance, and they refer to the hiring of a chief risk officer (CRO) and the line of reporting of that CRO. Risk governance is about encouraging a culture of risk-awareness throughout the firm, having an organizational structure to support the risk management

[15] Risk governance and holistic organization of risk management are interchangeable concepts.

system, and having in place governance mechanisms to oversee the system in a formal manner. ERM is a step beyond traditional risk management where additional efforts are made by the firm to unite the risk management process organizationally across internal systems, processes and people (Culp, 2001). Essentially, firms supplement the traditional risk management process with risk governance to achieve an integrated approach to risk management - ERM.

Given that ERM is a composition of traditional risk management and risk governance, it would be expected that each component has its own determinants and therefore different theoretical explanations. The distinctive set of determinants for risk governance is of particular interest because they address a previously unasked question in the ERM literature: why do firms take the step beyond traditional risk management to ERM implementation by choosing to implement risk governance. Are firms implementing risk governance exclusively because of outside pressure and a desire to window-dress, because of additional capital market imperfection expenses which cannot be mitigated solely with traditional risk management, or because of a need for better governance?

In order to investigate this, public Nordic firms (145 in the final sample) are surveyed in order to get inside the firms and obtain extensive and detailed information on the implementation of risk management. Firms respond with information regarding their degree of implementation of 59 dimensions of ERM, 24 which are directly related to risk management and ERM; few other ERM studies have wide-ranging information like this. Underlying relationships in the implementation of these dimensions are investigated with exploratory factor analysis resulting in a breakdown of ERM into components; in fact, the survey data supports the separation into the two components: traditional risk management and risk governance. Distinct determinants of these two components are estimated simultaneously using structural equation modeling (SEM).

By breaking ERM down into its two fundamental components and using detailed survey data to measure the implementation of those components, the study acknowledges and takes into account the complexity of ERM which is overlooked in previous studies. Motives for traditional risk management and motives for corporate governance, which are referred to in an inconsistent and ad hoc manner in current literature, fall into place as determinants for the respective components. This brings a certain level of clarity to the theoretical

foundation for ERM. It is then possible to investigate the motives for the step of implementing ERM distinct from the motives of simply managing risk.

The results of the study indicate that the two components of ERM do in fact have different determinants and that firms exhibit lower levels of risk governance when they are smaller in size, have higher levels of leverage and dividend payments, and have chief executive officers (CEOs) on the board. The study argues that these findings may be evidence that firms are taking the step of implementing ERM in order to address governance needs in the risk management system, specifically to monitor managers.

The article is organized as follows. In the next section, the two theoretical explanations for enterprise risk management implementation, traditional capital market imperfections and motives for corporate governance, are presented with some of their empirical support. The purpose of the discussion is to build the model tested in the study. In the following section, the methodology is presented with a brief discussion regarding the survey method and developed ERM component structure, followed by an overview of the variables used and the structural equation modeling estimation. Results and analysis follow with final conclusions in the end.

3.2 Background and Conceptual Framework

Though there are a number of working definitions of enterprise risk management, there does exist some consensus regarding what the purpose of ERM is: firm's take a portfolio view of risk instead of managing in silos, they take into account strategic and more qualitative risks, and the focus is not solely on the downside of risk but also opportunity (Bromiley et al., 2014). The move from silo organized risk management to more integrated risk management is one of the characteristic features of ERM. And while strategic and qualitative risks were always managed by someone, as Douglas Barlow said "all management is risk management", ERM prescribes that these risks be managed with all other firm risks holistically.

Occurring at the same time as the emphasis of the benefits of starting an ERM system in order to take a portfolio approach to risk management was the advancement in corporate governance standards to also take into account the risk management system (Kleffner, Lee, & McGannon, 2003). In order to support the complex integration of risks across the firm, more structure, organization, accountability, and communication in the risk management system was necessary. Risk governance (risk management-related corporate

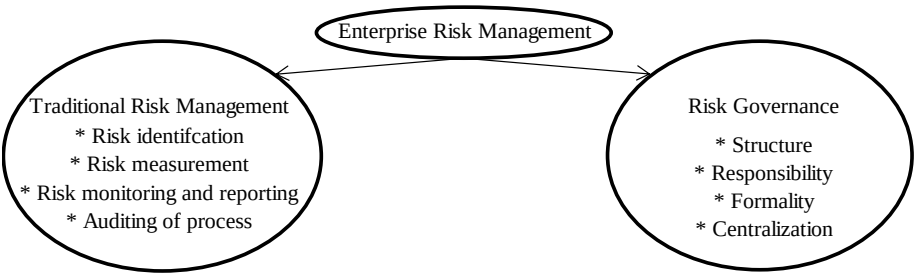
governance mechanisms), like the chief risk officer position, is a structural tool used in order to integrate risks into a single message to senior executives (Aebi et al., 2012); essentially, risk governance supports the process of integrating risks. These structural aspects made ERM a natural solution to the pressures for better governance of the risk management system. ERM began growing in importance because of the increased attention to risk management in the context of corporate governance (Altuntas, Berry-Stölzle, & Hoyt, 2011) creating a sort of shift in the focus of ERM from risk integration to risk governance.

This shift is reflected in announcements of CRO hirings; early announcements of positions of chief risk officer (CRO) focused on the positions role to identify, assess, report and support the management of risks, and recognize and evaluate total corporate risk. However, the perceived responsibility of the CRO changed in post-Enron corporate America into a role intended to put the accountability of risk management in place (Liebenberg & Hoyt, 2003). Risk governance has also become a central focus in ERM studies. For example, Aebi et al. (2012) investigate risk governance's relationship with bank performance and find evidence that firms with risk governance in place perform better than other banks. Many studies use the hiring of a CRO as a proxy of ERM (Beasley, Pagach, & Warr, 2008; Liebenberg & Hoyt, 2003; Pagach & Warr, 2011) which emphasizes the central importance of risk governance in ERM implementation. These studies make an implicit assumption that risk governance facilitates risk integration; nevertheless, it puts the governance aspect in central focus. In addition, a number of studies have identified that firms with ERM have better governance (Altuntas et al., 2011; Baxter, Bedard, Hoitash, & Yezegel, 2013; Gates, 2006). Baxter et al. (2013) argue that increased operating performance and earnings of ERM firms is attributed to investor perceptions of the credibility and persistence of earnings as a result of corporate governance.

While ERM's purpose of achieving risk integration is not under question here, the importance and centrality of risk governance is evident. Adding the risk governance element to more traditional risk management systems is the essential step to ERM implementation and aids the integration of risk management across the firm. The combination of managing all types of firm risk and a well governed system yields an integrated approach to risk management or ERM.

Figure 10 depicts this conceptual breakdown of ERM into the components proposed; the relative size of each component is firm specific. Some firms may excel in risk governance and be considered exemplary ERM implementers; other firms may not have ERM implementation in which case they would have no risk governance and may have ad hoc, "small", traditional risk management.

Figure 10. Proposed Conceptualization of Enterprise Risk Management



The question is: why do some firms implement the additional component of risk governance instead of sticking with more ad hoc risk management practices. The use of theories in empirical studies of ERM determinants is inconsistent and ad hoc and often relies on practical motivations. However, there are two general overarching theoretical explanations for the implementation of ERM which can be pulled from the literature: traditional capital market imperfections and motives for corporate governance. These also fit nicely with the conceptualization of ERM proposed above. Traditional corporate finance theories motivate risk management implementation because of its ability to reduce costs resulting from capital market imperfections and increase firm value. These theoretical arguments do not distinguish between a firm's choice to implement traditional risk management or enterprise risk management; both decisions would likely be influenced by such benefits. ERM also has a strong connection to internal corporate governance controls (Beasley et al., 2005; COSO, 2004; Gordon et al., 2009; Leadbetter, Kovacs, & Harries, 2008; Pang & Shi, 2009). While mitigating costs resulting from managerial incentive problems are incorporated in the traditional capital market imperfection theories for risk management, agency problems of this kind are much more central and prevalent in the motives for corporate governance. Therefore, motives for corporate governance also play a role in the implementation of ERM. Any

conclusions one can come to on the unique motives for risk governance are related to general incentives for corporate governance.

3.2.1 Motives for Traditional Risk Management as Motives for Enterprise Risk Management

Traditional theories motivating risk management are one of the predominant explanations for implementing ERM. Liebenberg and Hoyt (2003) refer to theories that motivate traditional risk management activities such as hedging and corporate insurance demand because at the time documented evidence regarding various aspects of ERM was limited to the trade press and industry surveys and there was a lack of academic literature regarding the determinants of ERM. However, Pagach and Warr (2011) refer to the same theories in their study published eight years later. This also reflects the stagnant nature of the development of a theoretical foundation for ERM.

Studied fervently in the late 1990s, evidence on determinants of a firm's decision to use derivatives supports to varying degrees traditional corporate finance theories motivating hedging. This study pulls from a plethora of risk management derivative and hedging studies (Gay & Nam, 1998; Géczy, Minton, & Schrand, 1997; Howton & Perfect, 1998; Mian, 1996; Nance, Smith, & Smithson, 1993; Samant, 1996; Tufano, 1996) and a recent study with similarities to this one as regards to the geographic area covered by Brunzell, Hansson, and Liljeblom (2011), to select some of the most prominent theoretical motivations for risk management. Traditional theories motivating risk management generally pertain to transaction costs, agency costs and other policy decisions which may substitute for risk management. Many of these studies employ derivative use of one form or another as the focus variable. Of course, not all derivative use is motivated by hedging and risk management. However, Géczy et al. (1997) find that on average the firms in their sample are not speculating, Mian (1996) finds that their results are robust regardless of how firms are treated if it is unclear if they hedge or speculate, and Brunzell et al. (2011) find that a hedging motive dominates derivative use in their sample of Nordic firms.

Transaction costs, in terms of costs of financial distress, are often found to be a significant determinant of hedging (Gay & Nam, 1998; Howton & Perfect, 1998; Samant, 1996; Tufano, 1996). There are also transaction costs associated with corporate risk management in terms of information services, employees, and know-how (Bartram, 2000); empirical support for a positive

and significant relationship between firm size and the use of derivatives is fairly robust (Brunzell et al., 2011; Géczy et al., 1997; Mian, 1996; Nance et al., 1993).

From an agency cost theory perspective, risk management can mitigate the underinvestment problem (Myers, 1977) by reducing the volatility of firm value; these costs are most significant for high growth firms. Gay and Nam (1998) find that each of their five growth proxies (R&D expenses, market-to-book ratio, Tobin's Q, price-to-earnings ratio, and market-adjusted cumulative abnormal return) is positively and significantly related to derivative usage. Additional support can be found in Brunzell et al. (2011) and Samant (1996). Additional agency costs of debt come in the form of debtholders' demands for costly compensation and/or debt covenants in order to block risk shifting from shareholders to debtholders (Smith & Warner, 1979). Risk management can mitigate these agency costs of debt by lowering the riskiness of projects which satisfies both shareholders, who like risk because of the call option nature of their equity holding, and debtholders. Géczy et al. (1997) find those firms with tighter financial restraints and a higher risk of breaking a covenant use currency derivatives to a greater degree.

Theoretically speaking, firms with high levels of debt face greater agency costs resulting from underinvestment problems and/or risk shifting. In addition, they face higher transaction costs of financial distress and more difficulty when coordinating financing and investment strategies. Therefore, one can confidently hypothesize that firms with higher debt levels would implement risk management in order to mitigate these problems. On the other hand, with risk management in place, firms theoretically should be able to hold more debt due to decreased probabilities of financial distress. Therefore, leverage is a determinant, but there is also an important feedback effect that stands out between risk management and debt capacity.

An additional motive of risk management is related to agency costs resulting from the manager and shareholder relationship. Some evidence supports the Smith and Stulz (1985) hypothesis that managers with stock ownership will be more likely to implement risk management due to increased risk aversion (Tufano, 1996), and that managers with option holdings will be less likely to implement risk management given that the value of their options increase with increased risk (Gay & Nam, 1998; Géczy et al., 1997; Tufano, 1996).

There are also a number of corporate policies which can be viewed as substitutes for risk management; this study focuses on two: operative diversification and dividend restriction. Brunzell et al. (2011) suggest that operative diversification decreases the incentive for firms to use derivatives for hedging purposes. They find that firm-level diversification is negatively related to hedging, but that it is positively related to the use of derivatives for speculation. Dividend restriction can also be seen as a policy decision which is substitute to risk management implementation; support can be found for the argument that dividends restrain liquidity and thus imply an incentive to hedge (Géczy et al., 1997; Mian, 1996). However, if you take into account the relationship between growth options and dividend payments, mature firms generally give dividends, and therefore, dividend paying firms generally have less growth options; the relationship between dividends and risk management is then likely to be negative (Bartram, 2000).

The motives for traditional risk management discussed above, transaction costs, agency costs of debt, agency costs of managerial incentives, and policy substitutes, should influence a firm's decision to implement ERM since a purpose of ERM is to manage risk. However, the main identifying feature of ERM is not that the firm manages risk but that it does so in an integrated way. In order to integrate and take the step beyond traditional risk management firms implement risk governance. The risk governance component of ERM may be better explained by the other general overarching motive for ERM - motives related to corporate governance.

3.2.2 Motives for Governance as Motives for Enterprise Risk Management

Nocco and Stulz (2006) argue that ERM can create a long-run competitive advantage for a firm by creating value both on the macro level, by helping the firm maintain access to the capital markets and other resources, and the micro level, by creating a "way of life" for managers and employees at all levels of the company. The macro level benefits are arguably related to the traditional risk management theories in the previous section. The micro level benefits, resulting from the "way of life", are a result of the governance mechanisms in place within the risk management setting.

Integration of risk management and internal control has existed prior to the current emphasis on enterprise risk management and this integration is essential to the perfection of both (Pang & Shi, 2009). A key aspect that

separates enterprise risk management from traditional risk management practices is in fact its relation to internal control. The Committee of the Sponsoring Organizations of the Treadway Commission's (COSO) ERM framework from 2004, one of the most popular ERM frameworks, has strong roots in COSO's 1992 internal control framework. After events like Enron, a heightened concern and a call for risk management prompted COSO to revisit its original framework and update it, leading to the ERM framework (Pang & Shi, 2009). The monitoring, information and communication, and control aspects of ERM are in many ways similar to the original internal control framework. ERM's connection to internal control and the governance imposed on the risk management system by implementing ERM is a central theme in the motivations given for ERM implementation.

Many of the external drivers for ERM implementation are related to a push for firms to have better governance of the risk management system. The Sarbanes-Oxely Act of 2002 placed greater responsibility on the board to understand and monitor firm risks which increased the importance of ERM (Fraser & Simkins, 2010). New York Stock Exchange Listing Standards have mandated the Audit Committee of the board to explicitly oversee risk management and risk management policies, and the U.S. Securities and Exchange Commission (SEC) proxy disclosure rules also require the Board to describe aspects of the oversight of risk management.

Regulatory frameworks have had a significant impact on the increasing popularity of ERM, and in particular financial firms have been greatly influenced by the Basel requirements (Pagach & Warr, 2011). In order to strengthen the supervisory guidance and address flaws in risk management practices which were symptoms of fundamental shortcomings in governance, the Basel Committee on Banking Supervision (2009) provides guidance for firm-wide governance and risk management in their proposal for enhancements of Basel II. Holistic risk management has a longer history in the financial industry, and results from Beasley et al. (2005) show that firms in the banking[16] industry are more likely to implement ERM than other firms. This could be evidence that financial firms are implementing ERM in order to respond to the regulatory push for better governance in the risk management system.

[16] The insurance and education industries were also included in their analysis.

Increased implementation of ERM in firms is often argued to be a result of the increased focus on ERM by rating agencies. In 2008, Standard and Poor's announced its intention to incorporate an ERM analysis into their corporate ratings stating that "ERM will add an additional dimension to our analysis of management and corporate governance, creating a more systematic framework for an inherently subjective topic" (Standard & Poor's, 2008). Though this argument is made over and over again in ERM literature (Pagach & Warr, 2011; Beasley et al., 2008; Hoyt & Liebenberg, 2011; McShane et al., 2011), a direct relationship between a firm having publically rated debt and ERM implementation has never been formally investigated.

Another external pressure is claimed to come from the larger auditing firms, namely the Big Four: PricewaterhouseCoopers, Deloitte Touche Tohmatsu, Ernst & Young, and KPMG. The auditing process can be considered part of the corporate governance system, and therefore having a Big Four auditor puts pressure on firms to exhibit better governance. Beasley et al. (2005) and Desender (2011) both find that having a Big Four auditor has a positive and significant impact on the level of ERM.

Firms may respond to pressure from regulators, rating agencies, and auditing firms by implementing ERM in a true attempt to adhere to the push for better governance of the risk management system. However, in response to purely external pressures, firms may implement ERM in a superficial manner in order to window-dress for these stakeholders. There is however evidence that there are also internal motives for ERM implementation related to corporate governance.

The view of corporate governance which is widely held in accounting and finance relies on agency theory, and key motives for corporate governance are grounded in agency costs of managerial incentives. According to Jensen (1986), conflicts of interest between management and shareholders often lead to value destruction; this can occur when managers act in their own interests by making poor decisions, for example investing in projects with zero net present value. Corporate governance is focused primarily on designing mechanisms that control this type of management behavior.

The risk governance aspects of enterprise risk management have a comparable purpose but in the context of the risk management system. It may not be in the interest of managers to have the additional layer of monitoring and restriction that ERM provides while independent members of the board may favor more comprehensive control, risk management, and internal audit

(Desender, 2011). Desender (2011) finds evidence that board independence is significantly related to ERM when the position of CEO and chairman are held by two different individuals. He argues that CEOs who are also chairman of the board can better withstand pressure from the board to implement ERM.

Agency costs become exacerbated as more free cash flow is available to managers. Therefore, one way to curb management activity is to increase leverage in the firm in order to restrict the free cash flow available for managers' discretion. Managers of highly levered firms are constrained by the reduction of free cash flow, and therefore, agency costs of managerial incentives are mitigated to some degree. This would in turn mean that highly levered firms are in less need of corporate governance mechanisms. Previous ERM studies have found leverage to be significantly and negatively related to ERM implementation (Beasley et al., 2008; Hoyt & Liebenberg, 2011). This is one of the most telling results that indicate that something is motivating ERM implementation besides the traditional motive of reducing financial distress costs. The existing explanation is that shareholders of highly leveraged firms may not want risk reduction since it reduces the value of their option written to them by debtholders, in which case the option value outweighs the deadweight costs of financial distress associated with high levels of leverage (Beasley et al., 2008). However, an explanation grounded in the agency theory of managerial incentives is in line with the findings in Desender (2011) and better matches the conceptualization that risk governance is the identifying component of ERM.

There is also robust evidence that there is a positive relationship between size and ERM (Beasley et al., 2005; Desender, 2011; Liebenberg & Hoyt, 2003; Pagach & Warr, 2011). Desender (2011) argues that larger size firms not only have a different scope of threats but also additional resources to implement ERM and therefore are more likely to have implemented ERM. Large firms may also face greater agency problems due to increased difficulty of monitoring or excess free cash flows and therefore need to compensate with stricter governance mechanisms (Klapper & Love, 2004).

