# Determinants and Value of Enterprise Risk Management: Empirical Evidence From the Literature

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## Abstract

The development of an enterprise risk management (ERM) program enables companies to manage corporate risks in a holistic manner as opposed to the silo-based perspective in traditional risk management frameworks. One main question in this regard is what factors drive the implementation of an ERM system in companies and whether ERM programs can actually create value once implemented. This article addresses these questions by conducting a comparative assessment of empirical evidence from the literature regarding the determinants of ERM and its value once implemented. In doing so we are able to illustrate differences in model specifications and the underlying data. Our literature study shows that particularly the company size and the level of institutional ownership are significantly positively related to the implementation of ERM in most empirical studies and, furthermore, that ERM generally has a (significant) positive impact on corporate value and performance (to a different extent and depending on the focus of the studies). However, geographic and/or industrial restrictions regarding the underlying data sets partly limit the generalization of the empirical results.

## Introduction

In recent years, enterprise risk management (ERM) has become increasingly relevant for managing corporate risk. In contrast to traditional silo-based risk management, ERM considers the company's entire risk portfolio in an integrated and holistic manner. It further constitutes a part of the overall business strategy and is intended to contribute to protecting and enhancing shareholder value (see Meulbroek, 2002; Hoyt and Liebenberg, 2011). The need and demand for ERM as a holistic and company-wide risk management framework is a result of several changing internal and external factors in the corporate

environment, which involve a broader risk scope, a higher risk complexity, and increasing interactions and dependencies between risk sources. Relevant external factors include, for example, globalization, industry consolidation, and deregulation as well as regulatory pressure (see, e.g., Pagach and Warr, 2011). Furthermore, rating agencies have started to incorporate companies' internal (enterprise) risk management systems in their rating processes (see Hoyt and Liebenberg, 2011).[1] In general, the internal factors can be reduced to the objective of risk management, which is to enhance the firm's shareholder value (see Meulbroek, 2002). ERM is also driven by methodological and technological progress including advanced methods of risk quantification and information technologies (see Jablonowski, 2001). Overall, an ERM system thus enables the board and senior management to better monitor the company's risk portfolio as a whole (see Beasley et al., 2005).

The benefits and disadvantages of implementing ERM are comprehensively discussed in the literature. The consideration of the company's entire risk portfolio in a holistic process is said to contribute to reduced earnings volatility, stock price volatility, and external capital costs as well as a higher capital efficiency, where the consideration of risk dependencies further allows companies to exploit synergy effects in the risk management process (see Liebenberg and Hoyt, 2003). However, the necessary financial and human resources, as well as the required IT systems, constitute an obstacle for ERM (see McShane et al., 2011). In addition, establishing a strong risk culture and the development of adequate (compensation) incentive systems are needed for the successful implementation of ERM (see Rochette, 2009). Furthermore, as part of the global corporate strategy, ERM shifts risk management to a more offensive function that also accounts for emerging and strategic opportunities and involves a better decision process with respect to operational and strategic decisions in order to eventually increase shareholder value (see Liebenberg and Hoyt, 2003; Rochette, 2009). To ensure the appropriate coordination and functionality of the ERM system, a senior executive such as a chief risk officer (CRO) or a committee of experts should therefore direct the risk management process. Despite the growing importance of holistic risk management systems, however, ERM has only been adopted by some companies.[2] Thus, questions arise as to why companies implement an ERM framework while others do not, to what extent and in which way ERM system actually impacts a firm's performance, and whether it actually contributes to increasing shareholder value, for instance.

In the literature, ERM frameworks and their implementation are widely discussed. For instance, several authors descriptively study the *stage of the ERM implementation* based on surveys, questionnaires, or interviews (see, e.g., Thiessen et al., 2001; Kleffner et al., 2003; Beasley et al., 2009, 2010; Daud et al., 2010; Altuntas et al., 2011; Daud et al., 2011; Yazid et al., 2011). Furthermore, there are quantitative studies that examine the

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[1] Since 2008, Standard & Poor's accounts for the level of ERM implementation in their rating process of nonfinancial companies, at the same time also considering the risk management culture, strategic risk management, and ERM resources (see Dreyer and Ingram, 2008); for insurers, this has been so since 2005, for instance.

[2] According to a worldwide survey by Deloitte (2011), only 52 percent of companies in the financial services industry had an ERM or a comparable system in 2010. By comparison with 2008, this constitutes an increase of 16 percent.

