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Enterprise Risk Management Sophistication and Firm Risk

Section 1 – Introduction

1.1 - Motivation

Enterprise risk management ("ERM") is touted by many risk practitioners, regulators, and researchers to be the new best practice in risk management. Risk management practices differ across firms and industries, but the ERM process typically refers to a holistic view of firm risk management, or the simultaneous treatment of numerous pure and speculative risk categories and the consideration of potential correlation and interrelations between individual risks.[1] Some researchers view traditional risk management as inefficient, especially if it does not add value to the corporation, while ERM is often considered a value-adding strategy (Hoyt and Liebenberg, 2011; Farrell and Gallagher, 2014; Grace, Leverty, Phillips and Shimpi, 2014).[2]

Interest in ERM has grown quickly since the early 2000s in both academia and industry. After the financial crisis of 2008, many firms are adopting ERM programs to avoid catastrophic failure and to protect managers and directors from potential backlash after a firm downturn. The proliferation of firms claiming to employ ERM is also gaining momentum from regulatory bodies such as the Security Exchange Commission (SEC), which now requires firms to define their methods of risk identification and management in its 2009 Rule 33-9089. This rule requires publicly traded corporations to "describe the board's role in the oversight of risk" and encourages companies to "… describe how the board administers its risk oversight function".

[1] For a brief overview of the history of ERM see Dickinson (2001).
[2] "Traditional" risk management refers to risk management where risks are managed separately and independently of other risks that may exist within the organization.

Most studies examining ERM investigate the firm factors associated with implementing ERM and whether or not ERM adds value (e.g., Liebenberg and Hoyt, 2003; Kleffner, Lee and McGannon, 2003; Liebenberg and Hoyt, 2011; Grace, Leverty, Phillips and Shimpi, 2014). Few prior studies examine the impact of ERM or firm risk management on volatility and those that do are often limited in their ability to relate the sophistication or extent of the ERM process in an organization (e.g., Pagach and Warr, 2011; Eckles, Hoyt and Miller, 2014). That we know of, no study has been able to address whether *better* risk management leads to reduced volatility as one might hypothesize it should. We hope to help close this gap in the literature by relating a firm's ERM sophistication with measures of volatility and other firm characteristics.[3]

1.2 - Purpose

As discussed previously, prior literature suggests that the implementation or existence of an ERM program can have the ability to both increase firm value and reduce firm volatility. However, to this point prior literature has not examined how the *sophistication* of an ERM program can influence volatility – especially volatility of cash flows. While firms may make the decision to implement ERM, there will be varying degrees to which the implementation has taken place, and it is likely that over time as an ERM program becomes more developed and ingrained in the company's culture, the effectiveness of the program should improve. The purpose of this study is to examine how the development and sophistication of an ERM program can impact firm volatility and value, with an expectation that a greater degree of sophistication is associated with lower volatility of cash flows and higher firm value. In addition to examining the differential effect of

[3] In this study, we refer to the risk management maturity as risk management sophistication (or similar) because we believe maturity may lead readers to misleading assumptions – e.g., that a firm has practiced ERM for a longer period of time. The survey results report the respondents' capabilities in ERM rather than how long they have practiced the process and we believe sophistication is a better characterization of the results.

ERM sophistication on the reduction of volatility, we also employ unique data to empirically test the relation between firm reputational value and ERM sophistication.

We conduct our study using two unique datasets that allows us to link firm-specific financial and operational factors to ERM sophistication and to reputational value. The use of this unique data allows us to contribute to the prior literature in a number of ways. First, our data allows us to directly identify firms that have an ERM program rather than relying on imprecise proxies. Many of the past studies that examine ERM either rely on the existence of a Chief Risk Officer or on searches of press releases, news articles, and other relevant media in order to identify whether or a firm has an ERM program (e.g., Liebenberg and Hoyt, 2003; Pagach and Warr, 2011; Eckles, Hoyt and Miller, 2014). While the prior methods are useful in identifying the *potential* existence of an ERM program, we utilize survey data in which firms explicitly identify themselves as having implemented an ERM program, which should remove noise that could be present when using other methods of identification. Second, we are able to examine ERM across a spectrum based on the development and sophistication of each firm's ERM program. Specifically, the survey data that are used to identify firms that use ERM also requires respondents to disclose the development of their ERM programs on a continuum, which allows us to classify firms based on how developed their programs are. The ability to classify firms based on the development of their ERM programs gives us the ability to test how ERM sophistication impacts firm volatility and firm value. While we recognize the potential for bias or measurement error caused by self-reporting, we believe this error is lower than that presented through the use of other data.[4] Third,

[4] To our knowledge, the only other data source that exists and allows authors to examine ERM on a continuum is the Standard and Poor's (S&P) ERM rating measure (e.g., McShane, Nair, and Rustambekov, 2011; Baxter et. al., 2013). The S&P measure classifies firms into four possible categories: Weak, Adequate, Strong, or Excellent. While this measure does allow researchers to examine the development of a firm's ERM program, very few firms that are rated by S&P receive ERM scores. We further discuss these issues below.

we are able test the relation between ERM sophistication and firm volatility across multiple industries rather than a single industry.[5] The focus on multiple industries allows us to examine differences in ERM sophistication and the aforementioned relationships across multiple industries rather than confining ourselves to a single industry, which should allow our results to be more generalizable.

As a preview to our findings, our results suggest that firms which report their risk management processes as being more sophisticated tend to be smaller with greater variation in operating cash flows and less leverage. Expanding the test of cash flow volatility, we find that greater cash flow volatility is associated with more sophistication in risk management and that this relationship is especially important for those firms which report greater sophistication in ERM planning and resilience.

The remainder of this study is organized as follows. We first provide a discussion of ERM, its purpose, methods used to identify firms using ERM, and the effects of ERM programs. We then provide an overview of our data and the methodology employed in this study and the methodology. Finally, we present and discuss our results and then conclude.

Section 2 – Enterprise Risk Management Identification and Effects

Enterprise Risk Management is the practice of considering the simultaneous effect of all risks on the firm. ERM developed over the past decades as a continuation of other risk management practices including "Integrated RM," "Holistic RM," and others. The development of ERM differentiates it from other prior "holistic" risk management techniques and its dissemination into industries is being spurred by laws and regulations such as the 2009 SEC Rule 33-9089.

[5] For example, Baxter et. al. (2013) focus on financial services firms (i.e., insurance companies banks) and McShane et. al. (2011) focus solely on the insurance industry.

Consequently, unlike past iterations of risk management concepts, it becomes more possible to differentiate firms by their ERM program quality levels. Although present data does not permit this level of focus, future studies should consider variation in ERM program structure and focus.

2.1 – Identifying ERM Firms

ERM is a relatively new practice and research topic. The earliest academic publications on ERM started appearing around 2000 and the earliest empirical studies appear around 2003 (e.g., Dickinson, 2001; Harrington, Niehaus and Risko, 2002; Liebenberg and Hoyt, 2003). Since then, a growing literature on ERM has appeared that examines the determinants of implementing an ERM program, the value added through ERM, and firm characteristics associated with the likely adoption of ERM. Because reporting on ERM is (largely) not standardized by any governing body, not consistently regulated, and not standard across industries, identifying firms which engage in ERM is a challenge.