The relation between manager interests and ERM are also touched upon in Pagach and Warr's (2011) study on factors associated with a CRO hire. They find that a CRO hire is positively and significantly related to the sensitivity of the manager's compensation to stock volatility (Vega). This suggests that as compensation becomes more sensitive to stock volatility the likelihood of implementing ERM increases.

The pressures to implement ERM are often referred to in a practical manner; ratings agencies, auditing firms, and regulators are pushing for ERM. This push however is directly related to the pressure for better governance of the risk management system. Firm characteristics related to corporate governance are also often associated with ERM implementation. Motives for corporate governance are generally not highlighted in empirical studies on the determinants of traditional risk management. It is therefore reasonable to assume that motives related to corporate governance are specific to ERM and the risk governance aspect of ERM implementation.

3.2.3 Determinants of Risk Governance

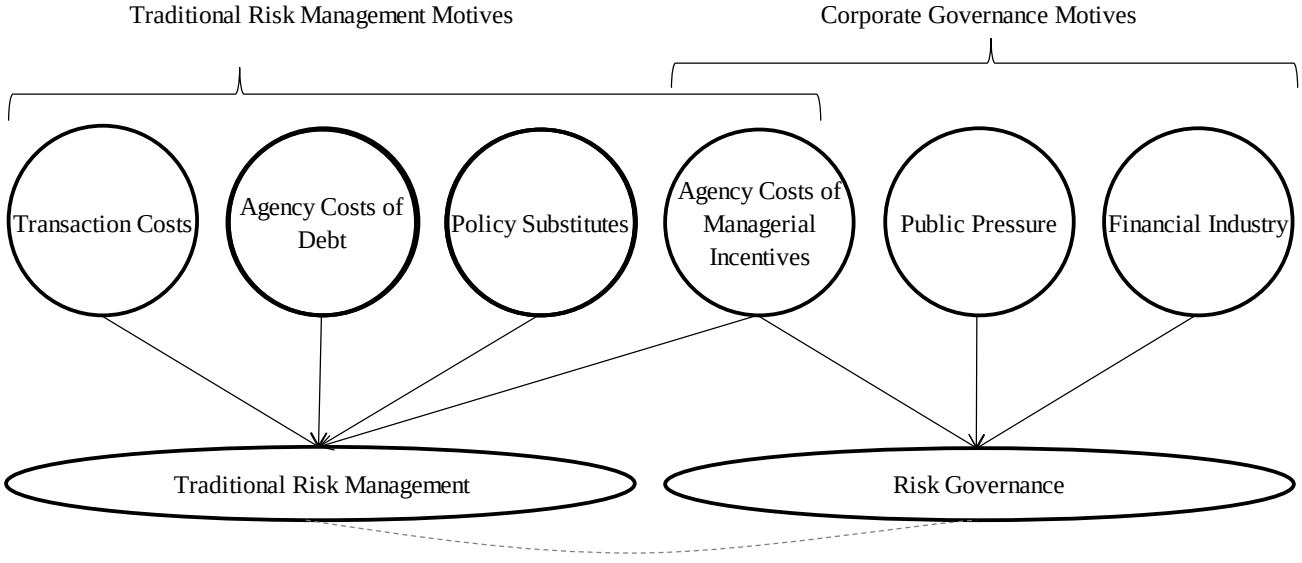
The purpose of this study is to determine why firms implement risk governance and take the step beyond traditional risk management to implement ERM. As presented in the previous sections, the two overarching theories also fit well with the conceptualization that ERM has two foundational components: traditional risk management and risk governance.

Theoretically one would expect the traditional risk management component of ERM to be best explained by traditional capital market imperfections and the risk governance component to be explained by motives related to corporate governance. Investigating this theoretical expectation is a step toward determining a theoretical foundation for ERM which has previously been ad hoc.

Figure 11 depicts the conceptual framework tested in this study. The model depicts the expected relationship between traditional and corporate governance determinants on risk governance while controlling for the determinants' effects on the traditional risk management component of ERM. Traditional risk management and risk governance are correlated by construction. The two are not uncorrelated separate entities, but they are correlated components which together make up ERM.

In the next section the methodology used to test this conceptual framework is presented.

Figure 11. Conceptual Framework



3.3 Methodology

A survey methodology is used to get inside firms risk management implementation and gain information about the implementation of a variety of dimensions of ERM. Questionnaire responses are analyzed with exploratory factor analysis in order to determine the underlying component structure of ERM. The final component structure gives a picture of what ERM is based on how its dimensions are actually implemented by firms. Two of the four components identified represent the risk-related components of ERM and support the argument that ERM is a composition of traditional risk management and risk governance. A confirmatory factor analysis (CFA) further confirms that the survey data supports the measurement of these two components using the developed structure.

Determinants of these two components are estimated simultaneously using structural equation modeling (SEM). This way the determinants of risk governance can be identified while controlling for the determinants of traditional risk management. The advantage of structural equation modeling is it allows us to indirectly measure complex and unobservable concepts, like risk governance, by making use of several imperfect but observable indicators, the questionnaire responses for dimensions of ERM; by modeling the unique variance of each imperfect indicator, SEM also accounts for measurement error of the concepts. With SEM, more valid and reliable conclusions can be made about the relationships in complex models which test a number of hypotheses simultaneously.

3.3.1 Questionnaire Design, Delivery, and Response

The questionnaire used in the survey focused on identifying a firm's level of implementation of a number of dimensions of risk management. The questionnaire was based on a set of dimensions found in Desender (2011); additional input regarding necessary dimensions of proper ERM implementation was received from two members of the COSO board and from a thorough review of ERM frameworks and literature. The dimensions were then transformed into questionnaire questions designed to assess the degree of implementation of each dimension in the firm.

The questionnaire was sent to the Chairman of COSO, a consultant of ERM implementation, and a researcher with experience in questionnaire use for comments. The questionnaire was also pre-tested on two practitioners. The final version of the questionnaire included changes based on the comments

from the aforementioned individuals. Minor changes were also made based on the recommendations of Sinitor[17], specialists in data collection, who helped distribute the questionnaire [18].

The final version of the questionnaire is comprised of 59 dimensions. Firms were asked to give the degree of implementation of each dimension on a scale from zero to three. Zero being that the dimension is non-existent in the firm and three being that the dimension is robustly implemented in the firm. During the testing process a more standard five item Likert-like scale was deemed more difficult to answer. Therefore, more reliability in the scale was chosen over the potential for additional variation.

Included in the questionnaire are also two background questions, questions directed at the firm's perception of their implementation of ERM, and a number of questions addressing ERM specific concepts. The questionnaire did not draw attention to its focus on ERM in order to ensure that respondents were not influenced by the mention of ERM but instead answered with a more general consideration to their risk management practices. Respondents were instructed to answer the questionnaire in relation to the firm's 2010 risk management practices.

The questionnaire was presented to all (676) firms listed at the start of 2011 on two major Nordic stock exchanges, either NASDAQ OMX or Oslo Börsen, with headquarters in a Nordic country (Sweden, Norway, Finland or Denmark). Iceland and associated territories are excluded due to their small number of companies. Sinitor attempted to contact the firms in the population directly by telephone and gave a brief introduction to the survey; the CEO, CFO, or an individual knowledgeable about risk management was targeted because of the important role they play in implementing enterprise risk management. Approximately 92% of respondents held the position of CFO, CEO, CRO or risk manager at the firm; the remaining respondents were for example part of the accounting function, treasury, or audit. Willing respondents were offered the questionnaire in Swedish, Norwegian, Danish, Finish, and English; they then received an e-mail with a link and filled out the questionnaire online.

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[17] Formally Anthill Stockholm.

[18] The questionnaire can be found in Appendix 1.1.

See Table 23 for basic descriptive statistics of the surveyed firms (population) and respondent firms (sample). The final response rate for the survey was 22.6% with 153 responses. A similar survey by Brunzell et al. (2011) had an overall response rate of 18.92%. The distribution of respondent firms and the distribution of the original sample of firms are similar in respect to country representation, industry, and market capitalization; it can therefore be concluded that the respondent group is an adequate representation of the original sample and there is no expected non-response bias. Six firms were not listed in 2009 and two respondent firms have since delisted and are therefore eliminated from the study, leaving a final sample of 145 firms.

The Nordic countries have well developed and international capital markets which are highly integrated. Foreign ownership of listed companies is over one third for the region as a whole. The Nordic corporate governance structure lies somewhere between the Anglo-Saxon one-tier and the continental European two-tier model (Danish Corporate Governance Committee et al., 2009). Many firms have Anglo-American board members; as a result, there may be institutional contagion from the Anglo-American market system which in turn has an effect on important dimensions of corporate governance (Oxelheim & Randøy, 2005). Some of the other key features of Nordic governance systems are: strong general meeting powers, shares with multiple voting rights, strong minority protection, effective individual shareholder rights, non-executive boards, use of board committees, auditors appointed by and accountable to the shareholders, active governance role of major shareholders, and high levels of transparency. Also, in Denmark, Norway, and Sweden employees are given the right to appoint a limited number of board members (Danish Corporate Governance Committee et al., 2009). Fernandes, Ferreira, Matos, & Murphy (2013) show that on average Swedish CEOs receive less pay for performance than CEOs in the United States; in 2006, the mean composition of CEO pay in stocks and options for Swedish CEOs was 2% and for U.S. CEOs it was 39%.

Table 23. Descriptive Statistics for the Surveyed Firms and the Respondent Firms

		Surveyed		Respondent		Response
		#	%	#	%	Rate
Country	Denmark	173	26	32	21	18%
	Finland	123	18	26	17	21%
	Norway	147	22	37	25	25%
	Sweden	233	34	58	38	25%
	Total	676		153		22.6%
Industry	Industrial	491	73	119	79	
	Utility	15	2	3	2	
	Transportation	44	7	8	5	
	Bank/Save and Loan	43	6	8	5	
	Insurance	7	1	4	3	
	Other Financial	68	10	10	7	
	Other	8	1	1	1	
Market	Large	122	18	30	20	
Capitalization	Mid	189	28	39	26	
(thousands of	Small	365	54	84	56	
U.S. $)	Mean	2002		1848		
	Median	173		167		
	Std. Dev.	6660		5403		
Total Assets	Mean	6286		4771		
(thousands of	Median	287		277		
U.S. $)	Std. Dev.	44742		26974		

Notes: No statistically significant differences in mean values are found.

3.3.2 Variables

This section discusses the variables used in the analysis, both the enterprise risk management components and its expected determinants.

Enterprise Risk Management Components - Exploratory Factor Analysis

The basic argument of this study is that dealing with the complexities of ERM is necessary to better understand its determinants. One way to address the complexity issue is to break ERM into its parts and separate it into its fundamental pieces. Responses to the questionnaire are analyzed using exploratory factor analysis in order to determine broader factors which are responsible for covariation in the responses.

The survey responses for the 59 ERM dimensions are first screened for evidence of multicollinearity; 48 dimensions of enterprise risk management are used in the EFA after eliminating highly correlated dimensions. Robust weighted least squares estimation (WLSMV) with geomin oblique rotation is used for estimation, and missing data is assumed to be missing completely at random (MCAR)[19].

Four factors are retained based on parallel analysis, goodness of fit statistics (four factor model fit statistics: root mean square error of approximation (RMSEA) = 0.038, Prob. RMSEA <= 0.05 = 0.998, the Bentler Comparative Fit Index (CFI) = 0.960, and the Standardized Root Mean Square Residual (SRMR) = 0.077) and interpretability.[20] The resulting factor structure identifies the four underlying components of ERM implementation based on how dimensions are implemented in firms. See Figure 12. for the components of ERM resulting from the factor analysis. Factor designation is based on the dimensions which load the highest on each factor. The resulting structure confirms the argument that ERM should be seen fundamentally as traditional risk management with the addition of risk governance.

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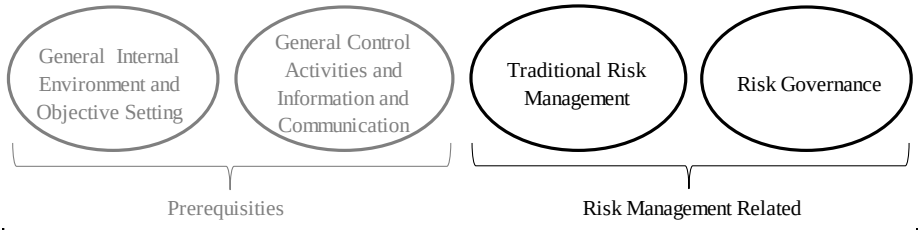
[19] Treating the variables as continuous, Little's MCAR (missing completely at random) test supports the assumption that missing data is MCAR.

[20] See Appendix 2 of Chapter 2 for more information on the factor retention decision and fit statistics.

Figure 12. Components of Enterprise Risk Management Resulting from Exploratory Factor Analysis of Survey Reponses



Two of the components, related to the general internal environment and control activities of the firm, can be viewed as "prerequisites" of ERM implementation. These components are necessary to have well-functioning and well implemented ERM but are not connected directly to risk management activities nor are they specific to ERM. They are made up of indicators such as: having a code of conduct, compensation which aligns the interests of managers and shareholders, and having a mission statement. Since these dimensions are outside of the risk management system, firms with no effort toward holistic risk management, or risk management at all for that matter, can have implemented these two prerequisite components robustly. [21] These are not included in this study as the focus here is on the risk management specific activities of the firm. The other two components are the main variables of interest and are the focus of the remaining discussion.

Summary statistics for responses from the questionnaire regarding the risk-related dimensions (only the indicators of traditional risk management and risk governance) can be found in Table 24. As expected, on average firms have more robustly implemented dimensions of traditional risk management than risk governance.

Traditional Risk Management Measure

The first risk-related component identifies efforts of the firm to manage certain types of risk: financial, strategic, compliance, technology, economic,

[21] Chapter 2 discusses the model in further detail.

and reputation. This component reflects traditional risk management implementation because it says nothing about the organization of the management system. Traditional risk management activities are those related to the risk management process which Culp (2001) describes all firms having in some form or another. Therefore, firms that have robustly or well implemented traditional risk management may be implementing a formally structured ERM framework, but they may also be implementing more ad hoc forms of risk management or a silo-approach where risks are managed separately.

Risk Governance Measure

The second component is truly the ERM identifier. The dimensions that make up this component are the typical characteristics of ERM addressing the organizational and holistic nature of risk management as ERM prescribes: formal written statement of risk appetite, having a senior manager assigned the responsibility of overseeing risk and risk management, and a formal risk management report submitted to board level regularly. This component sets up the structure of the risk management system, ensures centralization and integration, and formalizes the risk management process.

Table 24. Summary Statistics for Questionnaire Responses of Risk Related Dimensions of Enterprise Risk Management

	Indicator Variable	Mean	Mode	SD	Min	Max	Count
Traditional Risk Management	Financial Events	2.85	3	0.40	1	3	151
	Strategic Events	2.57	3	0.60	0	3	150
	Likelihood Strategic	2.57	3	0.57	1	3	149
	Compliance Events	2.44	3	0.64	1	3	150
	Likelihood Compliance	2.26	2	0.68	0	3	147
	Technology Events	2.40	3	0.67	0	3	149
	Likelihood Technology	2.27	3	0.79	0	3	147
	Economical Events	2.77	3	0.48	1	3	151
	Reputation Events	2.44	3	0.61	1	3	150
	Likelihood Reputation	2.35	2	0.66	1	3	150
Risk Governance	Corr and Portfolio	1.17	1	1.00	0	3	136
	Quantitative	1.72	2	0.94	0	3	141
	Board Report	2.29	3	0.90	0	3	146
	Risk Indicators	1.77	2	1.00	0	3	144
	Central Technology	1.12	0	1.10	0	3	141
	Verification	1.69	2	0.95	0	3	143
	Policies	2.11	2	0.86	0	3	149

	Indicator Variable	Mean	Mode	SD	Min	Max	Count
Risk Governance	Response Plan	1.72	2	0.96	0	3	146
	Alternative Response Plan	1.53	1	0.94	0	3	142
	Communication	1.79	2	0.97	0	3	143
	Indp/External Audit	1.23	0	1.12	0	3	149
	Updates	1.70	2	0.96	0	3	147
	Philosophy	1.78	2	1.01	0	3	148
	Risk Appetite	1.40	2	1.08	0	3	149
	Board Committee	1.46	0	1.27	0	3	145
	Senior Manager	1.61	3	1.22	0	3	150
	Central Department	1.08	0	1.25	0	3	151
	Internal Assessment Group	1.21	0	1.14	0	3	150
	Risk Owners	1.56	3	1.18	0	3	147

Notes: Responses for each indicator can range from zero to three; zero being that the dimension is non-existent in the firm and three being that the dimension is robustly implemented in the firm.

Determinants

Additional data regarding characteristics of the firms surveyed is collected from DataStream or directly from a firm's financial statements. Since the questionnaire addresses the risk management activities of the firm in 2010 and the focus is to identify determining factors of implementation, the data collected pertains to the 2009 year end or an average of three years prior to 2010. Table 25 and Table 26 summarize the determinant variables, their definitions, expected relationships with traditional risk management and risk governance, and data sources.

Determinants of Traditional Risk Management

In order to proxy transaction costs, this study follows Brunzell et al. (2011) and uses the book value of long-term debt over total assets as a measure of leverage (*Lev*) to proxy for financial distress costs. However, this study uses a three year average (2007, 2008 and 2009) as in traditional hedging literature (Gay & Nam, 1998; Howton & Perfect, 1998; Nance et al., 1993); this is in order to capture a more historic measure proxying the level of financial distress and risk of asset substitution and underinvestment problems and to decrease the likelihood of an endogeniety problem. Additionally, an attempt is made to analyze the feedback effect between risk management and leverage; this feedback effect stands out in the theoretical discussion of motives from Section 2. Financial distress is hypothesized to increase the need for risk management, and risk management in turn decreases the risk of financial distress allowing the firm to carry more debt. The effect of ERM on leverage has not been investigated previously, but a positive relationship is expected between both traditional risk management and risk governance and "future" leverage. To capture the feedback effect of risk management implementation on the amount of leverage in a firm, long-term debt over total assets for 2010 (*Lev2010*) is included as a dependent variable of traditional risk management and risk governance; the relationship of traditional risk management and risk governance (measured in 2009) with leverage the following year (2010) is estimated. This feedback effect is estimated simultaneously with the determinants in the structural equation model. In order to capture the relationship between size and traditional risk management, this study follows Liebenberg and Hoyt (2003) and measures size (*Size*) as the prior three year average of the natural logarithm of total assets measured in USD.

To proxy for the firm's growth opportunities, this study uses market-to-book (*MB*) (Gay & Nam, 1998; Pagach & Warr, 2011; Samant, 1996) at year end 2009.

To capture management compensation or incentives in terms of stock ownership (*ManOwn*), this study uses the percent of total shares owned by the management group at the end of year 2009. To capture option compensation and shareholder/manager incentive alignment (*ManOptD*), a dummy variable which takes the value of one if managers hold options, warrants, or convertibles at the end of 2009 is used. Both of these management compensation variables are hand collected from annual reports and follow Brunzell et al. (2011). While the measures do not differentiate between ownership from compensation and ownership bought on the market, both variables should still capture the ownership incentives of having equity and options.