*determinants* that significantly affect the implementation (or level) of an ERM framework by applying multivariate methods (see Liebenberg and Hoyt, 2003; Beasley et al., 2005; Hoyt and Liebenberg, 2008, 2011; Pagach and Warr, 2011; Razali et al., 2011; Golshan and Rasid, 2012),[3] while other quantitative studies deal with the *shareholder (firm) value and performance* as a consequence of an ERM implementation (see Beasley et al., 2008; Hoyt and Liebenberg, 2008; Gordon et al., 2009; Grace et al., 2013; Pagach and Warr, 2010; Hoyt and Liebenberg, 2011; McShane et al., 2011; Tahir and Razali, 2011).

The aim of this article is to conduct a structured review and comparative assessment of the empirical literature regarding the determinants for implementing a corporate ERM system and the resulting performance for the company. This analysis is intended to allow for the identification of commonalities and differences between the empirical studies to obtain a deeper and more holistic insight into the drivers of ERM and its impact on firm value. We therefore focus on the quantitative studies listed above, where determinants (seven studies) and the impact of an ERM system on the corporate performance (eight studies) are tested for statistical significance, and comprehensively discuss the data and the respective assumptions underlying the empirical work regarding ERM.

Our study emphasizes that the collection of data constitutes one major challenge, with the consequence that empirical studies are often restricted to single countries and/or certain industry sectors. As a result, the empirical findings partly differ. Regarding the determinants of ERM, for instance, our findings show that while some determinants (assets' opacity, growth opportunities) are not significantly related to the development of an ERM system or are ambiguous regarding the direction (financial leverage), the company size and the level of institutional ownership are, in particular, identified in most studies as significant factors that positively affect the implementation of an ERM system (generally approximated by the existence of a CRO and partly by additional ERM keywords). When looking at the performance and shareholder value after having implemented an ERM system, despite different assumptions and models, we find that most studies indeed reveal a (mostly significant) positive relation between the implementation of an ERM system and the corporate performance or shareholder value, whereby the extent depends on the focus and assumptions of the study.

The remainder of the article is structured as follows. The second section defines and describes ERM and the differences from traditional concepts. The third section contains a comparative assessment of empirical studies on the determinants of an ERM implementation. The fourth section focuses on the corporate value and performance as a consequence of ERM implementation. The fifth section concludes.

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[3] Further studies deal with general risk management activities, not focusing on ERM. For instance, Dionne and Garand (2003) analyze significant determinants for risk hedging in the mining industry in North America. A mathematical approach regarding the implementation of ERM to achieve strategic goals is presented in Ai et al. (2012).

## ENTERPRISE RISK MANAGEMENT

### Definition of ERM and Differences From Traditional Risk Management

In recent years, several conceptual frameworks have been developed and published that provide an overview of the key elements of ERM.[4] The Committee of Sponsoring Organizations of the Treadway Commission (COSO, 2004), for instance, defines ERM as:

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

Hence, ERM considerably differs from traditional risk management concepts. ERM defines a process that combines the corporate's entire risk management activities in one integrated, holistic framework to achieve a comprehensive corporate perspective. Traditional approaches, in contrast, are generally based on a silo-based risk consideration and a department-by-department perspective (see Kleffner et al., 2003) where risks are measured in isolation. ERM aggregates all the risks across the entire firm, thereby taking into account interdependencies between risks, which allows for a better assessment of the firm's risk situation and further improves the decision process with respect to strategic and operative developments (see Meulbroek, 2002; Nocco and Stulz, 2006; Pagach and Warr, 2011; Hoyt and Liebenberg, 2011).

Furthermore, risk handling in traditional approaches is generally rather defensive in that it concentrates on the protection of the firm against adverse financial scenarios. In ERM, the focus is shifted toward a more offensive handling through the integration of ERM into the corporate strategy and the decision process and is explicitly intended to contribute to increasing shareholder value (see Meulbroek, 2002; Liebenberg and Hoyt, 2003). ERM thus not only attempts to minimize risk but explicitly accounts for potential opportunities.