Empirical research on ERM has used several strategies to identify firms that practice ERM and, to a lesser extent, the effectiveness or pervasiveness of an ERM process. Kleffner, Lee, and McGannon (2003) and Gates (2006) use survey data to identify firms (or firm factors related to) implementing an ERM program. Several ERM studies have identified ERM practitioners by analyzing the content of press releases, news articles, and other relevant media (e.g., Liebenberg and Hoyt, 2003; Beasley, et al., 2005; Hoyt and Liebenberg, 2011; Pagach and Warr, 2011). More recently, some authors have utilized Standard and Poor's Ratings Direct database to identify firms with an ERM program that purchase an ERM program "quality" rating from S&P (e.g., McShane, Nair, and Rustambekov, 2011; Baxter, at al., 2013). Farrell and Gallagher (forthcoming) utilize data from a survey conducted between 2006 and 2011 by the Risk and Insurance Management

Society (RIMS) to identify ERM firms. The authors identify ERM implementation by characterizing firms as mature (which we refer to as sophisticated) or not in their risk management practices based on the survey responses.

There are several limitations to these prior studies that are addressed in the current study. Data collected from news reports and press releases suffers from potential sample bias – firms may be excluded or missed in collection and some firms may not publicize their risk management program. Because larger firms are likely to receive more news coverage, it is likely that there will be an over-representation of large "ERM" firms. The Standard and Poor's ERM Rating data is valuable because it provides an objective and verified measure of an ERM program, as well as a rating for that program. However, the sample of the firms which obtain an S&P rating is small and only contains firms which opt-in to the rating. Unlike their more recognized ratings, the value to the firm of obtaining an S&P ERM rating are not clear so many firms decide not to obtain the rating. Some surveys on ERM are older and do not account for the growth and development of ERM, especially due to new regulations which require board risk management and the impact of the financial crisis. This study, like Farrell & Gallagher, relies on the RIMS survey but extends the survey by two years; it contains responses from 2006-2013, which helps alleviate potential biases.

Using the RIMS survey data with more current responses, our larger (73% larger than Farrell and Gallagher, 2014), and more recent database of firms will help strengthen the ERM literature and build on the foundational studies that relied upon earlier available data. In addition, we use a more granular measure of risk management quality than is seen in the only other study based on the RIMS Survey data (Farrell and Gallagher, 2014).

2.2 – Enterprise Risk Management, Firm Value and Firm Risk

The relatively recent interest in the value of ERM in firms has resulted in a number of studies that have attempted to identify the factors associated with having ERM programs and potential benefits of having an ERM program. Liebenberg and Hoyt (2003) investigate the firm-specific factors related to the appointment of a CRO and find that firms with greater leverage are more likely to appoint CROs, which the authors argue may be done in an attempt to reduce asymmetric information. Similarly, Pagach and Warr (2011) find that firms that appoint CROs tend to be more volatile and when the firm's CEO has greater incentives to take risk. Beasley, Clune and Hermanson (2005) focus on the factors that are associated with the extent of ERM implementation rather than simply examining a binary indication of the existence of a CRO. The authors had members of the Institutes of Internal Auditors Global Audit Information Network complete a survey, which included information on what stage of implementation their ERM program was in.[6] The authors found that the stage of ERM implementation was related to the existence of a CRO in the firm, size, board independence, and CEO and CRO support for the program.

Although some literature has explicitly focused on the determinants of having an ERM program, many of the ERM studies have examined the effect that an ERM program can have on firm value. Liebenberg and Hoyt (2011) examine ERM programs within the insurance industry and find that firms with ERM programs have a significantly greater value than firms that do not have an ERM program, with the ERM premium equal to approximately 20 percent. McShane et al. (2011) also focus on the value of ERM for firms in the insurance industry but use S&Ps ERM

[6] The five stages captured by the author's survey include: (1) no plans exist to implement ERM; (2) the firm is investigating ERM, but they have not made a decision regarding the implementation of an ERM program yet: (3) the firm is planning on implementing an ERM program; (4) a partial ERM program is in place; and (5) a complete ERM program is in place.

rating. By relying on the S&P rating, the authors are able to examine a continuum from the use of traditional risk management to enterprise risk management. The authors find that when the S&P rating moves to higher levels of traditional risk management, firm value increases; however, they do not find evidence that moving into the "ERM" realm of ratings is associated with an increase in firm value. Baxter et al. (2013) also utilize the S&P ERM ratings and find that firm performance is positively associated with higher levels of ERM quality.

While studies have examined the relation between the existence of an ERM program and firm value, there is limited and mixed empirical evidence on the effect of ERM on a firm's risk or volatility. It may be argued that firms which engage in ERM will experience benefits of better risk identification and decision making compared to their peers, and further that firms which excel at ERM will outperform mediocre or poor ERM firms (Nocco and Stulz, 2006; Hoyt and Liebenberg, 2011; Baxter, et al., 2013). As part of the ERM framework, firms may attempt to minimize volatility in the firm, including volatility of cash flows, stock price, return on equity (ROE), or other important firm attributes. However, as stated previously, the evidence of ERM's effect on volatility is mixed.

Eckles, Hoyt, and Miller (2014) find that firms which implement ERM programs experience lower stock return volatility in the future compared with other firms, which may support the finding of Pagach and Warr (2011) that firms which appoint chief risk officers tend to be more volatile than their peers. Baxter et al. (2013) report a positive relation between ERM *quality* (measured using Standard and Poor's ERM ratings) and the standard deviation of cash flows as well as ERM quality and bankruptcy risk (proxied by the firm's z-score), although the relationships are only marginally significant. The authors also find a positive relationship between

ERM rating and S&P credit ratings. Hoyt and Liebenberg (2011) note that firms with ERM should experience lower earnings volatility, but find no significant relationship between the two variables.

The mixed results in prior literature may be due to: (i) the variety of ERM identification techniques discussed in Section 2.1, (ii) different samples used in each empirical study, and (iii) different applications of empirical models to the available data. Generally speaking, any results linking ERM and risk or volatility is secondary to the purpose of the study. We hope that by making the study of ERM and volatility one of our primary tests, we can improve the extant literature on ERM and firm performance.

Section 3 – Data, Variables and Methodology

In this study, we aim to empirically estimate the impact of enterprise risk management quality or sophistication on the firm's performance and risk. We obtain unique enterprise risk management data from the Risk and Insurance Management Society (RIMS) which we use in the study, which we discuss below. RIMS conducted a risk management maturity survey offered to global risk management professionals. In addition to the data obtained from RIMS, we also collect financial and operational data for our sample of publicly traded firms from the Compustat North America, Compustat Global, and FactSet databases. Below we provided a greater discussion regarding our sources of data and the variables employed in this study.