Policy decisions are incorporated by the inclusion of an operative diversification proxy; the diversification (*SIC*) variable follows Brunzell et al. (2011) and is the number of different SIC codes for a firm at the two digit level. SIC codes are retrieved from DataStream for 2009 where the maximum number of SIC codes per firm is eight. Dividend policy is incorporated into the model by using the prior three year average of the firm's dividend yield (*Div*) following Mian (1996).

See Table 25 for a summary of the variables used as determinants of traditional risk management, their definition, and the expected relationship.

Table 25. Variable Description for Determinants of Traditional Risk Management

Determinants of Traditional Risk Management			
Variable and Expectation			Definition
Transaction Costs			
Leverage	*Lev*	+	Long-term debt / Total assets averaged over end of year 2007, 2008, and 2009
Size	*Size*	+	Natural logarithm of total assets in USD averaged over 2007, 2008, and 2009
Agency Costs of Debt			
Growth Options: Market-to-Book	*MB*	+	Book value of equity/Market value of equity for end of year 2009
Agency Costs of Managerial Incentives			
Managerial Ownership	*ManOwn*	+	Percent of total shares owned by the management group end of year 2009
Managerial Incentive Compensation	*ManOptD*	-	Dummy variable =1 if managers hold options, warrants, or convertibles end of year 2009
Substitutes / Complements			
Diversification	*Sic*	?	Number of different SIC codes at the 2 digit level end of year 2009
Dividend	*Div*	?	Dividend per share/Share price averaged over end of year 2007, 2008, and 2009

Notes: Financial statement data from DataStream. SIC codes from Worldscope. Data on corporate governance, public pressure, the largest shareholders, and management ownership from annual reports.
For the leverage feedback effect, Long-term debt / Total assets for end of year 2010 (*Lev2010*) is included as a dependent variable of traditional risk management and risk governance.

Determinants of Risk Governance

Leverage (*Lev*) and size (*Size*), managerial stock ownership (*ManOwn*) and managerial incentive compensation (*ManOptD*) are included as determinants of risk governance as proxies of a firm's agency costs of managerial incentives.

Board independence (*BInd*) is the percentage of board members which are independent of the company and its major shareholder in 2009. CEO on the board (*CEOB*) is a dummy variable equal to one if the firm's CEO (or equivalent) sits on the Board of Directors (or equivalent supervisory board) in 2009. This data is retrieved by hand from the annual reports.

Publically rated debt (*Rate*) is a dummy variable equal to one if the firm has public debt rated by Standard and Poor's. This variable has not been tested in prior ERM studies. It is collected from DataStream and annual reports. Additionally, Big Four auditor (*Big4*) is a dummy variable equal to one if the firm does *NOT* use a Big Four auditor: PricewaterhouseCoopers, Deloitte Touche Tohmatsu, Ernst & Young or KPMG. The data is retrieved from the annual reports.

A financial industry dummy variable (*Fin*) is used to represent firms which are in the financial industry; the variable is equal to one if the firm is in the financial industry. General industry classifications given by DataStream are used where bank/savings and loan, insurance, and other financial are all considered financial firms.

Table 26 shows a summary of the variables used as determinants for risk governance, their definition and expectation. Table 27 presents the summary statistics for all variables in the study including factor scores for the traditional risk management implementation measure (TradRM) and the risk governance measure (RiskGov) calculated using the regression method for categorical outcomes with WLSMV.

Table 26. Variable Description for Determinants of Risk Governance

Determinants of Risk Governance

Variable and Expectation			Definition
Agency Costs of Managerial Incentives			
Leverage	*Lev*	-	Long-term debt / Total assets averaged over end of year 2007, 2008, and 2009
Size	*Size*	+	Natural logarithm of total assets in USD averaged over 2007, 2008, and 2009
Managerial Ownership	*ManOwn*	-	Percent of total shares owned by the management group end of year 2009
Managerial Incentive Compensation	*ManOptD*	+	Dummy variable =1 if managers hold options, warrants, or convertibles end of year 2009
Board Independence	*Bind*	+	Percentage of board members considered independent of the company and major shareholders end of year 2009
CEO on Board	*CEOB*	-	Dummy variable = 1 if the firm's CEO sits on the Board of Directors end of year 2009
Public Pressure			
Publically Rated Debt	*Rate*	+	Dummy variable = 1 if the firm has public debt rated by Standard and Poor's end of year 2009
(No) Big 4 Auditor	*Big4*	-	Dummy variable= 1 if the firm DOES NOT use a Big Four auditor end of year 2009
Financial Industry			
Financial Industry	*Fin*	+	Dummy variable= 1 if the firm is in the financial industry end of year 2009

Notes: Financial statement data from DataStream. SIC codes from Worldscope. Data on corporate governance, public pressure, the largest shareholders, and management ownership from annual reports.
For the leverage feedback effect, Long-term debt / Total assets for end of year 2010 (*Lev2010*) is included as a dependent variable of traditional risk management and risk governance.

Table 27. Variable Correlations

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Size	12.82	0.17	1.00														
2 Lev	0.17	0.01	0.42 **	1.00													
3 Lev 2010	0.17	0.01	0.36 **	0.76 **	1.00												
4 MB	2.16	0.23	-0.28 **	-0.18 *	-0.08	1.00											
5 Rate	0.07	0.02	0.53 **	0.02	0.03	-0.12	1.00										
6 Fin	0.15	0.03	0.32 **	0.15	0.14	-0.15	0.17 *	1.00									
7 Big4	0.06	0.02	-0.20 *	-0.17 *	-0.13	-0.08	-0.07	-0.03	1.00								
8 SIC	2.41	0.13	0.23 **	-0.12	-0.04	-0.13	0.02	0.08	0.00	1.00							
9 Div	3.43	0.30	0.24 **	0.06	-0.01	-0.06	0.07	0.05	-0.12	0.03	1.00						
10 CEOB	0.16	0.03	0.15	0.03	-0.01	0.10	0.16	0.02	-0.03	-0.02	0.09	1.00					
11 ManOwn	0.05	0.01	-0.24 **	-0.06	-0.04	0.08	-0.11	0.04	0.35 **	-0.12	0.05	0.20 *	1.00				
12 ManOptD	0.56	0.04	0.08	0.03	-0.05	0.16	0.04	-0.17 *	-0.06	0.00	-0.17 *	0.04	-0.01	1.00			
13 Bind	0.59	0.02	-0.16	-0.21 *	-0.21 *	0.08	-0.03	-0.06	-0.17 *	0.02	0.01	-0.23 **	-0.13	0.04	1.00		
14 TradRM	0.00	0.05	0.48 **	0.21 **	0.24 **	-0.05	0.30 **	0.16 *	-0.08	0.09	-0.01	0.08	-0.06	0.09	-0.11	1.00	
15 RiskGov	0.00	0.05	0.47 **	0.04	0.16 *	-0.18 *	0.24 **	0.24 **	-0.15	0.18 *	0.03	-0.11	-0.21 *	0.00	-0.03	0.64 **	1.00

	Min	Max	Mode
TradRM	-1.77	1.24	-0.03
RiskGov	-1.72	1.72	0.56

Notes: *p<0.05, **p<0.01

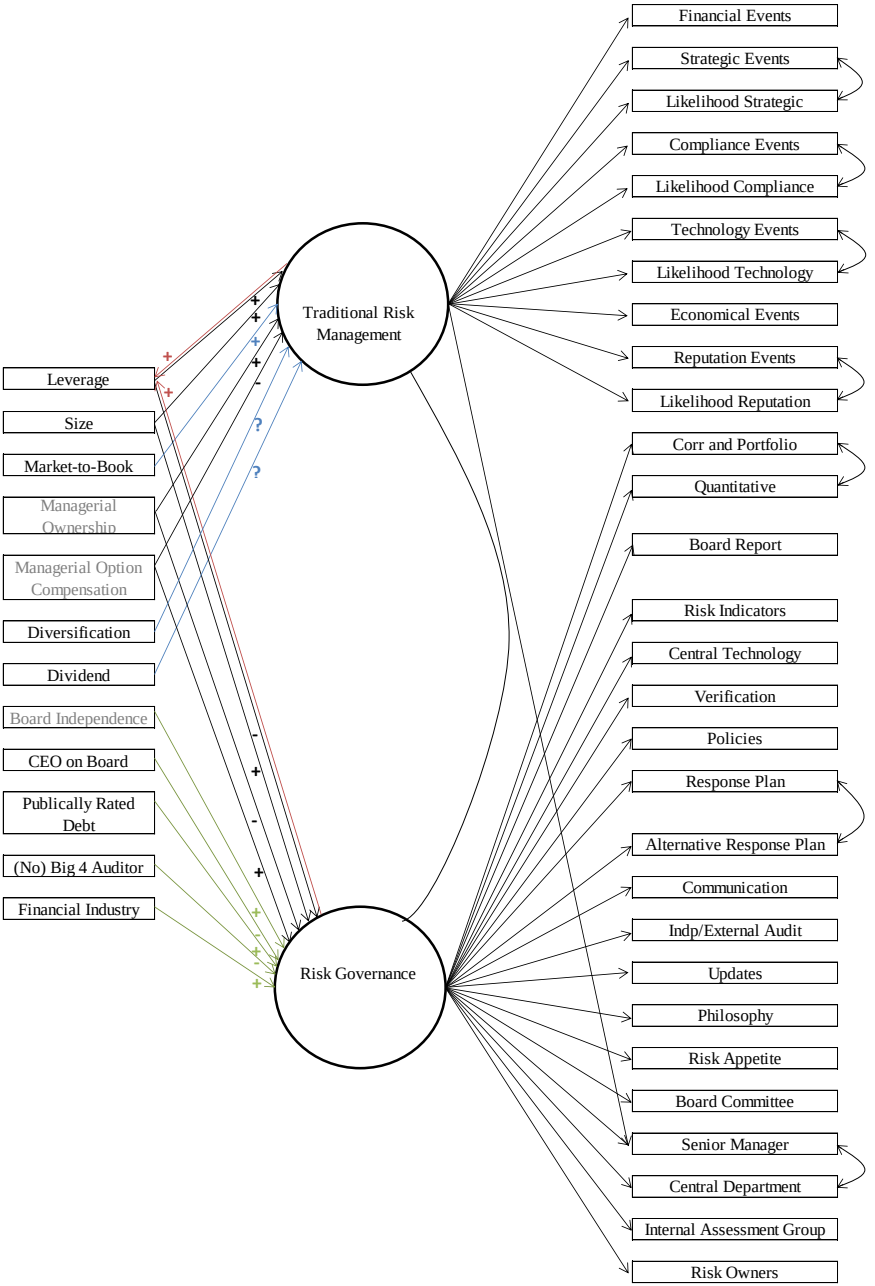
TradRM and RiskGov are factors scores calculated using the regression method, also known as the modal posterior estimator, for categorical outcomes with WLSMV.

3.3.3 Estimation of the Model

The base model is a MIMIC (multiple indicators multiple causes) model, with a feedback effect from traditional risk management and risk governance to leverage and a correlation between traditional risk management and risk governance. The base model does not include managerial compensation variables and board independence in order to preserve sample size. However, separate models are estimated with the addition of managerial compensation and board independence. The base model plus managerial compensation and board independence is depicted below in Figure 13.

Structural equation modeling is used to estimate the model and is used to explicitly consider the possible bias of measurement error on path estimates which is especially relevant given the nature of the underlying survey data. Additionally, it allows the creation of complex measures, like risk governance, from a number of imperfect underlying indicators and the simultaneous estimation of those measures' determinants. The model is estimated using Mplus Version 6. For structural equation estimation with at least one binary or ordered categorical dependent variable (factor indicators using survey data), the default estimator (WLSMV) represents weighted least square parameter estimates using a diagonal weight matrix with standard errors and mean- and variance- adjusted chi-square test statistic that uses a full weight matrix.

Figure 13. Base Model +Managerial Compensation +Board Independence



3.4 Results

3.4.1 Measurement Model Results

Although the measures of traditional risk management and risk governance are found through EFA and fit is indicated to be good, confirmatory factor analysis is used to test the validity of the measures of traditional risk management and risk governance without the two prerequisite components found in EFA. Fit of the measurement model must be tested before moving on to the structural equation modelling. Model statistics show that the chi-square (χ^2=436.42, d.f. =368, $p<0.05$) may indicate poor fit of the measurement model. Chi-square values are not relied on for model fit in this case given that Chau and Hocevar (1995) found that the chi-square test statistic is strongly biased against models with a large number of measured variables. However, the comparative fit index (CFI), Tuker-Lewis index (TLI) and root mean square error of approximation (RMSEA) indicate good fit (0.99, 0.98 and 0.035, respectively). All estimated unstandardized loadings are significant. See Table 28 for standardized loading estimates. Cronbach's alphas exceed the suggested 0.8 threshold (Nunnally, 1978).

Senior manager is allowed to load on both the traditional risk management and the risk governance component, but it loads negatively onto traditional risk management. This cross loading is suggested from the modification indices to provide better fit; it is incorporated into the model since it is theoretically accurate that a senior risk manager would be a prime identifier of risk governance and not a part of traditional or typical silo risk management[22]. Additionally, it may be of interest to note that traditional risk management and risk governance are highly and significantly correlated with a value of 0.60 (See Table 28). This is reasonable given that having robust implementation of one would likely mean relatively more robust implementation of the other.

[22] The results reported in the following sections are not significantly affected by this cross loading.

Table 28. Measurement Model Results

Indicators			Estimate	t-value	CR
TradRM					0.831*
TradRM	→	Financial	0.623	5.557	
TradRM	→	Strategic	0.553	5.943	
TradRM	→	LStrategic	0.472	4.299	
TradRM	→	Compliance	0.714	9.424	
TradRM	→	LCompliance	0.723	10.501	
TradRM	→	Technology	0.549	6.585	
TradRM	→	LTechnology	0.564	7.066	
TradRM	→	Economical	0.550	6.192	
TradRM	→	Reputation	0.814	12.64	
TradRM	→	LReputation	0.785	12.01	
TradRM	→	Senior Manager	-0.324	-2.867	
Strategic	◡	LStrategic	0.756	9.755	
Compliance	◡	LCompliance	0.396	2.722	
Technology	◡	LTechnology	0.727	12.93	
Reputation	◡	LReputation	0.528	3.681	

Table 28. cont.

Indicators			Estimate	t-value	CR
RiskGov					0.939
RiskGov	→	Corr and Portfolio	0.665	12.129	
RiskGov	→	Quantitative	0.754	18.159	
RiskGov	→	Board Report	0.809	20.126	
RiskGov	→	Risk Indicators	0.700	14.844	
RiskGov	→	Central tech	0.822	24.326	
RiskGov	→	Verification	0.723	17.134	
RiskGov	→	Policies	0.812	24.418	
RiskGov	→	Response Plan	0.738	17.704	
RiskGov	→	Alternative Response Plan	0.797	23.654	
RiskGov	→	Communication	0.740	18.682	
RiskGov	→	Indp/External Audit	0.637	11.871	
RiskGov	→	Updates	0.846	31.177	
RiskGov	→	Philosophy	0.827	27.316	
RiskGov	→	Risk Appetite	0.759	21.418	
RiskGov	→	Board Committee	0.557	8.564	
RiskGov	→	Senior Manager	0.826	9.360	
RiskGov	→	Central Department	0.734	14.399	
RiskGov	→	Internal Assessment Group	0.702	14.623	
RiskGov	→	Risk Owners	0.712	16.452	
Corr and Portfolio	⌣	Quantitative	0.453	4.338	
Response Plan	⌣	Alternative Response Plan	0.605	11.270	
Senior Manager	⌣	Central Department	0.625	6.476	
TradRM	⌣	RiskGov	0.604	9.474	

Notes: Number of observations is 151. Estimates presented are standardized. All unstandardized estimates are significant ($p<0.05$); Chi-square = 436.421 (d.f. =368, $p<0.05$), CFI = 0.985, and RMSEA = 0.035 (Prob. RMSEA <= 0.05 = 0.979).
CR = construct reliability or Cronbach's alpha.
* Not including item Senior Manager.

3.4.2 Results for the Base Model and Adaptations

Results for the base model and adaptations of the base model are show in Table 29.

Overall, the Base Model shows good fit (CFI: 0.976, TLI: 0.974, RMSEA: 0.030). The chi-square test statistic indicates poor fit of the model; however, the normed chi-square (1.13) falls below the most modest suggested cutoff of two (Ullman, 2001). Models with small sample size and a large number of variables show upward bias in chi-square statistics (Kenny & McCoach, 2003); therefore, the indications of the other fit statistics are relied upon. Adaptations to the Base Model and the All model also show good fit; based on parsimony, the Base Model is considered the best fitting model and the best model to explain risk governance and traditional risk management implementation.

Determinants of Traditional Risk Management

The expectation is that the determinants of traditional risk management implementation can be best explained using traditional corporate finance motives for risk management, and the findings show no evidence that this expectation is unrealistic, and the significant variables give reliable evidence for such an argument.

Starting with the results from the Base Model (see Table 29); *size* shows a significant and positive relationship with the implementation of traditional risk management. Large firms face lower transactions costs associated with corporate risk management based on economies of scale (Bartram, 2000), therefore making it value enhancing for the firm to do risk management instead of investors themselves through their own portfolios. This is in line with the previous finding of Géczy et al. (1997), Mian (1996) and Nance et al. (1993).

The proxy for *growth opportunities*, market-to-book, shows a weak (at the 10% level) positive relationship with traditional risk management implementation levels which is in line with Brunzell et al. (2011), Gay and Nam (1998) and Samant (1996), and the hypothesis that firms implement risk management in order to reduce agency costs of underinvestment.

Table 29. Structural Equation Modelling Results: Base Model, Adaptations, and All Model

Model Specifications	χ^2	d.f.	P-Value	CFI	TLI	RMSEA	90 Percent C.I.		Prob. <= .05	Sample
Base Model	740.471	653	0.0097	0.976	0.974	0.030	0.016	0.041	1.000	145 (Full)
+ Compensation	799.300	709	0.0102	0.970	0.968	0.032	0.017	0.043	0.998	127
+ Board Independence	815.730	738	0.0242	0.970	0.967	0.031	0.012	0.043	0.997	112
All	748.544	646	0.0031	0.972	0.969	0.033	0.020	0.043	0.998	145 (Full)

	Base Model		+ Compensation		+ BInd		All	
Lev → TradRM	0.202		0.497		0.849		0.202	
Size → TradRM	0.153	***	0.139	**	0.157	**	0.153	***
MB → TradRM	0.038	**	0.023		0.022		0.038	*
SIC → TradRM	0.004		0.018		0.028		0.003	
Div → TradRM	-0.025	*	-0.024		-0.029		-0.026	*
ManOwn → TradRM			0.457		0.777			
ManOptD → TradRM			0.034		0.006			
CEOB → TradRM							0.034	
Rate → TradRM							0.265	
Big4 → TradRM							0.154	
Fin → TradRM							-0.008	

	Base Model		+ Compensation		+ BInd		All	
Lev → RiskGov	-1.030	***	-0.802	*	-0.431		-1.031	***
Size → RiskGov	0.201	***	0.186	***	0.211	***	0.202	***
Rate → RiskGov	-0.192		-0.171		-0.191		-0.184	
Big4 → RiskGov	-0.145		-0.316		-0.174		-0.142	
CEOB → RiskGov	-0.314	**	-0.386	**	-0.408	**	-0.313	**
Fin → RiskGov	0.274	*	0.102		-0.070		0.274	*
ManOwn → RiskGov			-0.591		-0.486			
ManOptD → RiskGov			0.042		0.001			
BInd → RiskGov					-0.044			
MB → RiskGov							-0.004	
SIC → RiskGov							-0.005	
Div → RiskGov							-0.022	*
TradRM → Lev2010	0.000		-0.004		-0.016		0.000	
RiskGov → Lev2010	0.037	**	0.034	**	0.032	**	0.037	**
Lev → Lev2010	0.882	***	0.905	***	0.919	***	0.882	***
R^2 TradRM	0.241		0.286		0.329		0.283	
R^2 RiskGov	0.339		0.310		0.347		0.330	

Notes: Unstandardized coefficients are reported.
* p<0.10, ** p<0.05, *** p<0.01.