Due to the fact that ERM is part of the corporate strategy and the high relevance of an ERM implementation, ERM is directed top-down by the senior management (see COSO, 2009, p. 4). The senior management is therefore responsible for defining the objectives of the ERM plan and for integrating them into an integrated corporate strategy, ensuring that the company's defined risk appetite will not be exceeded while taking into account opportunities as discussed above. ERM thereby typically includes the appointment of a CRO or a committee of experts serving as a supervisor and coordinator of risk management, a position that in general does not exist in traditional approaches (see Liebenberg and Hoyt, 2003). The appointment of a CRO is thus intended to ensure an effective and efficient integrated risk management, which also includes a communication function with direct reporting to the executive board and shareholders concerning the

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[4] In 2001, KPMG published a guideline called KPMG Enterprise Risk Management (see KPMG, 2001). A framework for ERM was also developed by the Federation of European Risk Management Associations (FERMA) in 2002 (see FERMA, 2002). In addition, the International Organization for Standardization (ISO) proposed the ISO 31000 Risk Management principles in 2009 (see ISO, 2009), for instance.

**TABLE 1**

Data Collection Methods of Studies Regarding the Existence of ERM

| Survey | Public Source |
| --- | --- |
| Colquitt et al. (1999) | Liebenberg and Hoyt (2003) |
| Thiessen et al. (2001) | Beasley et al. (2005) |
| Kleffner et al. (2003) | Hoyt and Liebenberg (2008) |
| Beasley et al. (2005) | Gordon et al. (2009) |
| Beasley et al. (2009) | Pagach and Warr (2010) |
| Beasley et al. (2010) | Hoyt and Liebenberg (2011) |
| Daud et al. (2010) | McShane et al. (2011) |
| Daud et al. (2011) | Pagach and Warr (2011) |
| Grace et al. (2013) | Razali et al. (2011) |
| Altuntas et al. (2011) | Tahir and Razali (2011) |
| Deloitte (2011) | Golshan and Rasid (2012) |
| Yazid et al. (2011) | |

corporate firm's risk situation and profile. Thus, information asymmetries between the company representatives and shareholders can be reduced (see, e.g., Liebenberg and Hoyt, 2003; Beasley et al., 2008).

### Data Collection and Measuring the Implementation and Level of an ERM System

In general, companies hardly publish any comprehensive information about their existing risk management system or plans. Hence, the empirical literature is faced with the challenge of gathering information about whether or not an ERM system has been adopted and to what degree.[5] Information about the current corporate risk management system can either be collected by using surveys or by scanning public sources. An overview of the two data collection methods used in the empirical literature is given in Table 1.

Surveys are typically used to study the level or stage of the ERM implementation. Beasley et al. (2005), for instance, conduct a survey and introduce a classification of five stages to analyze the determinants of ERM.[6] Further studies make use of external databases such as Standard & Poor's (S&P) ERM rating (McShane et al., 2011) and the Osiris database (Razali et al., 2011; Tahir and Razali, 2011) or develop their own index for the firm's ERM (Gordon et al., 2009).

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[5] This lack of sufficient data may make for smaller sample sizes and lead to problems regarding the quality.

[6] Levels include: (1) no plans exist to implement ERM; (2) investigating ERM, but no decision made yet; (3) planning to implement ERM; (4) partial ERM is in place; and (5) complete ERM is in place. The classification into five levels by Beasley et al. (2005) is adopted in various further empirical studies (see, e.g., Beasley et al., 2009, 2010; Daud et al., 2010; Daud et al., 2011).

An alternative to surveys are public sources, where, for example, business libraries or annual reports are scanned for key words, their acronyms, or individual words within the same paragraph that indicate an implemented ERM system (ERM key words). Many studies thereby revert to the appointment of a CRO as a signal of an ERM system (CRO key words) (see e.g., Liebenberg and Hoyt, 2003; Pagach and Warr, 2011; Golshan and Rasid, 2012).[7] This assumption may lead to biased results in cases where the existence of a CRO does not correspond to an implemented ERM system or in cases where the title or person changes (see Grace et al., 2013). Furthermore, it allows for no differentiation with respect to the level of the ERM implementation. However, there are several strong arguments for using a CRO appointment as a signal. For instance, as described in the previous subsection, an ERM implementation process should typically be overseen and led by a senior executive due to the considerable impact of ERM and its complexity (see Pagach and Warr, 2011). In addition, Beasley et al. (2005) empirically show that there is a significant positive relationship between the presence of a CRO and the ERM implementation stage (see next section), thus providing support for the proxy used in the empirical studies.