3.1 - RIMS Data

RIMS is an international organization for risk management professionals consisting of more than 3,500 organizations and 11,000 members (RIMS – About RIMS). RIMS developed a survey on enterprise risk management maturity and activities which is available online. The survey

responses were collected between 2006 and 2013. The survey was publicized to all RIMS members and marketing partners and, according to Farrell and Gallagher (2014), "targeted search engine traffic from terms such as 'risk maturity models' drove a significant additional number of visitors to take the survey." In total, the dataset consists of 1,974 survey respondents. The survey consists of 25 questions related to the company's risk practices which require the respondent to rank each of the 25 questions on a 1-10 scale for the company's effectiveness, proactivity, and coverage in many areas of risk management. The complete question set is provided in Appendix 1.

The majority of survey respondents are U.S. based, although a large number of respondents are based in the U.K. and Canada. In total, over 25 countries are represented in the full sample. From this sample, we remove any observations in which the respondent did not list a company or job, respondents whose job title is not related to risk management in any capacity (e.g., student, professor, research assistant, paralegal) and erroneous observations for which no company data can be retrieved.[7] We also removed non-publicly traded firms because the firm financial data used in this study is limited to only publicly traded companies. In total, initial data screens result in the removal of 1,520 observations, leaving 454 respondents in the sample.[8] From these 454 respondents, we collect financial and other firm data from FactSet and Compustat. Complete data are available for 389 firms from 2006 through 2013.

We use the RIMS data to develop a measure of enterprise risk management sophistication based on the survey questions. For each of the 25 survey questions, respondents rank their company on a 1-10 scale for effectiveness, proactivity, and coverage in different aspects of firm risk management. We construct two enterprise risk management variables using this dataset.

[7] For example, several firm names were listed as "DDDD, DEFWEFWE, INSURANCE."
[8] The vast majority of lost observations are for firms which are not publicly traded. Because we can only collect supplemental data for publicly traded firms, we remove these observations.

First, we follow Farrell and Gallagher (2014) and construct a risk management index by averaging the 1-10 responses to the 25 questions and creating a single variable. We divide the 1-10 score by 2 and round to the nearest whole number. If the respondent's index is 1 or 2, they are not considered to have ERM. If the respondent's index is 3, 4, or 5, they are considered to have ERM. The resulting variable is called the ERM engagement dummy and equals 1 when the risk management index equals 3, 4, or 5 and is equal to 0 when the risk management index equals 1 or 2.

For the second risk management sophistication measure, we average the responses to the 25 risk management survey questions. We refer to this variable as the RM Score, and this variable has a maximum value of 10 and a minimum value of 1. A higher value of the RM Score should correspond with a more sophisticated risk management or ERM program.

Figure 1 shows the trend of the RM Score over our sample period of 2006 through 2013. The evidence from Figure 1 suggests that the response values increased sharply after 2006 and that some variation remains in the RM Score thereafter. Interestingly, Figure 1 suggests that RM Scores increased between 2008 and 2010 (during the recent financial crisis), but then declined afterwards (although the decline did not result in average RM Scores that were less than or equal to pre-crisis values).

[Insert Figure 1 about here]

[Insert Figure 2 about here]

In addition to presenting the change in risk management scores over time, we also present the average RM scores across industry. As noted previously, one of the contributions of our study is that we are able to examine the effect of ERM in firms across multiple industries, rather than focusing on a single industry. We use the information provided in the RIMS survey and assign

firms to an industry based on two-digit SIC codes. Figure 2 provides an initial breakdown of the RM Score by industry, ordered from industries with the lowest scores to those industries with the highest scores.[9] The chart provides some initial evidence that there is variation in the risk management measure among these industries in our study. Specifically, we find that services firms and financial firms are among the lowest reported risk management practitioners while wholesale, retail, and mining firms are among the highest. It is possible that firms in certain industries are not necessarily better at risk management than firms in other industries, but that they are more acutely aware of the risks they face and understand their own limitations in managing those risks. For example, financial firms in our sample may be aware of their vulnerabilities to risks because our dataset spans the period of the 2008-09 economic recession. The finance sector was one of the most heavily impacted industries during this period and these firms may be more likely to rate themselves as low-medium sophisticated ERM users compared with other firms. For the purposes of our study, Figures 1 and 2 demonstrate a need to control for potential time and industry effects when examining risk management sophistication. We therefore include year and industry dummy variables in our multivariate regression models that are discussed below.

3.2 – Control Variables

In addition to our risk management variables, we also control for other firm characteristics which may influence risk management sophistication or some metric of firm performance. We look to prior literature – primarily Hoyt and Liebenberg (2011) and Farrell and Gallagher (2014) for guidance in choosing our control variables. The control variables in our sample are described below.

[9] Industries are identified using the 2-digit SIC code. The industry codes can be located at the following website: https://onece.ncsu.edu/mckimmon/divisionUnits/ceus/sicCodePickList.jsp.

Tobin's q: Prior literature suggests that there is a relation between firm value and ERM (Hoyt and Liebenberg, 2011; Farrell and Gallagher (2014)). We also consider firm value in our models by following Farrell and Gallagher (2014) and using the Chung-Pruitt Tobin's q measure, which is equal to the market value of equity plus the value of preferred stock plus debt divided by total assets.

Size: We follow Hoyt and Liebenberg (2011) and Farrell and Gallagher (2014) and use the logarithm of the book value of firm assets to proxy for firm size.

Liquidity: Hoyt and Liebenberg (2011) and Farrell and Gallagher (2014) construct a financial slack variable equal to cash and short term equity to the total book value of assets. For the purpose of this study, we control for liquidity in our models as we believe this helps control for the replacement rate of assets, which is important for firms that are exposed to potential large losses. We construct our liquidity variable as the ratio of operating cash flows to total firm assets.

Sales Growth: We follow Hoyt and Liebenberg (2011) and Farrell and Gallagher (2014) and control for sales growth by including a variable equal to the change in sales from year *t-1* to year *t* divided by sales in year *t-1*. The growth of the firm may impact firm risk and volatility and may influence the degree to which firms choose to utilize ERM programs.

Leverage: For the purpose of our empirical analysis we consider two measures of leverage. First, we follow Farrell and Gallagher (2014) and include a leverage variable constructed as the book value of liabilities divided by the market value of equity. Second, we construct a leverage variable using the Dupont method which is equal to the difference between return on assets and return on equity (i.e., ROA – ROE). This value may also be considered the return associated with debt as firm assets should equal equity absent any debt.

ROA: Similar to the work of Hoyt and Liebenberg (2011), we include a measure of profitability in our models, proxied by return on assets (ROA). This variable is equal to net income divided by the book value of assets.

Coefficient of Variation of Cash Flows: Hoyt and Liebenberg (2011) and Farrell and Gallagher (2014) include a measure of earnings volatility to control for firm-specific risk. Similar to the aforementioned studies, we consider the relation between ERM sophistication and volatility by including the volatility of cash flows, which is a commonly used measure of firm risk in the corporate finance literature (e.g., Harford, 19999; Han and Qui, 2007). We employ the five year coefficient of variation of a firm's operating cash flows.