The result for *dividend policy* is also consistent with the underinvestment argument. A firm's dividend yield has a weak negative relationship with traditional risk management implementation. This is not in line with the substitute policy hypothesis presented in an earlier section which suggests firms with dividends would be more likely to implement traditional risk management because of reduced liquidity resulting from the dividend payout. However, previous empirical studies of risk management have led to ambiguous results with regards to dividends, and the negative relationship found in this study may be explained, not by a liquidity restraint argument, but instead by the negative relationship between growth options and dividends (Bartram, 2000). More mature firms give dividends and therefore dividends are a sign of less growth options which would in turn suggest less of a need for risk management to reduce the underinvestment problem. Both the results for growth opportunities and dividend policy suggest that firms implement traditional risk management aspects to reduce agency costs of debt resulting from the underinvestment problem.

None of the other Base Model determinants of traditional risk management are significant. *Leverage* shows an insignificant relationship with traditional risk management implementation, similar to the finding of Brunzell et al. (2011); a number of other empirical studies have also found ambiguous results regarding leverage (Bartram, 2000). *Diversification* also shows an insignificant relationship with traditional risk management implementation.

In the second model, management compensation variables are added to the base model (+ Compensation in Table 29); these variables are not included in the main specification because of the loss of sample size when adding them. They are found to have an insignificant effect on traditional risk management implementation. Brunzell et al. (2011) find no evidence of a relationship between derivative use for hedging and managerial ownership variables in their Nordic sample. When management compensation is added, the effects of growth opportunities and dividend yield on traditional risk management implementation become insignificant. This could be a result of loss of sample size since there is no obvious correlation problem between compensation variables and market-to-book or dividend yield.

Because evidence does not suggest that traditional risk management is motivated by transaction costs of financial distress (no leverage effect), the traditional theoretical expectation that implementing risk management should create additional debt capacity through reduction of costs resulting from leverage would not be expected to hold in this case. In fact, the feedback

effect between traditional risk management and leverage in 2010 is insignificant.

None of the evidence regarding determinants of the traditional risk management component of ERM suggests a need for alternative hypotheses outside of traditional corporate finance theories, and the findings are in line with the expectations and previous research. Therefore, one can conclude that part of ERM implementation, the traditional risk management activities associated with identifying and assessing risk, is due to traditional needs for risk management associated with capital market imperfections.

Determinants of Risk Governance

The determinants of risk governance and the motives for taking the active step past traditional risk management activities are expected to be related to motives for corporate governance. Because risk management and ERM is substantially an issue of accounting and finance, motives for corporate governance are rooted in agency theory and agency costs of managerial incentives; the findings can with consistency be interpreted from this perspective.

The results suggest that risk governance has a significant and positive relationship with *size*. This is in line with previous empirical ERM studies (Beasley et al., 2005; Desender, 2011; Liebenberg & Hoyt, 2003; Pagach & Warr, 2011) and with the hypothesis that large firms may also face greater agency problems due to increased difficulty of monitoring or excess free cash flows and therefore need to compensate with stricter governance mechanisms (Klapper & Love, 2004).

Leverage is highly significant and negatively related to risk governance implementation levels. This relationship suggests that higher levels of leverage negatively impact the level of risk governance which is not at all in line with the traditional corporate finance explanation for risk management based on transaction costs of financial distress. Therefore, there must be a motive for risk governance which is not part of traditional corporate finance theory for risk management. Evidence of this same relationship has been found in previous ERM empirical studies (Beasley et al., 2008; Hoyt & Liebenberg, 2011), and as mentioned previously, shareholders of highly leveraged firms may not want risk reduction since it reduces the value of their option written to them by debtholders (Beasley et al., 2008). However, one could also explain this relationship from an agency cost of managerial incentive perspective which would be in line with the overall hypothesis that

the risk governance component of ERM is related to needs for corporate governance. As proposed earlier, managers of levered firms are constrained in their use of free cash flows for their own incentives; therefore, agency costs of managerial incentives are already mitigated to some degree and additional mitigation through added risk governance is less necessary. This would then explain the negative relationship between leverage and risk governance implementation. Additional evidence of this type of hypothesis is discussed in the next section in relation to the relationship between dividend yield and risk governance.

Because public pressure for ERM implementation is often cited as a motivator for implementing ERM, a surprising finding is that both having *publically rated debt* and not having a *Big 4 auditor* have no effect on risk governance implementation in the sample of firms. Big Four auditor is a relatively standard variable used in ERM empirical studies (Beasley et al., 2005; Desender, 2011), but in this sample of Nordic firms, where most firms employ Big Four auditors (94%) and those that do not tend to be small[23], the size variable most likely accounts for any Big Four auditor effect which is essentially an indirect size effect. Publically rated debt is similar in the sense that the firms which have publically rated debt are few and are larger firms[24], and therefore size may be capturing any effect from this variable[25]. The lack of significant relationship between public pressure variables and risk governance implementation may be evidence that firms are implementing risk governance for reasons other than to appease stakeholders which may set aside some fears that ERM is simply a window-dressing technique.

The corporate governance variable *CEO on board* is significant and negatively related to a firm's implementation of risk governance. This is in line with the hypothesis from Desender (2011) that managers, who generally like freedom and would be opposed to additional corporate governance and

[23] A mean difference test reveals that the mean size of the non-audited firms is significantly smaller than that of the audited firms.

[24] A mean difference test reveals that the mean size of the rated firms is significantly larger than that of the audited firms.

[25] If size is removed from the model, having publically rated debt does in fact effect ERM specific implementation in a significant and positive way.

monitoring, would be more effective in stopping ERM implementation if they held a seat on the board. Without the support of the CEO and the executive management team, ERM implementation is more or less destined to fail. This makes evidence of an agency problem like this highly problematic.

Finally, being a *financial firm* shows a weakly significant and positive relationship with risk governance. This is in line with previous findings of Beasley et al. (2005) and arguments made by Pagach and Warr (2011). Given the importance of ERM for the Basel II framework, such a finding is not surprising.

When added, management compensation variables (+ Compensation in Table 29) have an insignificant effect on risk governance implementation. Also, the effect of financial firms becomes insignificant which again can be due to the loss of sample size.

Board independence is added to the model (+BInd in Table 29) in order to further explain risk governance but found to have an insignificant relationship. For the sample of firms that report board independence clearly (approximately 77% of the full sample) most report that they follow corporate governance guidelines for board independence or are transparent about not complying[26]; given that the guidelines are intended to mitigate governance problems solved by board dependence, following guidelines and reporting may imply enough mitigation of those governance problems deeming additional risk governance unnecessary to mitigate related issues.

Finally, there is evidence of a robust *feedback effect* between risk governance and future leverage holdings where higher levels of risk governance during 2010 are positively related to larger end of the year leverage holdings in 2011. This is the first evidence of ERM's relationship with leverage and debt capacity. One could argue at first glance that it is a result of the traditional transaction cost of financial distress argument for risk management;

[26] Codes in place year end 2009: The Swedish Code of Corporate Governance applicable July 1st, 2008; The Norwegian Code of Practice for Corporate Governance from October 21, 2009; Committee on Corporate Governance's Recommendations for corporate governance of August 15, 2005; Finnish Corporate Governance Code from October 20, 2008.

implementing risk management reduces the probability of financial distress and increases the debt capacity of the firm allowing the firm to take on more debt with less costs of future financial distress. However, the feedback only pertains to the risk governance component since traditional risk management implementation does not show any significant impact on leverage holdings, and there is no evidence that financial distress costs motivate either traditional risk management or risk governance in the sample. As shown by the determinants, the risk governance component is explainable using agency theory of managerial incentives, one of the main theoretical foundations for corporate governance. Therefore, it would be more likely that the relationship between risk governance and future leverage is grounded in the same theories. As mentioned previously, generally managers dislike leverage because of its restrictive qualities, it will therefore be in the managers' interests to have lower levels of leverage to increase their freedom to use free cash flows as they please. Therefore, one could argue that managers who are better monitored by risk governance will be less successful at curbing levels of leverage.

The estimated relationships between the variables are qualitatively unchanged if the feedback effect is removed; in fact, estimates generally change only slightly in the thousandths decimal place and all significance tests remain the same as the model with the feedback effect.

3.4.3 Exploratory Robustness Check – All Model

In order to ensure that the conceptual model (Figure 11) does not eliminate relationships which are significant, an "exploratory" model where all available variables for the full sample are determinants of both traditional risk management and risk governance is estimated (All in Table 29). *Size* is still robustly a significant and positive determinant of traditional risk management and risk governance. *CEO on board* is also significantly and negatively related to risk governance. There is weak evidence that *growth opportunities* increase the implementation of traditional risk management and that *dividend yields* decrease implementation, still supporting the motive that firms implement risk management in order to reduce agency costs of underinvestment.

However, this model also weakly suggests that *dividends* have a negative impact on risk governance[27]. Dividends have not been empirically studied as a determinate of ERM implementation in previous studies, and this is therefore the first evidence of this relationship. This may suggest, as mentioned previously, that firms which do not have growth options are less likely to implement ERM or risk governance. However, it could be instead interpreted from a corporate governance/managerial incentive perspective which is in line with the interpretation of the leverage relationship. Dividends reduce the free cash flow in the firm, this mitigates agency costs of managerial incentives because it decreases the available free cash flow that managers can use in their own interest, for example risk reduction through operative diversification which is generally associated with a loss in value for the owners (Bartram, 2000). Therefore, firms which give dividends require less monitoring and therefore are in less need of enterprise risk management's additional governance aspects.

Market-to-book is not a significant determinant for risk governance. This is consistent with the findings of Liebenberg and Hoyt (2003) and Pagach and Warr (2011). Growth opportunities then explain only the portion of overall ERM which is associated with traditional aspects of risk management but not the risk governance component. Therefore, one could potentially argue that firms facing very high agency costs of underinvestment gain sufficient advantages from traditional risk management and without other reason would not have an incentive to implement ERM. This also supports a different interpretation of the dividend and risk governance relationship from that of the dividend and traditional risk management relationship; the same consistency in dividend and growth option relationship does not exist for risk governance.

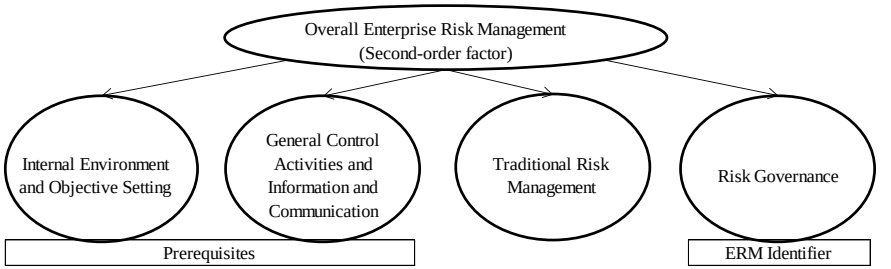
[27] This relationship holds when adding dividend yield as a determinant of ERM to the original base model; results for all other determinants are similar, and dividends are significantly (at the 10% level) and negatively related to ERM specific implementation.

3.4.4 Results for an Overall Enterprise Risk Management Model

Most existing determinants studies look at the relationship between firm characteristics and an overall measure or indicator of ERM like the hiring of a CRO or similar risk management position (Liebenberg & Hoyt, 2003; Pagach & Warr, 2011), a survey response on the firm's level of implementation (Beasley et al., 2005), or an aggregated ERM score made up of a number of dimensions (Desender, 2011; Gordon et al., 2009).

In order to compare to existing studies and show that the division of ERM into its underlying components provides more information about determinants than using an all-encompassing measure of ERM, the effects of base model variables on overall ERM implementation are estimated. Overall ERM is a second-order factor structure; all four factors identified in the EFA load onto a single ERM factor (See Figure 14).

Figure 14. Second-Order Enterprise Risk Management Factor Structure



As can be seen in Table 30, *leverage* and *dividend yield* have an overall negative and significant impact on overall ERM implementation and *size* maintains its positive effect. The weak effects found in some of the previous models of *market-to-book* and *financial industry* become insignificant and *CEO on board* becomes less significant (decreased to the 10% level). Therefore, results on determinants which are specific to risk governance or traditional risk management are altered when combining them to form an all-encompassing ERM measure. It also gives less clarity on how to interpret the remaining significant variables. The feedback effect of ERM on leverage is positive and significant. This suggests that the MIMIC model (Table 29:

Base Model) is a more informative way to approach the analysis than analyzing relationships between determinants and overall ERM levels.

Table 30. Structural Equation Modelling Results: Overall Enterprise Risk Management Model

	Estimate	
Lev → ERM	-0.478	**
Size → ERM	0.127	***
MB → ERM	0.001	
SIC → ERM	-0.014	
Div → ERM	-0.016	**
CEOB → ERM	-0.165	*
Rate → ERM	-0.060	
Big4 → ERM	-0.029	
Fin → ERM	0.090	
ERM → Lev2010	0.046	**
Lev → Lev2010	0.866	***
R^2 ERM	0.355	

Notes: 145 observations.
Unstandardized coefficients are reported.
* p<0.10, ** p<0.05, *** p<0.01.
Chi-square = 1810.979 (d.f. =1541, p=0.000), CFI = 0.943, TLI = 0.940, and RMSEA = 0.035 (Prob. RMSEA <= 0.05 = 1.000).

3.5 Conclusions

Typically enterprise risk management implementation is explained either by corporate governance motivations or traditional corporate finance theories. Previous empirical studies of ERM determinants focus on all-encompassing proxies for ERM. However, ERM can include varying levels of very traditional risk management activities and risk governance, and taking this division into account is an important step in clarifying theoretical motives for ERM implementation. By doing so, this study is able to investigate determinants of the additional risk governance component of ERM – the step beyond traditional risk management.

Based on a survey of 145 firms, results support that the two components do in fact have their own determinants, and that the level of risk governance in a

firm is related to the need for governance because of the size of the firm and the existing governance in terms of leverage and dividend payments. The level of control the chief executive officers have on the governance decisions in the firm also plays a role in risk governance implementation; given the importance of the support of the CEO and the executive management team for successful ERM implementation, evidence of an agency problem like this is highly problematic. These characteristics are consistent with motives for corporate governance, heavily grounded in agency theory of managerial incentives. Evidence does not seem to suggest that public pressure, from Big Four auditing firms and credit rating agencies, is motivating risk governance implementation. This may be evidence that risk governance and ERM implementation are not simply about firms' attempts to window-dress and appease stakeholders artificially. Traditional risk management seems to be best explained by the firms advantage in terms of transactions cost of risk management and the need to mitigate underinvestment costs. Therefore, the evolution of risk governance in the last few decades can arguably be in response to the growing concern about the lack of both corporate governance and risk management in firms.

As with most studies in corporate finance, there are limitations to this study. Structural equation modeling is intended for a priori testing of theoretical models, therefore, robustness is problematic in the sense that there is not a clear cut competing model to test. Sample size is also a crucial aspect of structural equation modeling. Based on Comrey and Lee (1992) the sample used in this study falls between poor and fair. Given several variables are loading strongly on each factor, a smaller sample, like the one in this study, can be argued as adequate. Further research should attempt to test this suggested model on another sample.

Given the limitations, the findings of this study should be taken as an exploratory step and not as absolute. Despite this, this study does contribute to sorting out motivations of ERM in a more theoretical manner; until now much of the argumentation has been intuitive and ad hoc and with little connection to corporate finance theory. It may also be evidence that firms are implementing ERM for the same reasons stakeholders have for pushing for its implementation. Future research should focus on the value of implementing risk governance while controlling for the value created by traditional risk management.

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Chapter 4. Risk Management Quality and Credit Risk

4.1 Introduction

The objective of this study is to determine if there is a relationship between credit risk and the quality of a firm's risk management. A firm's credit risk is a forward-looking measure of the firm's own probability of default or the current and future risk facing its creditors. Many credit risk studies have focused on how quantifiable and retrospective factors, like financial ratios or macroeconomic factors, predict credit risk. While these factors do contain a lot of information, more qualitative aspects of the firm are often ignored in credit risk prediction despite the fact that they may better capture how the firm will act in the future. Corporate governance is such a qualitative aspect, but only a limited number of studies have investigated this relationship (Bhojraj & Sengupta, 2003; Ashbaugh-Skaife, Collins, & LaFond, 2006). Surprisingly, the existing studies on credit risk predication have overlooked an important qualitative and forward looking factor directly related to a firm's credit risk, namely the firm's quality of risk management. In addition to the technical use of financial instruments for risk management, the concept of quality in the risk management system incorporates practices of the firm in terms of organizational structure, business model, firm-wide risk analysis, valuations, and risk measurement (Jorion, 2009); essentially, quality is defined as a well governed and well organized risk management system.

Theoretically, risk management can reduce the amount of credit risk by decreasing the volatility of cash flows and reducing the probability of financial distress (Smith & Stulz, 1985). Governance mechanisms decrease a firm's credit risk by increasing the amount of credible information available for properly evaluating the default risk of the firm and decreasing agency risk through monitoring (Bhojraj & Sengupta, 2003; Ashbaugh-Skaife, et al., 2006). It is relatively safe to assume that firms who actively choose to manage, control, and mitigate its risk in a formal and structured manner, would likely have lower credit risk and, for example, be rewarded with higher credit ratings by ratings agencies. A key challenge in empirically

investigating the effect of risk management quality on credit risk is how to operationalize the concept of quality; we solve this problem by using an enterprise risk management (ERM)[28] framework.

ERM has evolved because of a call for more holistic, integrated risk management in response to corporate failings and financial crisis (Kirkpatrick, 2009). This demand for firm-wide risk management has led to a number of ERM frameworks[29] and been incorporated into a variety of corporate regulations, such as the Basel Accords for banks. ERM as a framework is intended to ensure quality in the risk management system and enhance efficiency. It does so in part through traditional risk management mechanisms as well as through so called "risk governance" or risk management-related corporate governance mechanisms (Aebi, Sabato & Schmid, 2012). ERM should be able to create long-run competitive advantages and value through consistent and systematic measurement and management of firm risks and ensuring proper information and incentives for business managers (Nocco & Stulz, 2006). Through the integration of the risk management system, three common failures of risk management – failure to get information to the right people, failure to connect benefits to its costs, and failure to exploit strategic opportunities – can be addressed (Culp, 2001). Key dimensions which make ERM the epitome of quality are, for example, the establishment of a risk committee, the hiring of a chief risk officer (CRO), firm wide communication regarding risk management, the implementation of a risk appetite, and/or the creation of a risk management philosophy.