### DETERMINANTS OF ERM IMPLEMENTATION

Regarding the implementation and determinants of an ERM system, several studies have a primarily qualitative focus. While Thiessen et al. (2001) survey 21 CROs in North America to examine their roles, responsibilities, and skills, the decision criteria for adopting an ERM system in Canada is analyzed by Kleffner et al. (2003) based on a mail survey and telephone interviews. Beasley et al. (2009, 2010) conduct an online survey with 710 and 460 U.S. participants, respectively, to examine risk management practices including the level of ERM implementation and several aspects of risk oversight. Furthermore, surveys by Daud et al. (2010) and Daud et al. (2011) in the Malaysian market show that the level of ERM implementation is strongly influenced by the quality of the CRO and the board of directors.[8] Based on a survey of 95 German property–liability insurers, Altuntas et al. (2011) analyze how these companies adopt an ERM system and which risk sources are included in this holistic approach.

### Empirical Studies of ERM Determinants

Hence, while there are numerous studies on the determinants of an ERM implementation as discussed above and also shown in Table 1, in the following we focus on seven studies that apply multivariate methods to derive statistically significant evidence regarding the determinants of ERM. An overview of the seven empirical studies along with their underlying data, time period, methodology, ERM proxy, as well as empirical results is given in Table 2. As can be seen from Table 2, most of the studies are based on data from U.S. firms for different time periods and in most studies, the appointment or existence of

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[7] In the literature, business libraries such as LexisNexis, PR Newswire, or Thomson are used. Search criterions are, for example, "enterprise risk management" or "holistic risk management for ERM" and "chief risk officer," "director of risk management," or "risk committee" for CRO. For further examples, see, for example, Beasley et al. (2008), Hoyt and Liebenberg (2011), or Golshan and Rasid (2012).

[8] Yazid et al. (2011) consider government-linked companies in Malaysia and find similar results.

**TABLE 2**
Determinants of ERM Implementation: Evidence from Empirical Studies

| Authors | Data | Time Period | Methodology | ERM Proxy | $H_1$ Company Size | $H_2$ Financial Leverage | $H_3$ Earnings Volatility | $H_4$ Stock Price Volatility | $H_5$ Asset Opacity | $H_6$ Growth Opportunity | $H_7$ Diversification | $H_8$ Institutional Ownership |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LH (2003) | 26 U.S. companies | 1997–2001 | Logistic regression | CRO key words | $-^*$ | $+^{**}$ | $-$ | $+$ | | $+$ | | $+$ |
| BCH (2005) | 123 companies | 2004 | Logistic regression | ERM stage (survey) | $+^{**}$ | | | | | | | |
| HL (2008) | 125 U.S. insurers | 2000–2005 | ML model | ERM/CRO key words | $+^{***}$ | $-^{**}$ | | | | | $-/-$ (indust./internat.) | $+^{***}$ |
| HL (2011) | 117 U.S. insurers | 1998–2005 | ML model | ERM/CRO key words | $+^{***}$ | $-^{**}$ | $+$ | $+$ | $-$ | | $+/-^*$ (indust./internat.) | $+^{**}$ |
| PW (2011) | 138 U.S. companies | 1992–2005 | Hazard model | CRO key words | $+^{***}$ | $-$ | $+^{**}$ (cash flow volatility) | $+^{**}$ | $-$ | $-$ | $-$ (indust.) | $+^{**}$ |
| RYT (2011) | 528 Malaysian firms | 2007 | Logistic regression | Osiris database | $+$ | $+$ | | | | | $+^*$ (internat.) | $+$ |
| GR (2012) | 90 Malaysian firms | Not specified | Logistic regression | CRO key words | $+$ | $+^*$ | | | $+$ | | $-$ (indust.) | $-$ |

Notes: LH = Liebenberg and Hoyt; BCH = Beasley et al.; HL = Hoyt and Liebenberg; PW = Pagach and Warr; RYT = Razali et al.; GR = Golshan and Rasid. Significance levels: 1% (***), 5% (**), 10% (*). ML = maximum likelihood.

a CRO is used by itself or in addition to ERM key words as a proxy for the implementation of an ERM system. The supposed determinants related to an ERM implementation comprise company-specific variables such as financial, structural, or ownership characteristics. In the following, we present the most commonly analyzed hypotheses in the seven considered studies and describe the generally assumed relation.

> $H$:   Companies are more likely to implement an ERM system with increasing . . .

> $H_1$:   . . . company size.