Dividend Status: We follow Hoyt and Liebenberg (2011) and Farrell and Gallagher (2014) and include a binary variable equal to 1 if the company pays and dividend to its shareholders and a 0 otherwise.

US Incorporation: Farrell and Gallagher (2014) include a binary variable to control for possible differences that might exist between firms incorporated in the U.S. and those that are incorporated abroad. Following prior literature, we also include a dichotomous variable that takes the value of 1 if a given firm is incorporated in the U.S. and 0 otherwise.

3.3 – Summary Statistics and Univariate Comparisons

Variable definitions and summary statistics for our dependent and independent variables are provided in Table 1, while we include a correlation matrix presenting the correlations between the variables employed in our study in Table 2. The summary statistics presented in Table 1 provide some insight regarding the sample of firms that are used in this study. First, we find that, on average, firms have an RM Score of 5.26. This value suggests that firms contained in the sample

view their ERM programs as having a mid-level of sophistication rather than a belief that their programs are not mature (or of low sophistication) or that their ERM programs are highly sophisticated. We also find that average Tobin's q is 1.090, which is consistent with the Tobin's q that is reported in Hoyt and Liebenberg (2011).[10] The summary statistics also suggest that there is variation among firms across size, that firms in the sample tend to be profitable with an average ROA of 5 percent, the large majority of firms in the sample paid out dividends in the year that the survey was completed (i.e., 78.9 percent), and finally that the large majority of firms in the sample are incorporated in the United States. Turning our attention to the correlation matrix presented in Table 2, the correlations across the variables tend to be relatively low, with the highest correlation between our measure of leverage (proxied as the ratio of the book value of liabilities to the market value of equity) and Tobin's q.[11]

[Insert Table 1 about here]

[Insert Table 2 about here]

Prior to estimating our models in a multivariate setting, we first test for the relationship between ERM sophistication and our variables in a univariate setting. Specifically, we compare firms that are among the top 25 percent with regards to RM Score and those firms that are not among the top 25 percent in terms of RM Score. The results of this univariate comparison are presented in Table 3. The results of the univariate analysis indicate that there a number of statistically significant differences between those firms with higher RM Scores and those firms that are not among the top 25 percent of firms in terms of RM Score. First, we find that the average RM Score for firms the top 25 percent of firms is 7.56, which is approximately 67.8 percent larger than firms that are not

[10] Hoyt and Liebenberg (2011) report a mean Tobin's q of 1.089.

[11] We also check for multicollinearity in our models by checking the variance inflation factor (VIF) and find that the VIFs are below 10, which suggest that multicollinearity should not be an issue (Kennedy, 1998).

among the top 25 percent. This difference indicates that while the top 25 percent of RM Scores suggests a relatively high level of ERM sophistication, the remaining 75 percent of firms fail to even reach the 5.0 (mid-sophistication) threshold. This suggests that while top 25 percent believe that they have relatively sophisticated ERM programs, the majority of firms recognize that significant further development of their ERM program is likely required. We also find that firms with the highest RM Scores experience greater cash flow volatility, measured as the five-year coefficient variation of cash flows, while the remaining firms have significantly lower volatility (i.e., 0.772 v. 0.435, respectively). Prior literature suggests that firms that implement an ERM program tend to have higher levels of volatility, but these results suggest that higher levels of ERM sophistication are also related to higher levels volatility (e.g., Pagach and Warr, 2011). The univariate comparisons also indicate that firms with higher RM scores (i.e., those firms with more sophisticated risk management programs) tend to be smaller, hold less debt relative to equity (less leverage), are less likely to pay dividends, and typically experience a lower level of profitability than firms that are not among the top 25 percent in RM Score. Overall, the results presented above suggest that there are significant financial and operational differences that exist between firms based on the level of ERM sophistication. In the next section, we empirically examine the relation between ERM and firm risk in a multivariate framework.

[Insert Table 3 about here]

Section 4 – Multivariate Regression Results

As discussed previously, the primary purpose of this study is to examine how ERM sophistication is related to important firm characteristics, with a particular emphasis on firm risk / volatility. Prior literature has often examined the characteristics associated with *implementing* an

ERM program; however, we are able to more directly measure a firm's risk management *sophistication* (rather than just the existence of an ERM program) by analyzing the results of a survey related to risk management and ERM. Below we empirically examine the relation between ERM sophistication, firm risk, and the other control variables that were discussed previously.

Section 4.1 – Determinants of ERM Sophistication

Prior to examining the relation between ERM sophistication and volatility, we first attempt to identify the firm-specific factors that are associated with a greater level of ERM sophistication, using two different measures of risk management sophistication. First, we follow the work of Farrell and Gallagher (2014) and create an ERM engagement dummy variable equal to 1 when the average risk management score exceeds a certain threshold (as discussed previously in Section 3.1). Second, we relate firm-specific factors to the firm's actual risk management score – the average response (1-10) to the 25 survey questions in the RIMS dataset. We first estimate a probit model to examine the firm-specific factors related to ERM engagement, and then use an ordinary least squares (OLS) method to investigate how firm factors relate to overall ERM sophistication. Given the potential that time-specific factors could impact both ERM engagement and the level of sophistication (as presented in Figure 1), all models are estimated with year fixed effects. Additionally, since time-invariant industry-specific factors could influence both ERM engagement and ERM sophistication (as presented in Figure 2), we also include industry control variables. The results from these models are presented in Table 4.

[Insert Table 4 about here]

Focusing first on the results obtained from the probit model, the results in Table 4 indicate that a more sophisticated risk management program is negatively related to firm size as well as

liquidity. This result suggests that smaller firms tend to self-report as being more sophisticated in their risk management or ERM processes, which could suggest that either (a) they are overconfident with regards to the actual sophistication of their ERM program or (b) the smaller firms have less complex risks to manage which requires less development than that faced by larger firms.

The second set of results presented in Table 4 employs the firm's RM Score as the dependent variable. The results from this model again suggest that smaller firms report more sophisticated risk management practices than larger firms. The results also indicate that firms with less leverage and greater cash flow volatility are associated with ERM Scores. The cash flow volatility relationship is of particular interest because it runs counter to our initial intuition – that firms with more sophisticated risk management will also experience less volatile cash flows. Contrary to those expectations, our results suggest that it is actually firms with greater levels of cash flow volatility that have higher levels of ERM sophistication. We provide greater analysis of this relationship below.

Section 4.2 – Relating Cash Flow Volatility to ERM

To test this cash flow volatility / risk management relationship further, we perform regression analyses holding the coefficient of variation of cash flows as the dependent variable. We relate this variable to two measures of risk management sophistication and other firm control variables. Both models are OLS regressions which include both year and industry fixed effects. In the first model, our risk management independent variable is the same as the control variable in our univariate analysis (i.e., a binary variable equal to 1 for the top quartile of RM Score firms).