We construct a novel measure of risk management quality by using text-based searches of annual reports for word combinations related to a number of dimensions of ERM. The list of dimensions comes from previous ERM studies by Desender (2011), Lundqvist (2014), and Hoyt and Liebenberg

[28] Also referred to as integrated risk management, strategic risk management, consolidated risk management, or holistic risk management.

[29] Some of the most prominent and frequently mentioned frameworks are: COSO's ERM Integrated Framework, the Joint Australia/New Zealand 4360-2004 Standards, ISO 31000-2009, the Turnbull Guidance, the Casualty Actuarial Society Framework, the International Association of Insurance Supervisors Framework, and Basel II.

(2011). Our measure of quality therefore varies over time for each firm; we also find considerable variation in quality scores across firms. We proxy credit risk with credit default swap (CDS) spreads and credit ratings. From what we can tell, CDS spreads are not frequently used as a proxy for cross sectional variation in firm credit risk.

By proxying credit risk with credit ratings, we can investigate a relationship that is stressed over and over again in ERM literature (Pagach & Warr, 2011; Beasley, Pagach, & Warr, 2008; Hoyt & Liebenberg, 2011; McShane, Nair, & Rustambekov, 2011); effective ERM reduces risk and can help a company maintain or improve its credit rating (Fraser & Simkins, 2007). This relationship has to our knowledge never been formally tested.

Our sample consists of 78 of the largest banks in the world. Banks are the optimal sample for this kind of study given the importance of both credit risk and risk management quality in the banking industry. The default of a large bank may carry systemic risk. A main operation of banks is the management and control of counterparty risk, market risk, and operational risk, and regulators have stressed the importance of the quality of the risk management system in managing these risks, specifically through regulation like the Basel Accords. The banking industry also lends itself well to an ERM framework for quality given that evidence suggests that the financial industry generally shows more extensive implementation of ERM (Beasley, Clune, & Hermanson, 2005; Pagach & Warr, 2011).

We find a significant and negative relationship between the quality of a firm's risk management and its CDS spread. A one standard deviation increase in risk management quality decreases the CDS spread by approximately 97 basis points (bp), 49 bp when controlling for bank characteristics and corporate governance. With risk management quality as the sole determinant of credit rating, a one standard deviation increase in risk management quality increases the likelihood of having an AAA or AA rated company by 12%. However, when controlling for corporate governance characteristics of the bank, risk management quality is no longer a significant determinant of the credit rating. This may suggest that credit rating agencies value the governance aspects of ERM, and the market values something other than governance, likely the actual risk management function itself.

The article is organized in the following manner. We first present our arguments for using enterprise risk management as a framework for risk management quality. We then present a discussion about credit risk and its

relationship with risk management quality. We then present the sample, data, and method used to investigate the hypothesized relationship between risk management quality and credit risk. We conclude with results, conclusions, and suggestions for future research.

4.2 Enterprise Risk Management as a Framework for Risk Management Quality

In recent years, comprehensive risk management frameworks have included recommendations on the governance of the risk management system (e.g., Basel Committee on Banking Supervision, 2008; FSA, 2008; IIF, 2007). "Winning" risk management practices have been expanded to include cooperative organizational structures and firm-wide sharing of information about risk (Jorion, 2009). Enterprise risk management is a framework for achieving this type of "winning" risk management. ERM incorporates both more standard aspects of a risk management system, such as risk identification and hedging mechanisms, as well as the governance of the risk management system, organizational, structural, and monitoring aspects. As a whole, ERM is intended to enhance and ensure the quality of the risk management system by merging these two aspects.

While it is hard to pinpoint the exact mechanism with which ERM creates value for a firm, traditional risk management and governance related benefits are generally central to the argumentation. Nocco and Stulz (2006) argue that ERM can create long-run competitive advantages by creating value both on the macro level, by helping the firm maintain access to capital markets and other resources, and the micro level, by creating a "way of life" for managers and employees at all levels of the company. Macro benefits are arguably related to the standard corporate finance theories of risk management; risk management mitigates costs by reducing the underinvestment problem, mitigating financial distress costs, coordinating investment and financing strategies, and mitigating costs resulting from agency problems associated with managerial incentives (Bartram, 2000). Micro level benefits, resulting from the "way of life" established in the firm, are unique benefits of ERM. How risks are integrated and how the risk management system is governed and structured, for example by hiring a chief risk officer (CRO) or implementing risk governance mechanisms, has become the new focus in risk management (Aebi et al., 2012). Therefore, the firm can benefit from ERM in terms of enhanced governance of the risk management system, from the "enterprise" aspects, in addition to its more

basic risk management purposes, the "RM". These combined benefits make ERM the current "standard" of quality in risk management.

Given that parties heavily interested in corporate risk assessment, including credit risk, have shown support and placed weight on the implementation of ERM in both non-financial and financial firms, it does not seem to be just the framework creators and consultants who stand by the proposition that ERM ensures quality of the risk management system. The rise of interest and implementation of ERM is often argued to be a result of the increased focus on ERM by rating agencies. In 2008, Standard and Poor's announced its intent to incorporate an ERM analysis into their corporate ratings.

The implementation of ERM in financial firms has been greatly influenced by regulation, including the Basel recommendations. Pillar 2 of the Basel II framework pertains to the supervisory review process. "Flaws in risk management practices revealed by the crisis, which in many cases were symptoms of more fundamental shortcomings in governance structures at financial institutions", are a major influence for the enhancements to Pillar 2 proposed by the Bank of International Settlements in January 2009. In order to strengthen the supervisory guidance and Pillar 2, the Committee provides enhanced guidance for firm-wide governance and risk management.

Given the purpose of ERM and the support it has received, implementing risk management with the help of an ERM framework should ensure quality and create value for a firm. However, empirically there is no consistent evidence supporting this conjecture. Though there are a limited number of empirical studies on ERM due to its rather recent evolution, a number of studies have investigated the impact of ERM on a firm. The majority of studies focus on how ERM creates value for an enterprise where value is defined in terms of excess stock market returns (Beasley et al., 2008; Gordon, Loeb, & Tseng, 2009), an overall measure of value proxied by Tobin's Q (McShane et al., 2011; Hoyt & Liebenberg, 2011), perceived performance such as better decision making and profitability (Gates, Nicolas, & Walker, 2012) and bank performance measures like buy-and-hold returns and return on equity (Aebi et al., 2012).

Beasley et al. (2008) find that the average two-day market response to a CRO announcement is insignificant, but that the magnitude of equity market returns are dependent on certain firm specific characteristics. This would imply that the costs and benefits of ERM are firm-specific. Gordon et al. (2009) also find that the relationship between ERM and firm performance,

measured in excess stock market returns to shareholders over a year, is contingent on environment uncertainty, industry competition, firm size, firm complexity, and board of directors' monitoring. These studies provide some evidence that ERM is value creating to shareholders in some situations.

The strongest support for ERM's ability to create value comes from Hoyt and Liebenberg (2011). They find an ERM premium of roughly 20% which is both statistically and economically significant. They measure ERM using a dummy variable which takes the value of one if a string of search words related to ERM are found in the firm's public information. They estimate the relationship between the implementation of ERM and Tobin's Q, a commonly used proxy for firm value. McShane et al. (2011) also use Tobin's Q to proxy firm value but find no significant relationship between their ERM measure and Tobin's Q.

Gates et al. (2012) take a more qualitative approach to value and find that aspects of ERM significantly impact the perceived performance of a firm measured by surveying the perceived benefit of ERM to: measure risk-adjusted performance among business units, increase ability to meet strategic goals, reduce earnings volatility, and increase profitability.

Aebi et al. (2012) focus on the distinct characteristic of ERM of implementing risk governance. They test the relationship between risk governance and bank performance. They find that banks whose CRO, a common indicator of ERM, directly reports to the board of directors exhibit significantly higher stock returns and returns on equity during the financial crisis of 2007/2008.

Pagach and Warr (2011) argue that firms adopt ERM for economic reasons consistent with shareholder wealth maximization, when the benefits of ERM exceed the costs. In support of this, they find that larger firms and firms with more volatile operating cash flows are more likely to adopt ERM, identified by hiring a CRO. They also find that stock volatility is also an important determinant of CRO hiring as well as the incentives for the CEO to take risk. In their bank subsample, they find that banks with lower capital ratios are more likely to hire a CRO. Despite this support, Pagach and Warr (2010) are overall unable to find support that ERM is value creating using a wide range of firm variables. They call for further study in the area, particularly on how ERM's success can be measured.

The inconsistent evidence on the value of ERM may suggest that enterprise risk management does not ensure quality as intended and is in turn not value

creating, or that the costs of implementing outweigh any possible benefits. On the other hand, it could suggest that the current focus variables used to measure value are inappropriate or are simply too noisy. Like Pagach and Warr (2010), we believe the previous "value" variables to be the source of variation in the results.

Based on the law of one price, firm value is determined by the discounted future free cash flows of the firm, where the discount factor is determined by the cost of debt and equity. By using ERM as a measure of quality and analyzing its effects on credit risk, we answer Pagach and Warr's (2010) call by isolating and analyzing value creation through the specific channel of the reduction of the cost of debt by means of a decrease in a firm's probability of default. We therefore are able to meet the need for a new focus variable in the ERM literature as well as address the lack of research on how the quality of risk management affects a firm's credit risk.

4.3 Credit Risk and Risk Management Quality

If we view risk management quality as a risk management system that is well governed, we can rely on the underlying theories for risk management and corporate governance to come to the conclusion that risk management quality should decrease a firm's credit risk.

Theoretically, capital market imperfections create incentives for firms to implement risk management on the basis that it is value creating to do so. One way to create value is through the reduction of transaction costs of financial distress. Risk management can reduce the probability of future financial distress by decreasing the volatility of cash flows (Smith & Stulz, 1985; Bartram, 2000). By reducing the probability of financial distress and future default, the credit risk of the firm is reduced. Overall, empirical studies on risk management support the relationship between risk management, measured by the use of a variety of derivatives, and the probability of default, measured by leverage, interest coverage, or credit rating (Géczy, Minton & Schrand, 1997; Gay & Nam, 1998; Samant, 1996; Nance, Smith & Smithson, 1993; Brunzell, Hansson, & Liljeblom, 2011; Wall & Pringle, 1989; and Mayers & Smith, 1990).

Despite this theoretical and empirical connection between credit risk and risk management, if we look at studies on the determinants of credit risk, this relationship is ignored. There are a plethora of studies in the area of credit risk, specifically the prediction of credit ratings (Matthies, 2013b; Curry,

Fissel, & Hanweck, 2008; Kamstra, Kennedy, & Suan, 2001; Bissoondoyal-Bheenick & Treepongkaruna, 2011; Bhojraj & Sengupta, 2003; Blume, Lim, & MacKinlay, 1998; Ashbaugh-Skaife et al., 2006; Amato & Furfine, 2004). The determinants of credit ratings fall into three main categories: financial ratios and financial data, corporate governance mechanisms, and macroeconomic factors (Matthies, 2013a). Empirical studies have mostly looked at how the quantity of a firm's risk, financial and macroeconomic factors, affects credit ratings; resulting is a set of standard and robust factors which affect credit ratings, for example leverage, liquidity, and size. These types of factors are more retrospective and do not necessarily capture the forward-looking aspects which are relevant for credit risk. There have been a limited number of studies investigating corporate governance and its impact on credit risk (Bhojraj & Sengupta, 2003; Ashbaugh-Skaife et al. 2006). Governance qualities may better capture future firm activities and it is an integral part of high quality risk management.

Corporate governance can be viewed as a mechanism for reducing two risks which affect the firm's likelihood of default: agency risk and information risk. The firm's likelihood of default is dependent on having credible information for properly evaluating the default risk and agency costs in a firm (Bhojraj & Sengupta, 2003). Governance reduces agency risk by increasing monitoring in the firm, unless institutional investors act passively or outside owners act in favor of their own private benefits. Additionally, governance reduces information risk in the firm by encouraging firms to disclose information in a timely manner (Bhojraj & Sengupta, 2003). Ashbaugh-Skaife et al. (2006) argue that governance impacts credit ratings by controlling agency costs which occur from conflicts between managers and all external stakeholders. Like Bhojraj and Sengupta (2003), they argue that governance increases the monitoring in the firm which should result in better decision making by managers and increased value to all stakeholders. Moreover, weak governance will decrease the probability distribution of future cash flows which increases the likelihood of default and should in turn decrease the credit rating or increase the amount of credit risk.

Empirical evidence does in fact suggest that, after controlling for firm-specific risk characteristics, credit ratings are negatively associated with the number of blockholders and CEO power and positively related to takeover defenses, accrual quality, earnings timeliness, board independence, board stock ownership, and board expertise (Ashbaugh-Skaife et al., 2006). Bhojraj and Sengupta (2003) also find that firms with greater institutional ownership

and stronger outside control of the board enjoy lower bond yields and higher ratings on new bond issues.

The risk governance component of ERM is intended to achieve similar benefits to those of corporate governance but in the context of the risk management system: for example, having more credible information on risk and less risk of agency problems in terms of risk raking.

In terms of enterprise risk management specifically, Fraser and Simkins (2007) say clearly that the reduction in risk accomplished by effective ERM can help a company maintain or improve its credit rating. They give the example of Hydro One[30]:

> *Hydro One achieved a lower than expected interest cost on a $1 billion debt issue that was heavily oversubscribed. The credit analysts from Moody's and S&P who rated the issue cited the firm's ERM program as a factor in the ratings process (pg. 81).*

One of their ten common misconceptions of ERM is that ERM has no discernible effect on financial market or firm value; but to the extent that a higher credit rating means greater access to and a lower cost of debt, ERM can be seen as reducing a company's overall cost of capital and increasing its value (Fraser & Simkins, 2007). The relationship between ERM and credit ratings is stressed over and over again in ERM literature (Pagach & Warr, 2011; Beasley et al., 2008; Hoyt & Liebenberg, 2011; McShane et al., 2011) but never formally investigated.

There should be a connection between risk management quality and credit risk. Credit risk should be mitigated by the risk management itself, through the reduction of the probability of financial distress, and through the proper governance of the risk management system, through the reduction of information risk and agency risk. Information risk and agency risk are relevant concerns in the context of a risk management system in terms of, for example, the reliability of information about firm risks and the risk taking of

[30] For more on enterprise risk management at Hydro One, see Aabo, Fraser, and Simkins (2005).

managers. However, as far as we know, there are no studies that have analyzed the important relationship between risk management quality and credit risk. One reason could be the difficulty in measuring the quality of a firm's risk management. We use the enterprise risk management framework in order to operationalize quality. It is often argued that there is an explicit relationship between ERM and credit risk, but this has not been tested previously; we investigate this relationship in banks.

4.4 Sample, Data, and Empirical Method

We start with the 140 largest banks in the world based on total assets in U.S. dollars as of fiscal year end 2006. Banks without credit ratings or traded credit default swaps, without annual reports in English for at least one of the years 2005-2011, and that do not survive the entire time period drop out leaving 78 banks. For 2006, the average total assets of the 78 banks are equal to approximately 790 billion U.S. dollars. 12 are U.S. banks, 39 are European and 15 are Asian.

Banks are an appropriate sample given that credit risk and risk management quality are often a focus in the banking industry. Defaults of large banks may create systemic problems. Regulators have stressed the importance of the quality of the risk management system in managing a bank's counterparty risk, market risk, and operation risk, specifically through regulations like the Basel Accords. The banking industry also lends itself well to an ERM framework for quality given that evidence suggests that the financial industry generally shows more extensive implementation of ERM (Beasley et al., 2005; Pagach & Warr, 2011).

Sample years are 2005–2011; annual reports, which are necessary for the measurement of ERM, are difficult to obtain prior to 2005. A survivor sample is necessary because annual reports for banks which merge or cease to exist during the time period were not available to us. We obtain annual reports from the banks' websites. In cases where annual reports are unavailable online, we contact the bank via e-mail to obtain them.

Because we employ a survivor sample, the level of credit risk is likely to be underestimated given that firms with poor credit risk are likely to go bankrupt and thus drop from the sample. It may also bias the level of risk management implementation, but we do not expect it to have an effect on the relationship itself.

4.4.1 Measuring Credit Risk

We proxy banks' credit risk using two variables: borrower credit ratings and credit default swap spreads. The CDS spread is the amount paid for insurance against default and is a direct market-based measure of the company's credit risk, and credit ratings are opinions of the credit rating agency regarding a corporation's relative credit risk (Standard & Poor's, 2011). Therefore, both the credit rating of the firm and the CDS spread is driven by a bank's credit quality and level of credit risk which is otherwise unobservable.

We use both measures in order to obtain a robust picture of risk management quality's effect on credit risk. Credit rating data is more readily available for our sample of banks and credit ratings have long been used as an indicator of credit quality. However, credit ratings have been under scrutiny given their poor performance before and during the financial crisis. Credit ratings also have a certain stability which means that credit rating changes may not reflect credit risk in a timely manner. This is one reason to bring in CDS prices as an additional measure of credit risk; CDS prices should be a better measure of credit risk because of its market based and timely nature. One would therefore expect that credit rating changes should lag credit spread changes (Hull, Predescu, & White, 2004).

However, from what we can tell, no studies used CDS spreads as a cross sectional firm proxy of credit risk in the same way we do. A few studies do use cross sections of CDS spreads for other purposes like Ericsson, Jacobs, and Oviedo (2009) and Darwin, Treepongkaruna, and Faff (2012) who look at both bond spreads and CDS spreads to determine the liquidity risk premium in bond spreads. We do not expect the results to differ between the two measures. The close relationship between credit ratings and CDS prices has been fairly well established (Hull et al, 2004; Daniels & Jensen, 2005; Micu, Remolona, & Wooldridge, 2006).

Credit Default Swaps

CDS mid spreads for year-end are obtained from DataStream (DataStream code: SM). A typical bank has about 50-70 different CDS contracts traded that differ in time to maturity, currency, the definition of a credit event and the seniority of the debt. We choose contracts based on their liquidity, selecting contracts with a maturity of five years, denomination in U.S. dollars, senior debt and modified restructuring (MR) as the credit event. In cases

when this specific CDS contract is not available, we select contracts according to the following rules in order of importance. If U.S. dollar denomination does not exist we use euros, if senior debt does not exist we first use subordinated debt and if that does not exist preferred debt. For the credit event we choose in order of preference: modified restructuring (MR), modified-modified restructuring (MM), and complete restructuring (CR) which is sometimes called full restructuring (FR). For a description of the different credit events and their pricing impact see Packer and Zhu (2005).

Table 31 shows descriptive statistics for the CDS prices. For the CDS sample we lose the years 2005 and 2006 due to data availability in DataStream. The maximum sample size for any given year is 54 banks. The average value of the CDS spread varies over time from 46.9 basis points in 2007 to 458.4 basis points in 2011. There is also a lot of cross sectional variation between the banks with the first quartile at 86.2 basis points and the third at 265.1 when looking across all years and companies.

Table 31. Descriptive Statistics for the Credit Default Swap Prices

	All years	2007	2008	2009	2010	2011
Mean	264.31	46.88	193.59	175.40	295.34	458.41
St dev. (of mean)	26.13	2.61	20.61	46.42	52.25	75.18
1st quartile	86.24	40.88	112.00	65.00	104.88	149.61
Median	139.10	45.00	140.00	95.31	159.07	267.26
3rd quartile	265.13	53.38	225.00	141.67	261.36	481.31
Max	2646.00	69.00	785.19	2135.00	1519.00	2646.40
Min	27.00	27.00	70.50	43.33	55.83	67.55
# Observations	213	21	46	46	46	54

Notes: Year-end CDS prices are obtained from DataStream (DataStream code: SM). See main text for details on CDS selection.