A larger company size is generally associated with an increasing scope and complexity of risks, which increases the likelihood of an ERM implementation. Furthermore, according to Beasley et al. (2005) and Golshan and Rasid (2012), larger companies also tend to have more resources with which to implement an ERM system. A positive correlation of company size with the extent of the risk management system has also been shown previously (see, e.g., Colquitt et al., 1999). The studies considered in Table 2 measure company size using the natural log of the firm's (book value of) assets except for Beasley et al. (2005), who consider the firm's revenues.

> $H_2$:   . . . financial leverage.

Greater financial leverage is expected to generally induce a higher shortfall risk and thus higher financial distress costs. Even though the relationship between financial leverage and the adoption of an ERM system is not entirely clear (see Hoyt and Liebenberg, 2011, p. 805), financial leverage is expected to positively affect the adoption of an ERM system (see, e.g., Liebenberg and Hoyt, 2003). Financial leverage is mostly defined by the debt (or liability) to asset ratio.[9]

> $H_3$:   . . . earnings/cash flow volatility.

A reduction in earnings volatility is typically stated as one major benefit of ERM, which is expected to result from the comprehensive consideration of interdependencies between enterprise-wide risks (Liebenberg and Hoyt, 2003). In the empirical studies considered, earnings volatility is measured by the coefficient of variation of earnings before interest and taxes (EBIT). Pagach and Warr (2011) are the only ones in Table 2 to study cash flow volatilities instead of earnings volatility, using the firm's operating cash flows and hypothesizing that smoothing cash flows leads to a reduction in the likelihood of lower tail cash flow outcomes and, thus, that firms with higher cash flow volatility are more likely to benefit from an ERM implementation (p. 192).

> $H_4$:   . . . stock price volatility.

Similar to earnings and cash flow volatility, the implementation of a holistic risk management system can also reduce the firm's stock price volatility, as a higher stock price

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[9] Hoyt and Liebenberg (2008, 2011) and Razali et al. (2011) use the ratio of the book value of debt to the market value of equity.

volatility implies that companies are faced with greater risks and consequently benefit more from ERM system. Hence, a positive relation between the volatility of stocks and ERM is typically expected. In the empirical literature, this variable is defined as the standard deviation of stock prices or stock returns.[10]

$H_5$: . . . asset opacity.

In situations of financial distress, companies with more opaque assets have more difficulties liquidating their assets at purchase costs to prevent financial distress and they are more likely to cause an undervaluation of the company, also due to higher information asymmetry (see, e.g., Pagach and Warr, 2011, p. 192). In addition, Liebenberg and Hoyt (2003) argue that the economic benefit of ERM may be greater for companies with higher opacity due to the ability of the CRO to communicate the firm's risk profile and financial strength to prevent disagreement. The assets' opacity is measured by the ratio of intangible assets to total assets.

$H_6$: . . . growth opportunity.

Liebenberg and Hoyt (2003) and Pagach and Warr (2011) expect that firms with greater growth opportunities face an increasing degree of uncertainty with respect to future cash flows and are thus more likely to implement an ERM system. In particular, ERM does not only help reduce risks but also accounts for potential opportunities, such that the growth potential can be realized in an optimal way by means of an ERM system. Furthermore, according to Beasley et al. (2005), the growth opportunities of high-potential companies are generally undervalued, resulting in higher costs of debt. Hence, greater growth opportunities enhance the benefit of ERM and are measured by the (average) market-to-book asset ratio in the studies considered.

$H_7$: . . . diversification.

Companies that operate in several segments or business units are overall more broadly diversified, thus potentially helping to reduce operating and financial risks (see, e.g., Pagach and Warr, 2011). However, a higher diversification within the company is also consistent with higher risk complexity, thus resulting in the assumption of a positive relation between an ERM system and the firms' level of diversification (see, e.g., Golshan and Rasid, 2012). Hoyt and Liebenberg (2008, 2011) (focusing on the insurance industry) measure diversification by means of dummy variables for industrial and international diversification that are derived from the firm's industrial and international sales, while the other two studies use the number of (operating) segments (see Pagach and Warr, 2011; Golshan and Rasid, 2012).[11]

$H_8$: . . . institutional ownership.

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[10] Hoyt and Liebenberg (2011) use the natural log of the stock returns' standard deviation, while Golshan and Rasid (2012) consider the difference of the year high and year low stock prices.

[11] In Razali et al. (2011), the measurement of (international) diversification (as a dummy variable) is not specified in detail.