Our second model controls for risk management using the actual RM score (on a scale from 1-10). The results for these regressions are presented in Table 5.

[Insert Table 5 about here]

The results across both regressions presented in Table 5 are consistent with one another, suggesting a positive and statistically significant relationship between risk management sophistication and the volatility of firm cash flows. These findings again confirm the results that were previously reported in Tables 3 and 4. We also find that cash flow volatility is negatively related to firm liquidity (i.e., more liquid firms have lower cash flow volatility) and negatively related to dividend paying firms. The finding of a negative relation between cash flow volatility is consistent with the findings of Minton and Schrand (1999), who find that there is an inverse relation between dividend payout ratios and cash flow volatility.

The consistent finding of a positive relationship between risk management sophistication and cash flow volatility may be surprising at first, but is not necessarily counter-intuitive. Greater volatility of cash flows may lead some shareholders and other stakeholders in the firm to worry about financial distress, reduced profitability, or swings in shareholder value. Perhaps those firms which experience greater cash flow volatility invest more resources in enterprise risk management to alleviate shareholders' and stakeholders' concerns over the financial well-being of the firm. Risk management and ERM can serve as a source of monitoring within the firm and provide various stakeholders with a sense of security, even when cash flow volatility is relatively high.

Section 4.3 – Specific Risk Management Factors and Cash Flow Volatility

As a final empirical test we seek to determine *what* in an ERM program is driving the volatility of cash flows. RIMS constructs seven risk management attributes – tied to the ISO 31000

framework (International Organization for Standardization, 2009) –from the 25 risk management survey questions. These seven attributes and their corresponding survey questions are presented in Appendix 2. Using an OLS model, we attempt to identify how specific risk management attributes relate to cash flow volatility. In addition to including the seven different attributes, we also include firm-specific control variables used in previous models as well as industry and year fixed effects.[12] The results from this regression analysis are shown in Table 6.

[Insert Table 6 about here]

Consistent with the empirical results in Table 5, we find a negative relationship between cash flows and liquidity as well as dividend status. That is, more liquid firms and dividend payers tend to experience less volatility of cash flows. Focusing on the seven different risk management attributes, we find that only Attribute Seven is the only attribute that is exhibits a statistically significant relation to cash flow volatility. This specific attribute relates the firm's sophistication in resiliency and operational planning, risk-based planning, and understanding the consequences of risk. The results from this analysis suggest that firms which experience the greatest cash flow volatility rate themselves as more sophisticated at risk and resiliency planning. In other words, these firms claim to understand future potential loss events and are prepared to withstand those events. Because future uncertainty is associated with variation in cash flow, it is intuitive that firms which experience this variation are those which go to greater lengths to prepare for the same phenomenon in the future.

[12] It should be noted that the seven attributes are highly correlated with each other, with a minimum correlation of 68 percent and a maximum correlation of 87 percent. Given the high correlations, the potential for multicollinearity exists; however, we checked the VIF and found that the highest VIF among the attributes is 6.81 and the mean VIF is 4.12, which is within what are generally considered to be acceptable limits (Kennedy, 1998).

Section 5 – Conclusion and Future Research

Enterprise risk management has become an increasingly important tool within corporations both in the U.S. and abroad. While ERM continues to be implemented in a greater number of firms over time, researchers have begun to examine how the existence of an ERM program can impact firm value as well as firm risk. Although previous studies have shown that the existence of an ERM program can be associated with an increase in the value of a firm (e.g, Hoyt and Liebenberg, 2011) and that volatility is associated with the decision to implement an ERM program, little research exists that directly links the degree of ERM sophistication to firm risk. Given that firms may have reached varying points of ERM development, it is important to consider how the level of ERM development / sophistication can influence the firm. Using a unique dataset provided by the Risk and Insurance Management Society (RIMS), we are able to examine the relationship between ERM sophistication and firm risk. Our sample consists of publicly traded firms that completed the RIMS ERM survey from the period of 2006 through 2013 and the firms are from a variety of industries which allows us to determine how differences across industries influence ERM sophistication.

The primary results of this study indicate that sophisticated risk management practices are related to a *higher* variation in firms' operating cash flows. In other words, better risk management is related to greater cash flow volatility. While initially surprising, this finding may be the result of a firm's desire to assure shareholders that the firm is financially healthy (through ERM) even while experiencing swings in operating cash flows. Risk management and ERM may serve as a source of monitoring on the firm which encourages various stakeholders to engage with the firm. In this case, better ERM may lead to a more valuable firm by reducing stakeholder uncertainty in the firm and alleviating shareholder concerns of bankruptcy or financial distress. Prior literature

suggests that ERM can increase the value of the firm, but little evidence suggests how exactly value is enhanced through the use / implementation of an ERM program, and we believe that this is one firm characteristic which explains the relationship.

While the results across our various models are generally consistent, we plan on refining our research and results by further exploiting the risk management survey data which we obtained from RIMS. The dataset contains 25 questions related to risk management and ERM and our next step is to develop other refined measures of risk management for the firm – including questions related to executive support of ERM and the components of an ERM process (as defined by ISO or COSO, for example). We will then relate these questions to important financial characteristics of the firm such as firm risk, firm performance, and corporate governance.

ERM research is continuing to mature and develop, but many studies agree that ERM is a value-adding practice. As ERM research continues to mature, we must address *how* ERM adds value to the firm. We begin addressing this issue in the current paper and will continue refining our empirical tests in the future work.

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Figure 1
Average Risk Management Scores from 2006 through 2013