Credit Ratings

We use the Standard and Poor's year-end historical local borrower rating collected from DataStream (DataStream code: BSPHL). Standard & Poor's uses the following ratings: "AAA", "AA","A", "BBB", "BB", "B", "CCC", "CC", "C", and "D". Where "AAA" denotes the strongest creditworthiness and "C" or "D" denote the weakest or that default has occurred. Ratings

from “AA” to “CCC” may be modified by the addition of a plus (+) or minus (-) sign to show relative standing within the major rating categories. Firms with a rating of "BBB-" or higher is considered investment grade, anything below is considered speculative grade.

Ratings are grouped into four categories. We decide to treat plus and minus ratings as belonging to the same category, and we also group all non-investment grade companies into the same category. “AAA” and “AA” rated firms are grouped into the same category. Table 32 shows descriptive statistics for the credit ratings. Most banks fall into the A rating and only 13 ratings for all banks and all years are non-investment grade. The maximum sample size for any given year is 72 banks.

Table 32. Descriptive Statistics for the Credit Ratings

Rating	All Years	2005	2006	2007	2008	2009	2010	2011
# AAA or AA	145	18	25	30	22	18	17	15
# A	234	24	24	29	41	39	39	38
# BBB	51	3	3	3	6	13	11	12
# <BBB	13	1	1	0	0	0	4	7
# Observations	443	46	53	62	69	70	71	72

Notes: We use the Standard and Poor’s year-end historical local borrower rating collected from DataStream (DataStream code: BSPHL). Plus and minus ratings are grouped into to the same category as the major rating and all non-investment grade companies (below BBB) are grouped into a single category.

4.4.2 Measuring Quality of Risk Management

Our measure of quality is based on an enterprise risk management framework and previously used measures of ERM. A major obstacle to empirical research in ERM is the difficulty in identifying firms engaging in ERM, let alone identifying how well implemented ERM is.

Firms typically do not disclose whether they are managing risks in an integrated manner. Much of their risk management disclosure and discussion relates to specific risks and not whether they are managed in an integrated way (Liebenberg & Hoyt, 2003). In order to best deal with these challenges, we approach the measurement of quality by ensuring we include a variety of dimensions of risk management found under the ERM umbrella, from basic

risks which are considered to the organization and control of the risk management system, and we therefore avoid using just the most common signals of ERM implementation. The aim is to capture a broad measure of the quality of the risk management system and not place too much weight on more narrow aspects of ERM, for example, hiring and disclosing the position of Chief Risk Officer (CRO) which may or may not be more about window-dressing.

We measure the quality of risk management by searching the banks' annual reports for combinations of words related to ERM dimensions. The list of dimensions is based on Desender (2011), Lundqvist (2014) and Hoyt and Liebenberg (2011); we search for a total of 83 dimensions of ERM. As a specific single word would seldom well represent an ERM dimension, we search for word combinations. Some dimensions may be represented by more than one set of word combinations, for example synonym combinations.

As a specific example, one of the dimensions of ERM is the statement of risk appetite. For this, we search for "risk + appetite" which only gives a search hit if the word "risk" exists within plus/minus 200 characters of the word "appetite". In some cases, we also use combinations with more than two words, for example "risk + response + plan"; in that case, we count a hit if all the words exist within plus/minus 200 characters from the first word. See Appendix 4.1 for a full list of dimensions and the respective search combinations as well as the percent of firm/year observations with a hit for each dimension.

We code all search combinations that have at least one hit with a one and the others with a zero. As mentioned, some dimensions are represented by more than one set of word combinations; in these cases, a one for that dimension is an "or" function of the individual search combinations.

We sum the coded variables to create an overall quality score for each firm year. An alternative would be to use the sum of the number of hits for each search combination, but that would put more weight on search combinations that are more common which does not necessarily mean that they are more important. Our zero/one coding gives equal weight to all search combinations in the quality measure. Given the breadth of our search words, there is no reason to believe any given word holds relatively more weight than another.

Our quality measure could of course capture the disclosure of ERM, risk management in general, or even the general level of disclosure. To alleviate these concerns we add a general disclosure proxy (the total number of words in the annual report) as a control variable in the regression analysis and find that our measure of quality captures a dimension that is different from general disclosure.

We attempted also to create a measure comparable to that of Hoyt and Liebenberg (2011). They search public information for a number of key words associated with ERM.[31] We search for the same keywords as part of our measure; but when using them exclusively to create a distinct dummy variable, we find that 98% of firms would be characterized as ERM implementers. In the largest banks, a narrow measure of ERM is insufficient for capturing variability in ERM implementation, and we do not include this measure in the analysis.

The benefit of a more broad measure is that it should better measure quality of risk management without placing too much weight on typical ERM indicators. It also can vary over time for each firm and has more variation between firms given that it is a continuous variable.

Table 33 and Table 34 show the descriptive statistics for the risk management quality measure for the CDS sample and the credit rating sample respectively. The mean level of quality of risk management increases over time in both samples.

[31] Enterprise risk management, chief risk officer, risk committee, strategic risk management, consolidated risk management, holistic risk management, integrated risk management.

Table 33. Descriptive Statistics for the Risk Management Quality Measure for the CDS Sample

Risk Management Quality	All years	2007	2008	2009	2010	2011
# Observations	213	21	46	46	46	54
Mean	49.61	48.10	47.74	49.96	51.13	50.20
St dev. (of mean)	0.69	1.35	1.52	1.35	1.30	1.58
1st quartile	45.75	40.00	44.00	47.00	49.00	46.00
Median	52.00	52.00	52.00	52.00	53.00	52.50
3rd quartile	56.00	54.50	55.00	56.00	57.00	58.00
Max	65	60	63	63	62	65
Min	12	28	19	21	19	12

Notes: The hypothetical maximum score for the risk management quality measure is 83.

Table 34. Descriptive Statistics for the Risk Management Quality Measure for the Credit Rating Sample

Risk Management Quality	All years	2005	2006	2007	2008	2009	2010	2011
# Observations	442	46	53	62	69	70	71	71
Mean	47.36	43.26	44.74	46.94	46.17	48.73	49.22	50.27
St dev. (of mean)	0.52	1.38	1.22	1.15	1.40	1.20	1.27	1.38
1st quartile	41.0	36.0	37.75	41.0	41.75	44.00	46.25	46.00
Median	50.50	45.50	47.00	48.50	50.00	51.00	52.00	53.00
3rd quartile	56.00	53.00	53.00	54.00	55.00	56.00	57.00	58.00
Max	66	61	60	65	64	63	63	66
Min	12	15	24	24	17	21	18	12

Notes: The hypothetical maximum score for the risk management quality measure is 83.

4.4.3 Control Variables

We control for differences among the companies in the level of overall disclosure, level of risk, profitability, firm characteristics, valuation, and corporate governance. The controls we select are those used in bank credit rating determinants literature e.g. Curry et al. (2008) for supervisor ratings given to bank holding companies and Bissoondoyal- Bheenick and Treepongkaruna (2011) for bank credit ratings. Influenced by the findings in Ashbaugh-Skaife et al. (2006) and Bhojraj and Sengupta (2003), we also include a number of measures related to corporate governance. We use the same set of controls for the CDS spreads and for the credit ratings for the reasons mentioned previously.

All control variables, apart from the disclosure variable, are collected from DataStream.

Number of words *(#Words*): Our risk management quality measure could capture the general level of disclosure, where more hits of search combinations are given to firms which simply choose to articulate more information overall. To alleviate these concerns we add a general disclosure proxy, the total number of words in thousands in each annual report, as a control variable in order to ensure that our measure of quality captures a dimension that is different from general disclosure.

Total assets (*TA)*: Total assets are included in order to control for the size of firms. Larger firms face lower market risk and are thus expected to have higher credit ratings (Bhojraj and Sengupta, 2003).

Return on assets (*ROA*): ROA is used as a proxy for a firm's default risk where lower ROA reflects greater levels of default risk (Ashbaugh-Skaife et al., 2006).

Capital adequacy ratio – Tier 1 (*Tier 1 Ratio*): The Basel Accord stresses the importance of capital adequacy, and capital adequacy ratios are used by regulators to assess compliance with minimum capital standards required for sensible banking (Bissoondoyal-Bheenick and Treepongkaruna, 2011). Banks with higher capital adequacy ratios should have higher credit ratings and lower CDS prices. The Tier 1 ratio is the ratio of Tier 1 capital to total risk-weighted assets, calculated in accordance with banking regulations and expressed as a percentage. Tier 1 capital includes common shareholders' equity and qualifying preferred stock, less goodwill and other adjustments.

Non-performing loans over total assets (*Non-Performing Loans / TA)*: Non-performing loans and provision for loan losses both capture a bank's credit quality (Curry et al., 2008). Both variables are expected to be negatively related to credit ratings and positively related to CDS spreads. Non-performing loans represent the amount of loans that the bank foresees difficulty in collecting. It

includes but is not restricted to: non-accrual loans, reduced rate loans, renegotiated loans and loans past due 90 days or more. It excludes: assets acquired in foreclosures and repossessed personal property.

Provision for loan losses over total assets (*Provision for Loan Losses / TA)*: For banks provision for loan losses represents losses that the bank or the company expects to take as a result of uncollectable or troubled loans.

Corporate governance score: Because our measure of the quality of risk management and ERM are intended to represent aspects of a firm's risk governance, we control for overall firm governance in order to ensure the quality measure represents governance in the risk management framework and does not pick up an effect from more general governance practices. In order to do this we use a corporate governance score which should incorporate many of the governance aspects included by Ashbaugh-Skaife et al. (2006) and Bhojraj and Sengupta (2003).

The corporate governance score comes from the Thomson Reuters ASSET4 environmental, social and governance (ESG) content. ASSET4 data is used more prominently in corporate social responsibility (CSR) literature (Cheng, Ioannou and Serafeim, 2013; Ioannou and Serafeim, 2012). ASSET4 specializes in providing objective, relevant, auditable, and systematic ESG information and investment analysis tools. Specially trained research analysts collect evaluation points for each firm, where all the primary data used must be objective and publically available (Cheng et al., 2013).

The corporate governance pillar score used in this article measures a company's systems and processes, which ensure that its board members and executives act in the best interests of its long term shareholders (DataStream code: CGVSCORE). The score ranges from 0 to 100, and the aspects covered in this score are board structure, compensation policy, board functions, shareholders rights, and vision and strategy. [32]

Audit Committee Independence: In order to place less reliance on the corporate governance score, we also control for two additional corporate governance proxies. Audit committees can be argued to more effectively carry out their oversight if they have a strong base of independent directors; under this hypothesis, there should be a positive relationship between the percentage of independent board members on the audit committee as stipulated by the company and the bank's credit rating (Ashbaugh-Skaife et al., 2006). Because of the connection between an enterprise risk management function and an

[32] More information on the Asset4 ESG content can be found at http://thomsonreuters.com/esg-research-data/.

audit function, it is important to control for this specific aspect separately, in order to obtain cleaner "risk governance" effects.

Single Biggest Owner: In order to control for ownership effects of governance, we control for the percentage ownership of the single biggest owner by voting power. Large owners may on average be beneficial to bondholders because of their ability to discipline management or they may be detrimental to bondholder because of their desire to redistribute wealth from bondholder to themselves and other shareholders (Ashbaugh-Skaife et al., 2006). Because ownership effects are not directly incorporated in the corporate governance score, we include it as a separate governance control.

Finally, we include year dummies to control for time variation. All variables are defined in Table 35 and descriptive statistics are given in Table 36 and Table 39 in the results section for the CDS sample and the credit rating sample respectively.

Table 35. Description of Control Variables

Variable Name	Definition	Source
#Words	Number of words in each annual report. Measured in thousands.	Annual reports
Total Assets (TA)	Cash & Due from banks + Total Investments + Net Loans + Customer Liability on Acceptances (if included in total assets) + Investment in Unconsolidated Subsidiaries + Real Estate Assets + Net Property, Plant and Equipment + Other Assets Measured in billions.	DataStream code: WC02999
Return on Assets (ROA)	(Net Income before Preferred Dividends + ((Interest Expense on Debt-Interest Capitalized) * (1-Tax Rate))) / (Last Year's Total Assets - Last Year's Customer Liabilities on Acceptances) * 100 Customer Liabilities on Acceptances only subtracted when included in Total Assets	DataStream code: WC08326
Tier 1 Ratio	Tier 1 Capital / Total Risk-Weighted Assets	DataStream code: WC18157
Non-Performing Loans / TA	Non-Performing Loans / Total Assets	DataStream code: WC02285 / WC02999
Provision for Loan Losses / TA	Provision for Loan Losses / Total Assets	DataStream code: WC01271 / WC02999
Corporate Governance Score	Corporate Governance Score from 0 to 100.	DataStream code: CGVSCORE
Audit Committee Independence	Percentage independent board members on the audit committee as stipulated by the company.	DataStream code: CGBFDP018
Single Biggest Owner	Percentage ownership of the single biggest owner by voting power.	DataStream code: CGSRDP045

Notes: Corporate governance data from Thomson Reuters ASSET4 ESG Database in DataStream.

4.4.4 Modelling Credit Default Swap Spreads

To explain the CDS spreads we use a panel regression model of the form:

$$\boldsymbol{CDS_{it} = \alpha_t + x_{it}\beta + u_{it}}$$

We find that there is significant variation in the CDS spread over time that is not captured by firm specific variables. We model this by allowing the intercept to vary over time (time fixed effects). The time varying intercept accounts for differences in the level of the CDS spread that is common to all companies and obviates the use of macroeconomic control variables. As explanatory variables, $\mathbf{x}_{it}$, we use the same control variables described in the previous section. One potential advantage with using panel data is that the problem of unobserved heterogeneity can be considerably mitigated by including firm fixed effects. We have however a sample that is much smaller in the time dimension than in the cross-section, and we also expect there to be more variation across firms than across time for a given firm. Because of this, we abstain from using firm fixed effects but instead use fixed effects for different geographical regions, see the endogeneity section for further details.

4.4.5 Modelling Credit Ratings

As is common in the credit rating literature, see e.g. Blume et al. (1998), we use an ordered probit model. We observe differences in the level of ratings between the years, just as we did with the CDS spread, and also here account for these differences by using time fixed effects. We also use fixed effects for different geographical regions in the same manner as for the CDS spread.

The ordered probit model transforms the four discrete ratings group categories (AAA or AA, A, BBB, and <BBB) into a real valued continuous variable, R_{it}, through the variable z_{it} according to:

$$R_{it} = \begin{cases} 3 \text{ if } z_{it} \in [\mu_3, \infty] \\ 2 \text{ if } z_{it} \in [\mu_2, \mu_3] \\ 1 \text{ if } z_{it} \in [\mu_1, \mu_2] \\ 0 \text{ if } z_{it} \in [-\infty, \mu_1] \end{cases}$$

The endpoints for the categories are parameters in the estimation. The most general specification we use for the zs is:

$$z_{it} = \alpha_t + \boldsymbol{x}_{it}\boldsymbol{\beta} + u_{it}$$

With x_{it} being the explanatory variables of primary interest as well as firm specific control variables (see previous section). The distribution of $u_{it}|x_{it}$ is assumed to be N (0, 1). We also estimate various restricted versions of the model.

The distribution of $z_{it}|\Omega$ with $\Omega = x_{it}, w_{it}$ is found by computing the probability for the different possible outcomes according to:

$$P(R_{it} = j|\Omega) = \begin{cases} P(z_{it} < \mu_1|\Omega) = \Phi(\mu_1 - \widehat{z_{it}}) & \text{if } j = 1 \\ P(\mu_{j-1} < z_{it} < \mu_j|\Omega) = \Phi(\mu_j - \widehat{z_{it}}) - \Phi(\mu_{j-1} - \widehat{z_{it}}) & \text{if } j = 2,3 \\ P(z_{it} > \mu_4|\Omega) = 1 - \Phi(\mu_4 - \widehat{z_{it}}) & \text{if } j = 4 \end{cases}$$

With Φ being the cumulative distribution function of the normal distribution with mean zero and variance one and $\widehat{z_{it}} = \alpha_t + x_{it}\beta$, that is, the predicted value of z_{it}. The likelihood function is then found by summing over all observations for all j.

Interpreting coefficients

We are interested in the partial effects of the coefficients on the credit ratings $P(R_{it} = j|\Omega)$ which are given by (see e.g. Wooldridge (2010, p 656)):

$\frac{dp_1}{dx_k} = -\beta_k \phi(\mu_1^* - \bar{x}\beta^*)$ for j=1,

$\frac{dp_j}{dx_k} = -\beta_k[\phi(\mu_{j-1}^* - \bar{x}\beta^*) - \phi(\mu_j^* - \bar{x}\beta^*)]$ for j=2,3,

$\frac{dp_4}{dx_k} = \beta_k \phi(\mu_j^* - \bar{x}\beta^*)$ for j=4,

with ϕ being the probability density function of the normal distribution with mean zero and variance one , $\bar{x}$ the average value of all explanatory variables (including year dummies), and μ_j^* and β^* the parameter values from the maximum likelihood estimation. From these derivatives, it can be seen that beta coefficients cannot be directly compared across model specifications since the magnitudes also depend on the cut-off parameters μ_j. Further note that the sign of the effect is only determined by the sign of beta for j=1 and j=4.

4.4.6 Endogeneity

There are three issues of endogeneity to address in this study. The first is the issue of reverse causality, a case of simultaneity. We argue that credit risk is a function of the quality of risk management and that an increased level of quality should result in higher credit ratings and lower CDS spreads. However, a reverse argument could in fact be that the quality of risk management is a function of credit risk and that having high credit risk, low credit ratings and high CDS spread, should result in a need for higher quality risk management. Evidence of this can be seen in the risk management determinant literature discussed in section three. Because the direction of the relationship is opposite depending on the argumentation, and we find a negative relationship between ERM and credit risk, any effect of reverse causality endogeneity would bias the coefficient upward and against us finding a relationship.

Finding a suitable instrument variable in order to correct for such an endogeniety problem is difficult and has its own set of disadvantages. However, we do identify a possible instrument and use two-stage least squares to alleviate this concern (see footnote 34 on page 203).

Hoyt and Liebenberg (2011) use a treatment effects model since they appear to view non- random assignment of treated and non-treated firms (ERM implementers and non-implementers) as their primary endogeneity problem. Unfortunately, the treatment effects model cannot solve the problem of omitted variable bias (often called unobserved heterogeneity) when the omitted variable is unobservable and can hence not be included in the equation that estimates the treatment. A common unobserved variable in corporate finance research is managerial quality. One could propose that banks with better management quality are more likely to implement higher quality risk management and would therefore have lower credit risk, not

because of the risk management but because of management quality. Since management quality is difficult to measure, it is absent from the model and the risk management quality variable would therefore capture the impact of manager quality on credit risk. We mitigate this omitted variable problem by including variables which proxy managerial quality. For example, return on assets (ROA) can give an indication on how efficient management is at using its assets to generate revenues. Additionally, the corporate governance variables reflect a company's management practices and efficiency. To further alleviate potential problems from omitted variables we take advantage of our panel data set which makes it possible to include cross sectional fixed effects. We include fixed effects based on geographical region by including dummy variables for Australia, North-America and Asia. Europe is left out and its effect is captured by the intercept, Russia and South-America have too few observations to be included as separate geographical regions and are therefore added to Europe.[33]

The final endogeneity problem is the potential measurement error in our quality of risk management variable. This results in attenuation bias which will bias the coefficient towards zero. Therefore, this would bias us against finding a relationship.