Firms with a higher proportion of institutional share ownership are assumed to be exposed to a higher pressure to introduce a control system, and thus tend more toward the implementation of a holistic ERM framework (see Liebenberg and Hoyt, 2003; Hoyt and Liebenberg, 2011).[12]

### Empirical Results Regarding the Determinants of an ERM Implementation

In the empirical literature on the determinants of ERM, different multivariate methods are applied to study the hypotheses laid out in the previous subsection.[13] Liebenberg and Hoyt (2003), Beasley et al. (2005), Razali et al. (2011), and Golshan and Rasid (2012) use logistic regression models, for instance,[14] while Pagach and Warr (2011) apply a (proportional) hazard model (Cox model), which takes into account the impact of time on the hiring decision of a CRO, to overcome the issue of the assumption of the independence of all firm observations.[15]

The results of the empirical studies are summarized and presented in Table 2 for the eight discussed determinants. In the majority of the empirical studies, the impact of the company's size ($H_1$) on ERM is identified as a (significant) positive determinant. In Hoyt and Liebenberg (2008, 2011) and Pagach and Warr (2011), for instance, the size of the company is even significant at the 1 percent level. Thus, as expected, larger companies appear to require a more efficient risk management system as a result of the increasing scope and complexity of risks. This argumentation also generally applies for the determinant diversification ($H_7$). Since more diversified companies are faced with an increasing risk complexity, similar to company size, a positive relationship with ERM is assumed. The empirical results, however, cannot confirm this assumption in general, as only Razali et al. (2011) find a positive significant relation for international diversification. Apart from that, the coefficients for (industrial and international) diversification are generally not significant and moreover negative with the exception of a positive relation for industrial diversification found in the insurance sample studied by Hoyt and Liebenberg (2011). The relation between international diversification and ERM in this study is even negatively significant at the 10 percent level.

When looking at the financial leverage ($H_2$), results are ambiguous. While Liebenberg and Hoyt (2003) and Golshan and Rasid (2012) find this factor to be significantly positively related to ERM,[16] Hoyt and Liebenberg (2008, 2011) show a significant negative relationship. The positive coefficient supports the assumption of more efficient risk management systems in higher leveraged companies to mitigate potential losses due to a greater risk of financial distress (see Golshan and Rasid, 2012). In contrast, according to the results in Hoyt and Liebenberg (2011), for instance, companies with lower financial leverage, which is generally associated with lower financial risks, may decide in favor of an ERM system to be able to take more financial risk in the future.

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[12] The percentage of the 30 largest shareholders is considered in Razali et al. (2011).

[13] Besides multivariate methods, several studies additionally present univariate statistics of the determinants for comparison between ERM and non-ERM companies.

[14] The dependent variable is therefore binary (ERM is implemented or not). In Beasley et al. (2005) the values of the dependent ERM variable can vary from 1 to 5 (level of ERM implementation).

[15] The estimation results with the hazard model should hardly differ when compared to the logistic regression; only the test statistics are superior (see Pagach and Warr, 2011).

[16] Razali et al. (2011) detect a positive but not significant relationship.

The volatilities of earnings (or cash flows) ($H_3$) and stock prices ($H_4$) are always positively related to the adoption of an ERM system in cases where the relationship is significant. This is mainly in line with our expectations, as firms with more volatile earnings, cash flows, or stock prices benefit from an ERM system due to smoothed earnings and a better control of stock prices (e.g., Pagach and Warr, 2011).

Regarding the impact of the assets' opacity ($H_5$) and the growth opportunity ($H_6$) on ERM, in general, no significant evidence is found. Furthermore, the (insignificant) direction of the relationship is inconsistent across the empirical literature. Regarding $H_8$, the findings confirm that institutional shareholders indeed appear to apply pressure to develop an efficient and holistic corporate risk management, as most studies find a (significant) positive relation between institutional ownership and ERM adoption.

In contrast to the six studies described above, Beasley et al. (2005) use a different approach by distinguishing the state of the ERM implementation into five levels based on a survey as described earlier. The results of their study show that the existence of a CRO constitutes a highly significant determinant for an existing ERM system (at the 1 percent level), thus providing support for the use of the CRO as a proxy for ERM in the other studies listed in Table 2. Besides company size (significant at the 10 percent level),[17] the results of the study emphasize the high significance of the independence of the board of directors (significant at the 1 percent level) and the auditor type (Big Four, significant at a 1 percent level) as positively impacting an ERM implementation. The latter result is similar to Golshan and Rasid (2012), who also find the auditor type to be a significant (positive) determinant at the 5 percent level, which implies that an audit by one of the Big Four can be considered as being associated with a higher developed corporate risk management system.