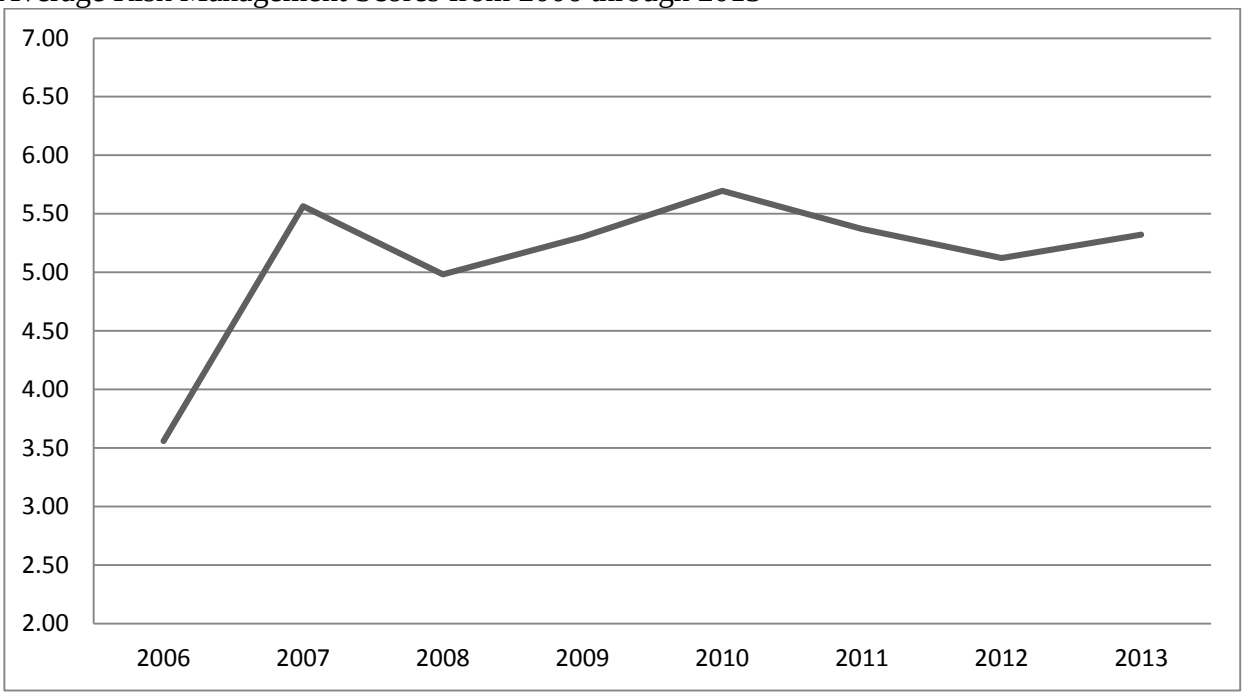
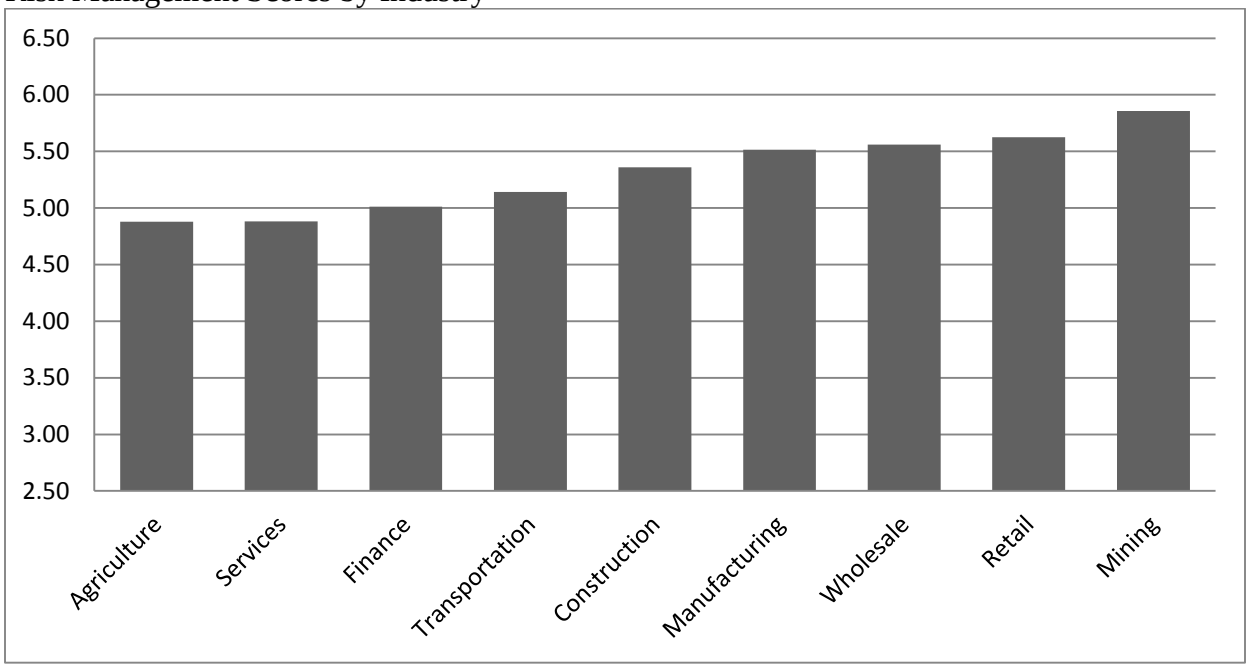


Figure 2
Risk Management Scores by Industry



Industry classifications are based on two-digit SIC codes obtained from FactSet. Values presented in the figure above are mean values and are calculated based on the risk management scores of all firms in a given industry. Note: only one firm identifies as agricultural so the average value is based on a single observation.

Table 1
Variable Definitions and Summary Statistics

	Distribution of Values					
	10%	25%	50%	75%	90%	Mean
RMM Engagement	0	1	1	1	1	0.779
RM Score	3	3.96	5.2	6.52	7.56	5.26
Tobin's q	0.296	0.626	0.934	1.445	1.939	1.090
Size	2.996	3.461	3.962	4.443	5.040	3.997
Dividend Payer	0	1	1	1	1	0.789
Sales Growth	-0.139	-0.024	0.043	0.117	0.256	0.057
Leverage (Dupont)	-0.055	0.039	0.078	0.129	0.243	0.081
Leverage (Liab/Equity)	0.275	0.449	0.823	1.693	5.491	2.518
Liquidity	0.040	0.069	0.109	0.168	0.268	0.132
ROA	-0.020	0.014	0.041	0.090	0.136	0.050
CV Cash Flow	0.088	0.148	0.267	0.482	0.926	0.518
US Based	0	1	1	1	1	0.859

	Variable Definitions
RMM Engagement	= 1 if the risk management index = 3, 4, or 5 (following Farrell and Gallagher, 2014)
RM Score	The risk management sophistication score derived from RIMS survey responses
Tobin's q	The ratio of firm market value to the book value of assets. Specifically, the Chung and Pruitt (1994) method: (Market Value of Equity + Value of Preferred Stock + (Current Liabilities – Current Assets) / Total Assets)
Size	The log-10 value of book assets
Dividend Payer	Binary variable equal to 1 if the firm pays a dividend that year
Sales Growth	Percentage change in sales, equal to sales in year t minus sales in year t-1, divided by sales in year t
Leverage	DuPont measure of leverage: ROA - ROE
Leverage	Book value of liabilities divided by the market value of equity
Liquidity	The ratio of operating activities cash flow to the book value of assets
ROA	Ratio of net income to total assets
CV Cash Flow	Coefficient of variation of operating activities cash flows for prior 5 years
US Based	Binary variable equal to 1 if the firm is incorporated in the United States

Table 2

Correlation Matrix

	RM Score	Tobin's q	Size	Dividend	SGrowth	Levg L/Eq	Levg Dup	Liquidity	ROE	US
RM Score	1									
Tobin's q	0.0377	1								
Size	-0.2255	-0.2924	1							
Dividend	-0.1741	-0.1073	0.3354	1						
SGrowth	0.0118	-0.0259	0.0120	0.0145	1					
Levg L/Eq	-0.1066	-0.3479	0.2630	-0.0391	0.0005	1				
Levg Dup	-0.0362	0.0436	0.0954	0.0758	0.0928	-0.1263	1			
Liquidity	-0.0251	-0.0046	0.0644	0.0045	0.0221	-0.0142	0.2622	1		
ROA	-0.0914	0.3052	-0.0048	0.1156	0.1628	0.0286	0.1604	-0.3287	1	
US	0.0406	-0.0530	-0.0133	-0.0650	0.1073	0.0242	-0.0121	0.1030	-0.1012	1

Tobin's q = The natural logarithm of the ratio of firm market value to the book vaue of assets; *RM Score* = the risk management sophistication score derived from RIMS survey responses; *Size* = the logarithm of book assets; *Dividend* = binary variable equal to 1 for firms that pay a dividend in a given year; *SGrowth* = percentage change in sales; *Leverage L/Eq* = ratio of book value of liabilities to market value of equity; *Levg Dup* = Dupont measure of leverage (ROA – ROE); *Liquidity* = ratio of operating cash flow to the book value of assets*; ROA* = ratio of net income to total assets; *CV Cash Flow* = 5-year coefficient of variation of operating activities cash flow; *US* = binary variable equal to 1 for firms that are incorporated in the US.