4.5 Results

4.5.1 Credit Default Swap Spreads and Quality of Risk Management

Descriptive statistics for the independent variables used in the CDS spread model can be found in Table 36. For detailed descriptive statistics for the risk management quality variable for the CDS sample, see Table 33

[33] Adding Russia to Asia and South-America to North-America or excluding Russia and South-America from the data leaves the results virtually unchanged.

Table 36. Descriptive Statistics for the Control Variables in the Credit Default Swap Model

Variable	Mean	Median	Max	Min	St. dev.
#Words (in thousands)	145.47	131.08	453.32	7.67	69.86
TA (in billions)	0.75	0.51	3.50	0.09	0.72
ROA	0.98	1.06	3.55	-6.68	1.16
Tier 1 Ratio	10.28	10.07	18.10	4.30	2.63
Non-Performing Loans / TA (in percentage)	1.98	1.24	18.68	0.14	2.21
Provision for Loan Losses/ TA (in percentage)	0.63	0.42	5.91	-0.10	0.82
Audit Committee Independence	84.51	100.00	100.00	28.57	23.16
Corporate Governance Score	66.96	74.61	96.68	3.04	23.30
Single Biggest Owner	22.50	15.14	99.80	3.50	19.82

Notes: Variables from 2007-2011 year end. Variable definitions can be found in Table 4.

The correlations, reported in Table 37, show that risk management quality is negatively correlated with the CDS spread and that control variables, such as the ratio of non-performing loans to total assets, show a strong positive correlation with the CDS spread. The two highest correlations among the explanatory variables are between our measure of risk management quality and the number of words in the annual report (0.65) and between the two measures for bad loans (0.71). The high correlation between the number of words and our risk management quality measure is of potential concern; however, as we will see from the regression results, while both variables explain the CDS spread, only our risk management quality measure is significant when both variables are included in the same regression.

Table 37. Variable Correlations – Credit Default Swap Sample

	Variables	1	2	3	4	5	6	7	8	9	10	11
1	CDS price	1.00	-0.20	-0.05	-0.25	-0.54	0.07	0.69	0.47	-0.24	-0.11	0.24
2	Risk management quality		1.00	0.65	0.26	0.00	0.04	-0.03	-0.09	0.27	0.33	-0.10
3	# Words			1.00	0.44	-0.17	-0.04	0.11	-0.06	0.06	0.32	0.03
4	TA				1.00	-0.16	0.05	-0.23	-0.13	-0.09	0.39	0.06
5	ROA					1.00	-0.13	-0.45	-0.38	0.30	-0.04	-0.13
6	Tier 1 Ratio						1.00	0.11	0.07	-0.01	0.02	0.14
7	Non-Performing Loans / TA							1.00	0.71	-0.15	-0.18	0.28
8	Provision for Loan Losses / TA								1.00	-0.09	-0.10	0.20
9	Audit Committee Independence									1.00	0.36	-0.49
10	Corporate Governance Score										1.00	-0.33
11	Single Biggest Owner											1.00

Notes: Years 2007-2011, correlations computed on the average of the year by year.
Variable definitions can be found in Table 35.

Table 38 shows the results for the OLS regressions where the dependent variable is the CDS spread for the end of each year (2007-2011). Year fixed effects are included for all specifications; values for the year dummies are not provided but can be obtained from the authors upon request.

In specification one we estimate CDS spreads as a function of solely the risk management quality measure. We find a significant and negative relationship. Higher levels of risk management quality result in lower CDS spreads which is line with our expectation. The magnitude of the quality coefficient is -9.65 which is also economically meaningful; a one standard deviation increase in implementation (10.07) lowers the CDS spread with 97 basis points (bp).

In specification two we control for the number of words in the annual report in order to control for the potential inflated number of hits due to a generally higher level of disclosure in certain firms. As the sole explanatory variable, number of words is a significant determinant of CDS spreads. However, when risk management quality and number of words are included in the specification together, as in specification two, number of words is no longer significant. This means that the common variation in ERM and number of words is what explains CDS spreads and not the overall level of disclosure. The magnitude of the quality coefficient is almost unchanged with the addition of number of words and still significant at the 1% level. Our measure of quality therefore captures a dimension that is different from general disclosure. [34]

[34] For robustness we also estimate a two-stage least squares specification using number of words as an instrument for risk management quality for all specifications. Number of words is a significant determinant of ERM (relevance criteria), and we would not expect number of words to be a significant determinant of CDS spreads (exclusion criteria). The magnitudes of the estimated risk management quality coefficients are very similar to the OLS estimation. However, we are mindful of the problems associated with weak instruments (Roberts & Whited, 2011) and therefore use the OLS estimations as our main specifications.

Table 38. OLS Panel Regression Results – Credit Default Swap Sample

Explanatory variable	1)		2)		3)		4)		5)	
Intercept	779.707	***	785.054	***	813.250	***	584.394	**	478.538	***
	(185.675)		(186.871)		(200.808)		(235.611)		(135.818)	
Risk management quality	-9.655	***	-10.016	***	-5.772	***	-5.238		-4.875	**
	(3.419)		(3.850)		(2.030)		(3.398)		(2.152)	
#Words (in thousands)			0.081						0.095	
			(0.405)						(0.275)	
TA (in billions)					-54.943	***			-85.531	***
					(17.383)				(26.689)	
ROA					-126.037	***			-77.965	***
					(20.238)				(16.799)	
Tier 1 Ratio					-22.024	*			-9.249	
					(12.303)				(7.468)	
Non-Performing Loans / TA					3.830	***			5.386	***
					(1.420)				(1.786)	
Provision for Loan Losses / TA					5.399				3.172	
					(4.174)				(4.308)	
Audit Committee Independence							-1.262		-1.049	
							(1.341)		(0.765)	
Corporate Governance Score							0.084		2.384	**
							(1.037)		(1.149)	

Explanatory variable	1)	2)	3)	4)	5)
Single Biggest Owner				1.695	1.001
				(1.950)	(0.977)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes
R-Squared	22.10%	22.10%	71.80%	26.80%	68.60%
# Observations	213	213	197	172	162

Notes: Coefficients from OLS panel regressions with heteroscedasticity (White) adjusted standard errors in brackets. The dependent variable is the CDS spread at the end of each year (2007-2011). Non-Performing loans / TA and Provision loan losses / TA are scaled by 1,000. Control variable definitions can be found in Table 35. The values of the year and regional dummies are not given in the table for brevity but can be obtained from the authors.

*Denotes significance at the 10% level, ** 5% and *** 1%.

In specification three we add controls for bank characteristics and the risk taking of the bank. For the quality measure, the coefficient is smaller (-5.77) but still significant at the 1% level.

We then test the corporate governance controls separately. The coefficient for the quality measure decreases only slightly in comparison to the previous specification (-5.24) but is no longer significant[35]. None of the corporate governance variables are significant determinants of the CDS spread. Because none of the corporate governance variables are significant, the loss in significance of risk management quality is not due to controlling away the effect but to the poor specification of the model resulting in an increase in standard errors. If the corporate governance score is used as a sole determinant of CDS spreads it is found to have a significant (at the 5% level) and negative impact on credit risk. The corporate governance score is correlated with the audit committee and single biggest owner variable with correlations of 0.36 and -0.33 respectively. If only ERM and corporate governance score are included in the specification, ERM is significant at the 5% level but not the corporate governance score.

In specification five we control for both the bank characteristics and the corporate governance aspects and again get significant (at the 5% level) and negative coefficients for the quality measure. Specification five shows a relatively high coefficient of determination at more than 68%, and the regional fixed effects are no longer jointly significant for this specification, indicating that our set of control variables can explain most of the heterogeneity among the banks.[36]

[35] Since our alternative hypothesis is one-sided, a one-tailed test could be argued to be appropriate, in which case risk management quality is still significant at the 10% level.

[36] Because the sample period includes the recent financial crisis, we test for an effect on credit ratings and CDS spreads of an interaction between crisis period (2006 and 2007) and ERM for the full specifications. We do not find a significant relationship between the interaction and CDS or credit ratings.

4.5.2 Credit Ratings and Quality of Risk Management

Descriptive statistics for the explanatory variables used in the credit rating sample can be found below in Table 39. We also check the correlations among all the explanatory variables (presented in Table 40) and find them very similar to the CDS sample.

Table 39. Descriptive Statistics for the Explanatory Variables in the Credit Rating Model

Variable	Mean	Median	Max	Min	St. dev.
#Words (in thousands)	133.42	118.51	453.32	7.67	67.27
TA (in billions)	0.75	0.40	3.77	0.09	0.77
ROA	1.03	1.08	3.71	-6.68	1.09
Tier 1 Ratio	9.92	9.70	19.60	4.30	2.49
Non-Performing Loans / TA (in percentage)	1.51	0.97	18.67	0.05	1.84
Provision for Loan Losses / TA (in percentage)	0.57	0.34	5.91	-0.10	0.74
Audit Committee Independence	86.88	100.00	100.00	25.00	21.71
Corporate Governance Score	67.15	74.37	96.68	2.30	23.44
Single Biggest Owner	19.59	12.28	99.80	2.39	18.56

Notes: Variables from 2005-2011 year end. Variables definitions can be found in Table 35.

Table 40. Variable Correlations – Credit Rating Sample

	Variable	1	2	3	4	5	6	7	8	9	10
1	Risk management quality	1.00	0.69	0.23	-0.02	-0.01	0.05	0.02	0.26	0.31	-0.02
2	# Words		1.00	0.41	-0.17	-0.03	0.20	0.02	0.10	0.32	0.06
3	TA			1.00	-0.13	0.05	-0.16	-0.14	-0.04	0.38	0.02
4	ROA				1.00	-0.26	-0.50	-0.45	0.22	0.07	-0.03
5	Tier 1 Ratio					1.00	0.19	0.23	-0.06	-0.03	0.16
6	Non-Performing Loans / TA						1.00	0.61	-0.14	-0.11	0.18
7	Provision for Loan Losses / TA							1.00	-0.01	0.08	0.07
8	Audit Committee Independence								1.00	0.43	-0.46
9	Corporate Governance Score									1.00	-0.30
10	Single Biggest Owner										1.00

Notes: Correlations between the independent variables from 2005-2011 year end. Variable definitions can be found in Table 35.

Table 41 shows the results from the ordered probit regressions. The dependent variable is the S&P credit rating at the end of each year (2005-2011). Marginal effects of the coefficients are only reported for the ERM measure since this is the variable of primary interest.[37] Specifications are identical to those in the CDS model.

In specification one we use our quality measure as the explanatory variable without using any control variables. The coefficient is significant at the 1% level. For interpretation we look at the marginal effects. The effect of the risk management quality measure for category one (AAA or AA rating) is that a one unit increase in quality increases the likelihood of having an AAA or AA rating with 1.10% and it decreases the probability of having A, BBB and <BBB ratings with 0.49%, 0.49% and 0.12% (the changes in probability have to add to zero, any deviation stems from round off error). Therefore, a one standard deviation increase (10.93) in quality increases the probability of having an AAA or AA rating by roughly 12%. This result is in line with the overall expectation that risk management quality will result in higher credit ratings for banks.

Controlling for the number of words or the general disclosure of the firm has very little impact on the results. When we control for bank characteristics, in specification three, coefficient size for the risk management quality measure drops but maintains significance. In specification four we control for corporate governance characteristics of the bank. Risk management quality is no longer significant. Corporate governance variables are significant for the determination of credit ratings but not for the CDS spreads. The final specification includes all control variables; the quality measure is not significant.

[37] Marginal effects from all coefficients and the estimated cut-off points can be obtained from the authors upon request.

Table 41. Ordered Probit Panel Regression Results – Credit Rating Sample

Explanatory variable	1) Coefficient		Marginal Effects (%)	2) Coefficient		Marginal Effects (%)	3) Coefficient		Marginal Effects (%)
Risk management quality	-0.032	***	1.10	-0.034	***	1.07	-0.020	***	0.60
	(0.006)		-0.49	(0.007)		-0.47	(0.007)		-0.34
			-0.49			-0.48			-0.25
			-0.12			-0.12			-0.01
#Words (in thousands)				0.001					
				(0.001)					
TA (in billions)							-0.328	***	
							(0.092)		
ROA							-0.090		
							(0.087)		
Tier 1 Ratio							0.092	**	
							(0.036)		
Non-Performing Loans / TA							31.569	***	
							(5.344)		
Provision for Loan Losses / TA							61.728	***	
							(16.136)		
Year fixed effects	Yes			Yes			Yes		
Region fixed effects	Yes			Yes			Yes		
# observations	442			442			388		

Notes: See Notes for Table 42

Table 42. Ordered Probit Panel Regression Results – Credit Rating Sample Continued

Explanatory variable	4) Coefficient		Marginal Effects (%)	5) Coefficient		Marginal Effects (%)
Risk management quality	-0.008		0.33	-0.009		0.29
	(0.007)		-0.22	(0.011)		-0.22
			-0.10			-0.07
			-0.01			0.00
#Words (in thousands)				0.001		
				(0.002)		
TA (in billions)				-0.494	***	
				(0.143)		
ROA				-0.096		
				(0.094)		
Tier 1 Ratio				0.159	***	
				(0.046)		
Non-Performing Loans / TA				34.424	***	
				(8.343)		
Provision for Loan Losses / TA				37.843	**	
				(17.113)		
Audit Committee Independence	-0.010	**		-0.016	***	
	(0.004)			(0.005)		
Corporate Governance Score	-0.013	***		0.003		
	(0.004)			(0.006)		
Single Biggest Owner	0.009	*		0.011	**	
	(0.005)			(0.006)		
Year fixed effects	Yes			Yes		
Region fixed effects	Yes			Yes		
# observations	281			265		

Notes: Coefficients from the ordered probit regressions with Huber/White standard errors in brackets. The dependent variable is the S&P credit rating at the end of each year (2005-2011). Control variable definitions can be found in Table 35. The values of the year and region dummies are not given in the table for brevity but can be obtained from the authors. *Denotes significance at the 10% level, ** 5% and *** 1%.

Why Risk Management Effects CDS and Credit Ratings Differently

The main difference between the results for the CDS model and the credit rating model is what happens to the significance of the risk management quality measure when controlling for corporate governance variables. When controlling for corporate governance variables in the CDS model, the coefficient of the risk management quality measure does not change much, but it does become insignificant and the corporate governance variables are insignificant; suggesting that the model is poorly specified. When the model is better specified with corporate governance variables and additional bank characteristics, risk management quality is significant. Risk management quality is a significant determinant of CDS spreads even when controlling for corporate governance.

When controlling for corporate governance variables in the credit rating model, the risk management quality variable becomes insignificant, the coefficient size becomes much smaller, and the corporate governance variables are significant. In other words, when controlling for corporate governance, risk management quality is no longer a determinant of credit ratings.

This is evidence that credit rating agencies and the market value risk management quality for different reasons. One could argue that credit rating agencies view risk management quality as primarily a governance function, especially in the case when quality is defined by an enterprise risk management framework. When Standard and Poor's (2008) announced they would begin to consider ERM in their credit ratings, it was to enhance the rating process:

> *ERM will add an additional dimension to our analysis of management and corporate governance, creating a more systematic framework for an inherently subjective topic (pg. 2).*

Standard and Poor's relate ERM directly to governance and management of the firm which we see evidence of in the results of this study.

Based on the results, the market values risk management quality for something besides its governance mechanism. If risk management quality is the combination of risk governance and traditional risk management, the

results may indicate that the market values pure risk management over risk governance.

Essentially, risk management quality means different things to different stakeholders and is valued differently depending on the stakeholder.

4.6 Conclusions

Our study provides initial evidence of risk management quality on the amount of credit risk in a firm. In order to measure quality of risk management, we use an enterprise risk management framework and define quality using a broad continuous score of quality. We then estimate the relationship between risk management quality and two proxies of credit risk, the year-end credit rating and the year-end CDS spread. We do this for a sample of the largest banks in the world whose credit risk and risk management quality are generally closely followed.

We find evidence that higher levels of risk management quality decrease the level of credit risk, or the risk a bank's creditors face, as measured by CDS spreads. However, we find that risk management quality's relationship with credit ratings is insignificant when governance characteristics are controlled for. This suggests that credit rating agencies value the risk governance aspects of risk management quality and the market values something else, perhaps the risk management function itself.

We believe that reduction of credit risk is one way to measure the success of the quality of risk management and ERM. This also suggests that it should continue to be a focus of rating agencies and banking regulation.

While risk management quality may increase value through a decrease in credit risk, previous value studies show varying results; ERM may have negative implications which outweigh the positive effects of credit risk reduction. Therefore, other channels of value, like the cost of equity and future cash flows, may have larger effects, both positively and negatively on firm value. Our research is therefore a starting point, and we suggest that the different pieces of the value puzzle become the future focus of research in risk management quality and enterprise risk management.