Table 3

Univariate Comparisons Based on Risk Management Score

Variable	1. High RM Score = 1 (n = 96)	2. High RM Score = 0 (n = 293)	3. Difference (1-2)
RM Score	7.5629	4.5059	3.0570***
CV Cash Flow	0.7720	0.4350	0.3370**
Tobin's q	1.0747	1.0954	-0.0207
Size	3.8308	4.0520	-0.2212**
ROA	0.0346	0.0545	-0.0199*
Sales Growth	0.0622	0.0559	0.0063
Liquidity	0.1256	0.1338	-0.0082
Leverage	1.7050	2.7849	-1.0799**
Dividend Payer	0.7083	0.8157	-0.1074**
US Based	0.9063	0.8430	0.0632*

*, **, and *** denote statistical significance at the 10, 5 and 1 percent levels respectively. All t-tests are conducted assuming unequal variances. Values presented in the column titled "High RM Score = 1" represent mean values for those firms that are among the top 25 percent of firms in risk management score. Values presented in the column titled "High RM Score = 0" represent mean values for firms that are not among the top 25 percent of firms in risk management score. Values presented in the column titled "Difference" represent the difference between firms in the "High RM Score = 1" column and firms in the "High RM Score = 0" column. *RM Score* = the risk management sophistication score derived from RIMS survey responses; *Tobin's q* = The natural logarithm of the ratio of firm market value to the book vaue of assets; *RM Score* = the risk management sophistication score derived from RIMS survey responses; *Size* = the logarithm of book assets; *Dividend* = binary variable equal to 1 for firms that pay a dividend in a given year; *SGrowth* = percentage change in sales; *Leverage L/Eq* = ratio of book value of liabilities to market value of equity; *Levg Dup* = Dupont measure of leverage (ROA – ROE); *Liquidity* = ratio of operating cash flow to the book value of assets*; ROA* = ratio of net income to total assets; *CV Cash Flow* = 5-year coefficient of variation of operating activities cash flow; *US* = binary variable equal to 1 for firms that are incorporated in the US.

Table 4
ERM Engagement and ERM Sophistication

	ERM Engagement Dummy		**RM Score**	
Variables	Coefficient Estimate	Robust S.E.	Coefficient Estimate	Robust S.E.
Size	-0.480***	0.105	-0.457***	0.116
Leverage (Liab / Eq)	0.014	0.019	-0.021**	0.010
Sales Growth	-0.024	0.367	0.142	0.441
Liquidity	-0.152***	0.054	-0.022	0.023
Cash Flow CV	-0.010	0.085	0.171**	0.069
US Based	-0.113	0.226	0.226	0.231
Model	Probit		OLS	
Year FE	Yes		Yes	
Industry FE	Yes		Yes	
Pseudo // Adj. R^2	0.106		0.127	
Chi-Sq. // F-Statistic	586.58***		4.30***	
Observations	389		389	

*, **, and *** denote statistical significance at the 10, 5 and 1 percent levels respectively. The dependent variable for the first model is a dummy variable equal to 1 when firms risk management score equals 3, 4, or 5 according to the Farrell and Gallagher (2014) definition of ERM engagement. The dependent variable for the second model is risk management score calculated from the RIMS survey data. Industry and year fixed effects are included in each model (unreported).

Table 5
ERM Sophistication and Cash Flow Volatility

	CV of Operating Cash Flow		CV of Operating Cash Flow	
Variable	Coefficient Estimate	Robust S.E.	Coefficient Estimate	Robust S.E.
High RM Score (1/0)	0.257**	0.124		
RM Score			0.058*	0.032
Size	-0.103	0.077	-0.092	0.078
Liquidity	-1.185**	0.506	-1.216**	0.507
Sales Growth	-0.194	0.250	-0.204	0.251
Leverage	0.008	0.010	0.008	0.010
Dividend Status	-0.269*	0.139	-0.265*	0.139
US Based	-0.185	0.156	-0.172	0.156
Model	OLS		OLS	
Year FE	Yes		Yes	
Industry FE	Yes		Yes	
Adjusted R^2	0.132		0.130	
F-Statistic	3.69***		3.64***	
Observations	389		389	

*, **, and *** denote statistical significance at the 10, 5 and 1 percent levels respectively. The independent variable of interest for the first model is a dummy variable equal to 1 for those firms that are among the top 25 percent of firms in risk management score. The independent variable of interest for the second model is risk management score calculated from the RIMS survey data. Industry and year fixed effects are included in each model (unreported).

Table 6
Cash Flow Volatility and Risk Management Attributes

	CV of Operating Cash Flow	
Variable	Coefficient Estimate	Robust S.E.
Attribute **1**	0.031	0.064
Attribute **2**	-0.028	0.071
Attribute **3**	0.040	0.043
Attribute **4**	-0.046	0.060
Attribute **5**	-0.0005	0.061
Attribute **6**	-0.041	0.051
Attribute **7**	0.115**	0.056
Size	-0.10	0.079
Liquidity	-1.249**	0.510
Sales Growth	-0.139	0.253
Leverage	0.011	0.010
Dividend Status	-0.278**	0.140
US Based	-0.191	0.157
Adjusted R^2	0.129	
F-Statistic	3.05***	
Observations	389	

*, **, and *** denote statistical significance at the 10, 5 and 1 percent levels respectively. The independent variables of interest include seven risk management attributes (Attrib1 – Attrib7) and the composition of each of these variables is shown in Appendix 2. The seven attributes can range in value from 1-10. Industry and year fixed effects are included in each model (unreported).

Appendix 1 – RIMS Risk Management Maturity/Sophistication Survey Questions

Potential Responses:

Effectiveness: Range from fully ad hoc (low) to fully managed (high)
Proactivity: Range from full reactive (low) to fully proactive (high)
Coverage: range from fully uncertain (low) to fully pervasive (high)

Questions:

External

1. Adverse Events as Opportunities: Strategic Opportunities are routinely identified and explored during adverse event planning
2. Resiliency and Operational Planning:
    a. Business units report on how external and internal events might impact their business models
    b. Business units use far-sighted scenario analysis to document resiliency and sustainability key drivers
    c. Resiliency aspects of root cause categories (people, process, external environment, relationships, systems) are considered in operational planning
    d. Logistics, security, resources, and organization of response procedures are well documented

People

3. Communicating Goals
    a. Employees understand how a risk-based approach helps them achieve goals. Goals and risks' implications are understood by all employees.
    b. All goals have performance measures and all performance measures are linked with goals.
    c. Resource allocation decisions are based on formalized evaluation criteria, such as impact, timing, and assurance.
    d. Accountability for goals and risks are fully understood by all personnel
4. ERM Program Oversight
    a. Operational managers actively participate in the ERM program.
    b. Process owners and risk ownership are clearly defined.
    c. Risk Management accountability is woven into all processes, support functions, business lines, and geographies to achieve goals.
5. Executive ERM Support
    a. Risk Management competence is part of all managers' performance reviews.
    b. The organization is self-governed with shared ethics and trust to ensure that promise makers are held accountable.
    c. Qualitative risk assessments are required for every big project, new products, business practice changes, acquisitions, etc.
    d. Operational risk priorities are always reported to the board of directors or other similar oversight group.

6. Risk Culture, Accountability, and Communication
    a. Risk management is clearly defined and practiced at every level
    b. Viable opportunities are routinely evaluated as risk plans develop
7. Understanding Consequences
    a. Resiliency and sustainability are always a part of the ERM process
    b. Risk assessments by front-line risk owners determine the need for business continuity analyses and planning

Process

8. Business Process Definition and Risk Ownership
    a. Processes are defined and process-specific risks are identified
    b. Process owners consistently manage their risks and opportunities within regular planning cycles
    c. Process and risk owners use the ERM process to enhance their functions
    d. Risk issues are communicated and acted upon effectively and in a timely manner
9. ERM Information and Planning
    a. ERM is woven into strategy and planning at all levels.
    b. Risk management competency is part of compensation and career development for all levels.
10. ERM Process Goals and Activities
    a. Effectiveness of managing uncertainties and seizing risky opportunities is measured and reported.
    b. Risk management is formal part of goal setting.
    c. Employees at all levels use a risk based approach to achieve goals
    d. Financial, customer, business process and earning perspectives are examined within business units and process.
    e. Deviations from plans or expectations are measured against corporate- and business unit-level goals.
11. ERM Process Steps
    a. Qualitative assessments determine the need and priority for further quantitative analysis or modeling.
    b. Sequential and iterative steps of risk identification, assessment, evaluation, mitigation and monitoring are used to improve decision-making and performance.
    c. Information required for effective risk management is dynamic, available and shared across departments.
12. Follow-up Reporting
    a. Organizational follow-up requires aggressive management of the upside and downside of identified risks.
    b. Risk mitigation activities are monitored to ensure that desired outcomes (e.g., reduced risk) are achieved.
13. Formalized Risk and Measure
    a. Risk indicators in particularly sensitive areas (e.g., critical processes, high risk projects) are periodically analyzed and revisited by front line risk owners.
    b. Standardized evaluation criteria such as of impact, likelihood and controls' effectiveness are always used to prioritize risk for follow-up.

14. Front Line and Support Process Owner Participation
    a. Risk management issues are clearly understood at all levels.
    b. Risk assessments are consistently conducted in all business areas.
15. Repeatability and Scalability
    a. An enterprise risk committee or equivalent regularly reviews risk plans.
    b. Risk and performance assumptions are included in qualitative assessments which are routinely revisited and updated.
16. Risk and Opportunity Information Collection
    a. Scenario analyses are performed throughout planning.
    b. Causes of events are recorded and measured to determine effectiveness of controls.
17. Risk Ownership by Business Area
    a. Front-line owners identify risks that are specific to their business arrears and processes to create, meaningful context for their risk mitigation activities.
18. Risk Portfolio View
    a. Portfolio views of risk are dynamic.
    b. Risk assessment information is aggregated, analyzed and dependencies addressed.
    c. Risk tolerance is formally defined for each aspect of risk.
    d. Differences between defines risk tolerance and actual risks are regularly assessed.
19. Risk-based Planning
    a. Balance is achieved between quarterly deliverables and longer-term value.
20. Risk-reward Tradeoffs
    a. Expected effect of mitigation is measured against risk tolerance during the ERM process.
    b. Resources are allocated based on risk-reward priorities.
    c. An appropriate amount of risk is considered in each ERM process step.
    d. Operational risk us understood and assessed when performance and risk metrics are changed.
    e. Risk-reward tradeoffs are understood and guide actions.
    f. Actual risk is compared against assessed risk.
21. Root Cause Consideration
    a. A root cause approach is used in each ERM process step to ensure that the problem and not the symptom is not addressed.
    b. Root cause categories that prevent distortive double counting within risk assessments are used.
    c. The cause and effect chain from the top-down and the bottom-up is easily understood.

<u>Relationships</u>

22. Far-sighted Risk Management Vision
    a. Business units and departments create and evaluate far-sighted scenarios to drive risk management activities.
23. Risk Management Reporting
    a. Periodic reports measuring ERM progress and activities are provided to stakeholders.

Systems

24. Dependencies and Consequences
    a. Dependencies and consequences across-departments are linked and fully understood.
    b. Risk analysis always identifies potential losses and gains as well as effects on goals.
    c. All incidents are tracked back to root causes to evaluate the cost benefit for improvement.
25. Information Classification
    a. Classification of risk information within the ERM process is fully implemented.
    b. Goals are always documented, measured, reported and managed.
    c. Operational risks' roots causes are consistently investigated, defined quantified and routinely monitored.
    d. Credit, solvency and equity risks are consistently investigated, classified, quantified, monitored and reported.

Appendix 2 – The Seven Risk Management Attributes (Question Composition)

Attribute 1
Q5. Executive ERM Support
Q8. Business Process Definition and Risk Ownership
Q14. Front Line and Support Process Owner Participation
Q22. Far-sighted Risk Management Vision

Attribute 2
Q4. ERM Program Oversight
Q6. Risk Culture, Accountability, and Communication
Q11. ERM Process Steps
Q16. Risk and Opportunity Information Collection
Q23. Risk Management Reporting

Attribute 3
Q18. Risk Portfolio View
Q20. Risk-reward Tradeoffs

Attribute 4
Q16. Risk and Opportunity Information Collection
Q21. Root Cause Consideration
Q24. Dependencies and Consequences
Q25. Information Classification

Attribute 5
Q1. Adverse Events as Opportunities:
Q12. Follow-up Reporting
Q13. Formalized Risk and Measure
Q17. Risk Ownership by Business Area

Attribute 6
Q3. Communicating Goals
Q9. ERM Information and Planning
Q10. ERM Process Goals and Activities

Attribute 7
Q2. Resiliency and Operational Planning:
Q7. Understanding Consequences
Q19. Risk-based Planning