Appendix 4.1: Enterprise Risk Management Dimensions and Respective Search Combinations

	Dimensions	Search Combinations	% with at least 1 hit	
			CDS N=214	CR N=442
1	charter of the board	charter + board	46.7	38.0
2	code of conduct/ethics	code + conduct; code + ethic	78.0	75.8
3	compensation policies to align interest of managers with shareholders	compensation + align + interest; remuneration + align + interest	21.0	15.2
4	individual performance targets	individual + performance + target	19.6	17.6
5	procedures for hiring and firing of board member and management	hiring + board; hiring + manage; firing + board; firing + manage	18.2	17.4
6	remuneration policy for board members and management	remuneration + board; remuneration + manage; compensation + board; compensation + manage	97.2	91.9
7	training, coaching and educational programs	train; educat; coach	98.1	98.6
8	training in ethical values	train + ethic	14.5	13.6
9	board responsibility	board + responsibilit	87.4	86.0
10	audit committee responsibility	audit + committee + responsibilit	59.8	55.7
11	CEO responsibilities	CEO + responsibilit; chief + executive + officer + responsibilit	47.2	41.2

	Dimensions	Search Combinations	% with at least 1 hit	
12	company mission	mission	80.8	79.4
13	company strategy	strategy; strategies	100.0	100.0
14	company business objectives	business + objective	86.0	82.6
15	adopted benchmarks to evaluate results	benchmark + result	27.6	25.1
16	approval of the strategy by the board	approv + strategy + board; approv + strategies + board	50.9	41.0
17	consideration of financial risk	financial + risk	99.5	99.1
18	consideration of the extent of liquidity	liquidity	99.5	100.0
19	consideration of the interest rate	interest + rate	99.5	99.5
20	consideration of the foreign exchange rate	foreign + exchange + rate	95.3	95.5
21	consideration of the cost of capital	cost + of + capital	97.2	91.2
22	consideration of the access to the capital market	access + capital + market	62.1	57.7
23	consideration of long-term debt instruments	long-term + debt; long + term + debt	78.5	67.0
24	consideration of compliance risk	compliance + risk	93.9	94.8
25	consideration of litigation issues	litigation	68.7	70.4
26	consideration of compliance with regulation	compliance + regulation	82.7	81.9
27	consideration of compliance with industry codes	compliance + industry + code	6.5	5.0

	Dimensions	Search Combinations	% with at least 1 hit	
28	consideration of compliance with voluntary codes	compliance + voluntary + code	2.3	1.8
29	consideration of compliance with recommendation of corporate governance	compliance + corporate + governance	60.3	54.1
30	consideration of technology risk	technolog + risk	56.5	57.9
31	consideration of data management	data + management	86.4	86.2
32	consideration of computer systems	computer + system	30.8	35.1
33	consideration of the privacy of information held on customers	privacy + information + customer	0.9	0.9
34	consideration of economical risk	economic + risk	98.6	92.8
35	consideration of the nature of competition	competition	90.2	91.4
36	consideration of reputational risk	reputation + risk	74.8	74.2
37	consideration of environmental issues	environment	100.0	99.8
38	consideration of ethical issues	ethic	92.5	90.5
39	consideration of health and safety issues	health; safety	99.1	99.5
40	processes for determining how risk should be managed	process + manage + risk	96.3	93.0
41	written guidelines about how risk should be managed	written + guideline + manage + risk	0.5	0.5
42	sales control	sale + control	66.4	61.3

	Dimensions	Search Combinations	% with at least 1 hit	
43	contingency plans or DRP (Disaster recovery plans)	contingency + plan; disaster + recovery	66.8	66.3
44	review of the functioning and effectiveness of controls	review + function + control; review + effectiv + control	47.2	48.4
45	segregation of duties	segregat + duties; segregat + duty	12.6	13.8
46	authorization issues	authorization; authorisation	83.6	82.8
47	documents and record as control	document +control; record + control	81.3	77.4
48	independent verification procedures	independent + verification; independent + verif	33.6	28.5
49	physical controls	physical + control	12.6	12.2
50	process control	process + control	93.0	90.0
51	verification of completeness, accuracy and validity of information	complete + information; valid + information; accura + information	76.2	71.5
52	channels of communication to report suspected breaches of laws, regulations or other improprieties	communicat + law; communicat + improp; communicat + regulation	31.3	26.0
53	channels of communication with customers, vendors and other external parties	communicat + customer; communicat + external; communicat + vendor	62.1	58.8
54	monitoring of processes	process + monitor	88.8	83.3
55	internal audit	internal + audit	96.7	97.7
56	budget for the internal audit	budget + internal + audit	12.1	6.6
57	consideration of strategic risk	strategic + risk	83.2	79.0

	Dimensions	Search Combinations	% with at least 1 hit	
58	consideration of customer concentration	customer + concentrat	65.0	54.8
59	consideration of product expansion	product + expan	74.3	82.4
60	consideration of acquisition aggressiveness	acquisition + aggressiv	2.3	3.6
61	consideration of manufacturing location concentration	manufactur + location + concentrat	0.0	0.0
62	consideration of business cycle	business + cycle	50.5	44.8
63	consideration of inflation	inflation	85.0	77.1
64	correlation and portfolio effects of combined risks	correlation + risk; portfolio + risk	98.6	96.6
65	quantitative impacts risks may have on key performance indicators	key + performance + indicator	23.8	25.1
66	formal report submitted to board level on risk and effectiveness of risk management	report + board + risk + manage	77.6	75.6
67	key risk indicators	key + risk + indicator	42.1	33.9
68	centralized technology for risk-related information	central + technolog + risk	5.6	4.3
69	risk response plan	risk + response + plan	9.8	10.0
70	alternative risk response	alternative + risk + response	0.5	0.2
71	communication to all stakeholder on the importance of risk management	communica + risk + manage	47.2	48.4

	Dimensions	Search Combinations	% with at least 1 hit	
72	assessment of the firm's risk management function done by an independent external party	assess + risk + manage + independ; assess + risk + manage + external	47.2	45.5
73	updates on risk-related information	update + risk + information	20.1	13.3
74	formal written risk management philosophy	risk + manage + philosophy	12.1	13.1
75	risk appetite	risk + appetite	71.5	59.7
76	risk tolerances	risk + tolerance	51.9	48.4
77	senior manager with responsibility to oversee risk and risk management	senior + manage + risk	71.5	70.8
78	centralized department or staff function dedicated to risk management	central + risk + manage	86.9	76.9
79	internal risk assessment of risk management	assess + risk + manage + internal	68.7	60.0
80	allocated risk owners	risk + owner	80.8	73.1
81	Chief Risk Officer	chief + risk + officer	72.0	69.5
82	risk committee	risk + committee; board + committee + risk + manage	98.6	99.1
83	enterprise risk management # denotes exact match	#enterprise risk management; #strategic risk management; #consolidated risk management; #integrated risk management; #holistic risk management	23.8	27.4

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Chapter 5. Conclusions

5.1 Introduction

As firms began to abandon the traditional "silo" approach to risk management by considering portfolios of firm risks, managing risk in a strategy setting, and increasing the governance of the risk management system, enterprise risk management emerged as a framework for providing this increased integration. Though there has been momentum in exploring enterprise risk management, there is an overall lack of consensus and conclusion on three essential questions about enterprise risk management implementation:

- What does an ERM firm look like?
- Why do firms implement ERM?
- What effect does ERM have on the firm?

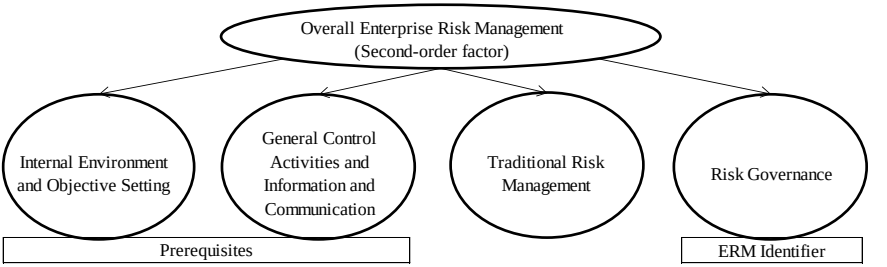
This dissertation has approached these questions by applying new methodologies, a new conceptualization of ERM, and a new way to measure the success of ERM. The results of the articles are summarized in the following section. Following this are implications and suggestions for further research.

5.2 Summary of the Results

5.2.1 What does an enterprise risk management firm look like?

Based on how firms implement enterprise risk management dimensions, there are four pillars of enterprise risk management.

Figure 15. Pillars of ERM

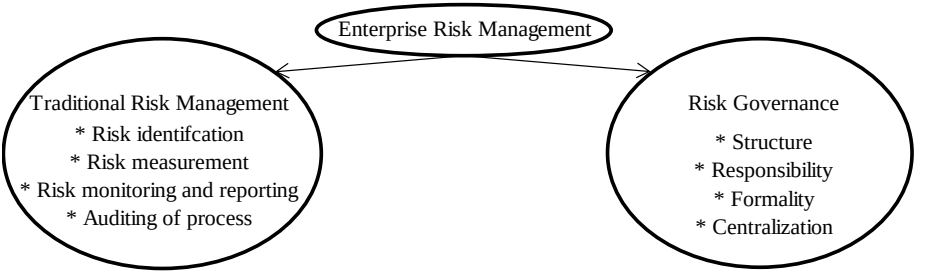


The two prerequisite components are related to the general internal environment and control activities of the firm. The prerequisite components are not directly associated with risk management; firms that demonstrate no risk management activities could still implement these two components in a robust way, for example if they have strong governance in place. One component identifies the risk management activities of the firm in terms of which types of risks the firm considers. This traditional risk management component, distinguishes between firms that are actively managing different risks of the firm and those that are not, but this component provides no information on the organization of these risk management activities. The fourth component has the defining attributes of ERM implementation and is related to the holistic organization of risk management or implementation of risk governance. This component contains the dimensions that are characteristic of ERM implementation and holistic organization of risk management, for example: formal written statement of risk appetite, correlated and determined portfolio effects of combined risks, senior manager assigned the responsibility of overseeing risk and risk management, and a formal risk management report submitted to board level regularly. All four components must be implemented in order to have well implemented ERM, but only one separates ERM firms from non-ERM firms. Holistically organizing risk management or implementing risk governance is the distinguishing characteristic of an ERM firm and is the step beyond traditional risk management to ERM implementation.

5.2.2 Why do firms implement enterprise risk management?

By conceptualizing ERM as the separation of its two fundamental risk management related components as in Figure 16, it is possible to investigate the distinct determinants for each component.

Figure 16. Proposed Conceptualization of Enterprise Risk Management



Motives for traditional risk management and motives for corporate governance, which are referred to in an inconsistent and ad hoc manner in previous literature, fall into place as determinants for the respective components. This brings a certain level of clarity to the theoretical foundation for ERM.

The two components of ERM have different determinants and firms exhibit lower levels of risk governance when they are smaller in size, have higher levels of leverage and dividend payments, and have chief executive officers (CEOs) on the board. These findings may be evidence that firms are taking the step beyond traditional risk management and implanting risk governance in order to address governance needs in the risk management system, specifically to monitor managers.

5.2.3 Does enterprise risk management affect the firm?

A specific channel of value creation is investigated by analyzing the effects of risk management quality, measured using an enterprise risk management framework, on credit risk.

The results reveal a significant and negative relationship between the quality of a firm's risk management and its credit default swap (CDS) spread. A one standard deviation increase in risk management quality decreases the CDS spread by approximately 97 basis points (bp), 49 bp when controlling for bank characteristics and corporate governance. With risk management quality as the sole determinant of S&P credit ratings, a one standard deviation increase in risk management quality increases the likelihood of having an AAA or AA rated company by 12%. However, when controlling for corporate governance characteristics of the bank, risk management quality is no longer a significant determinant of the credit rating. This may suggest that

credit rating agencies value the governance aspects of ERM and the market values something other than governance, likely the risk management function itself. Again, this emphasizes that ERM has two distinct foundational components; traditional risk management and risk governance.

5.2.4 Summary in Short

Essentially, enterprise risk management is supported and characterized by the holistic organization of the risk management system - the implementation of risk governance. Risk governance implementation is motivated by a need for better governance of the risk management system. Credit rating agencies value enterprise risk management for its aspects for risk governance; the market however values enterprise risk management for something besides its governance mechanism.

5.3 Implications

5.3.1 Implementation Guidance

The motive for exploring the pillars of ERM was in part because ERM frameworks vary in their conceptualization of ERM, and in some cases frameworks are perceived as ambiguous, overly theoretical, and insufficient. The four pillars are to some extent developed from the COSO framework for ERM since many of the dimensions are pulled from their framework. The pillars are however a more parsimonious model of ERM than that depicted by the COSO (2004) cube, presented in Section 1.2.1. While the eight COSO components can with little effort be "assigned" to one of the four pillars, the other two dimensions of the COSO conceptualization are represented in a different way in the four pillar conceptualization of ERM. The entity dimension of the COSO cube is inherently incorporated into the risk governance pillar; holistically organizing risk management in a way which spans across and up and down the firm captures this dimension without over complicating the conceptualization. The third dimension in COSO's cube is the objecting setting, and this dimension is captured by the prerequisite pillars. A precondition for ERM implementation is having a well-established objective setting, and when combined with risk management and risk governance, the result should be a risk management system integrated with the objectives of the firm.

Despite being more simplistic in some senses, the four pillars do capture something important and unique about ERM implementation missed by some frameworks. The CAS (2003) ERM framework is more simple in its conceptualization of ERM, focusing on two dimensions – the risk management process and the types of risk. One important pillar which is missing from this conceptualization is the risk governance pillar. Looking at the two dimensional conceptualization of ERM proposed by CAS, there is nothing in the model that differentiates it from a "silo" approach; each risk could be managed with the process steps independently of each other. Therefore, the aspect of risk governance is missing. The four pillars are not simply an over simplification, they do in fact identify important aspects of ERM which are missing in some conceptualizations.

The balance between parsimony and distinction should make the four pillars more relatable to managers because they reflect actual approaches to implementation. Managers would hopefully be able to recognize their own firm to some degree in this conceptualization of ERM. The pillars can provide more clarity in terms of what the extra component is when implementing ERM – namely holistically organizing the risk management system or implementing risk governance. This can clear up ambiguities in regards to implementation and mitigate some of the difficulties of implementing ERM. By implementing the four pillars, managers should have in place what is necessary to achieve the integration of risks in a strategic setting.

By taking into account the four pillars, ERM guidance going forward can better relate to how firms implement ERM. Some frameworks should perhaps be simplified to better match the parsimonious conceptualization provided by the four pillars; otherwise, frameworks need to provide more explicit guidance if the four pillars in some way do not capture intended aspects of implementation. It may also be that some conceptualizations of ERM need to be revised to include the pillars of ERM implementation that may be left out.

5.3.2 Managerial Tensions When Implementing Enterprise Risk Management

Implementing enterprise risk management and risk governance provides an additional layer of governance in the firm but in the risk management setting; stakeholders have been pushing for this type of improved governance of the risk management system. The current state of overall corporate governance in

the firm is shown to be related to a firm's decision to take the step beyond risk management to implementing ERM. The interaction between governance mechanisms and the risk management system provided by implementation of ERM suggests that ERM should continue to be championed as way to improve governance in the risk management system.

However, some managers will be opposed to this component of ERM implementation because it imposes additional monitoring and control and restricts a manager's freedom in decision making. Because management support is important for the success of ERM implementation, boards and top managers in favor of ERM implementation need to understand and be prepared for this tension as it may be a substantial road block in implementation.

5.3.3 Credit Risk Assessment

Finally, an important implication is that the market recognizes the value of ERM which shows in the results that on average firms which have implemented ERM have significantly lower credit default swap spreads. Therefore, management should be interested in implementing ERM in order to decrease the firm's credit risk and in turn the cost of debt. ERM should also continue to be a focus of banking regulation as it does impact credit risk.

Results also suggest that ERM can increase a firm's credit rating only in some cases. Credit ratings, somewhat surprisingly, are only significantly related to ERM implementation before controlling for corporate governance variables. It seems that credit rating agencies value ERM for its governance mechanisms, and they do not seem to make much of a distinction between the need for corporate governance in general and governance in the risk management system specifically. Owners of firms with poor governance may want to initiate implementation of ERM in order to add an extra layer of governance and achieve a higher credit rating.

It seems however that the rating agencies are not taking into consideration an important aspect of ERM - the traditional risk management pillar. Standard and Poor's take enterprise risk management into account in their determination of credit worthiness, but their consideration of ERM differs between insurers and corporates. In the last few years, the focus for insurance

companies has been on "enterprise risk management" while the most recent criteria and commentaries for corporates have been on "management and governance"[38]. The Standard and Poor's conceptualization of ERM differs depending on if they are considering corporations or insurance firms; this separation seems to have occurred primarily in the last few years and much of the development in ERM consideration has occurred for insurance firms.

In the analysis of ERM for insurers, Standard and Poor's considers five sub factors: the risk management culture, risk control, emerging risk management, risk models, and strategic risk management (Standard & Poor's, 2013). This could be interpreted as a fair balance between traditional risk management and risk governance. However, the most recent documents for corporates are much more focused on "management and governance" in general. The analysis of management and governance includes a review of: management, strategic positioning, risk management/financial management, organizational effectiveness, and governance (Standard & Poor's, 2012). The weight here is placed on management and governance; the scoring rules almost entirely exclude traditional aspects of risk management. The sub factors used to evaluate risk management/financial management specifically are: enterprise-wide risk management standards and tolerances (corporates only), comprehensive financial standards (insurance only), risk tolerances (insurance only), and standards for operational performance (Standard & Poor's, 2012). Even the specific aspects related to risk management/financial management are skewed towards operations and management and only superficially broach traditional risk management functions. Perhaps Standard and Poor's should open their conceptualization of ERM up for corporates to include more aspects of the traditional risk management components.

5.4 Further Research

One of the main contributions of this dissertation is a new conceptualization of ERM's components. However, the support for this conceptualization is dependent on the survey data from a sample of Nordic firms. The reliability of survey data is always in question; respondents may not provide accurate or honest answers, they may not answer the questions thoughtfully, they may

[38] For more on S&P's enterprise risk management commentary and criteria, see: http://www.standardandpoors.com/ratings/erm/en/us.

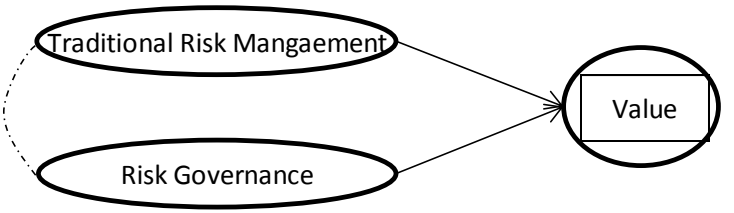
misinterpret questions or answer options, etc. Of course, a lot of effort goes into creating a survey which results in the most reliable data and subsequent measures. Response rates for surveys are also often low, resulting in small samples which can be subject to response bias. For a complex structural equation model, the resulting sample size is on the smaller side.

Because the pillars of ERM and the conceptualization of ERM are somewhat dependent on the data from the survey, future research should confirm the model of ERM components using other samples. Because methods of identification and measurement seem to bounce back and forth between survey and publicly available information, future research could focus on reconciling the two; one way would be to investigate what kind of public information tends to yield similar information about ERM implementation as survey results. The focus then can be on how to best identify/measure the pillars using publically available data, making the study of ERM using the pillars more accessible.

Most of the previous ERM studies are on U.S. firms. There may be something unique about Nordic firms, and the geographic concentration of firms potentially limits generalizability to a majority of readers. As discussed in Section 3.3.1, Nordic countries do have some specific characteristics in terms of corporate governance and risk taking. However, because of how international and integrated Nordic firms are with the world market, the results are not obviously specific only to the Nordic region. One way to empirically investigate possible country specific differences is to study the implementation of ERM in a cross-section of different legal approaches, for example: common-law, French-civil-law, German-law, and/or Scandinavian-law. These legal approaches differ in their protection of corporate shareholders and creditors and explain underlying differences in corporate governance (LaPorta, Lopez-de-Silanes, Shleifer, & Vishny, 1998 and 2000). This approach could identify if risk governance implementation has the same connection to local legal approaches as general corporate governance, or if risk governance is a distinct phenomenon resulting from a globalized push.

A next step to identifying the value creation of ERM is to look at which pillars of ERM are value creating; especially investigating if risk governance effects the value of a firm. This can be approached with a structural model where risk governance and traditional risk management are determinants of value. That way, the value of risk governance can be estimated while controlling for the value of traditional risk management (See Figure 17).

Figure 17. Value of Risk Governance Model



Value can be approached in a way similar to previous studies; investigating for example the effects of risk governance on Tobin's Q. However, channels of value should be investigated more thoroughly in order to better explain the mechanisms through which ERM creates value.

As the ERM literature evolves and there becomes more consensus and consistency, there needs to be a more rigorous approach to the theoretical foundations of ERM. This will further shape and evolve the subject of ERM going forward.

In corporate finance, closeness to the firm is especially important in order for research to be relevant for corporations. Additional case studies on ERM, for example following the implementation process in firms and revising or confirming the four pillar conceptualization, would be of substantial value to the enterprise risk management field of study.

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