In the comparative assessment of the empirical results, one also has to take into account the role of the industry sector and the firm's geographical location as relevant determinants of an ERM program, as some industries are more strictly regulated than others. Hence, regulated industry sectors such as the banking or energy sector are more likely to implement an ERM system to assure an adequate and effective risk management system (see Golshan and Rasid, 2012). Pagach and Warr (2011) further restrict their analysis to only financial firms and banks and, for the bank sample, find company size, institutional ownership, and the tier 1 capital ratio to be significant ERM determinants. Liebenberg and Hoyt (2003) test the hypothesis as to whether U.S. companies are more likely to adopt an ERM system when they have subsidiaries in the United Kingdom or Canada and find a positive but not significant effect. In a similar analysis, Beasley et al. (2005) find that U.S. organizations have a less developed ERM system than international organizations. In Golshan and Rasid (2012), a firm's headquarters or subsidiary being in the United Kingdom, Canada, Australia, or New Zealand is found to be a positive but not significant determinant for ERM. To account for differences with respect to specific business lines within the insurance sector, Hoyt and Liebenberg (2008, 2011) include a dummy variable for life insurers, which in both studies is found to be positive but

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[17] In contrast to the further studies (see Table 2), company size is here measured by the firm's revenues.

not significantly related to ERM. The impact of the industry sector is also studied by Beasley et al. (2005), focusing on the banking, education, and insurance industries. Their results show that these industries are indeed more advanced in the development of ERM frameworks as opposed to other sectors. A similar approach is taken by Golshan and Rasid (2012) for the (Malaysian) regulated financial and energy sectors, which, however, could not detect a significant relationship.

## THE VALUE OF IMPLEMENTING AN ERM SYSTEM

We next investigate the value of a holistic ERM framework and the evidence provided in the empirical literature. We also show that the approaches used for assessing the value or the performance of implementing an ERM program from a firm's perspective can considerably differ. In what follows, we first discuss the procedures and objectives of the considered studies and then assess and compare the empirical evidence with respect to the value of ERM.

### Empirical Studies on ERM Performance

Eight studies are identified that empirically deal with the impact of ERM on firm performance and shareholder value in the sense of providing statistical evidence. The underlying data, time period, methodology, and assumptions regarding the ERM proxy along with the key findings are summarized in Table 3.

As can be seen from Table 3, five of the eight studies focus on the impact of ERM on shareholder value, while three studies examine the impact on the company's (financial) performance. In all studies on *shareholder value*, Tobin's Q is used to approximate the firm's value from the shareholder perspective,[18] which is useful as it reflects the future expectations of shareholders (Hoyt and Liebenberg, 2008). Only the study by Beasley et al. (2005) reverts to using the cumulative abnormal returns after the announcement of a CRO being hired instead of Tobin's Q, thus focusing on equity market reactions after the announcement of a CRO being hired.

In the three studies that assess the (financial) *performance* of ERM, the impact is measured by excess stock market returns (Gordon et al., 2009), cost and revenue efficiency including return on assets (ROA) (Grace et al., 2013) or several financial variables, such as financial leverage, return on equity (ROE), as well as stock price and cash flow volatility (Pagach and Warr, 2010).

Regarding the methodology and the underlying data of the shareholder value studies, Beasley et al. (2008) use a linear regression model to investigate the impact of an ERM implementation on shareholder value, which is approximated by equity market reactions after the hiring of a CRO, where the dependent variable is the cumulative abnormal return after the announcement. The study includes 120 U.S. companies, which are further divided into subsamples comprising 47 financial firms and 73 nonfinancials (including the insurance sector, the energy sector, and miscellaneous) from 1992 to 2003. In Hoyt and Liebenberg (2008, 2011), a maximum likelihood (ML) model is applied to assess the impact of ERM on shareholder value using CRO and ERM key words as described

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[18] Tobin's Q is given by the ratio of the market value of equity plus liabilities (at book value) and assets (at book value).

**TABLE 3**
Value of ERM Implementation: Evidence from Empirical Studies

| Authors | Data | Time Period | Methodology | ERM Proxy | Objective: Impact of ERM on | Measure for SHV/Performance | Key Finding 1 | Key Finding 2 | Significant Positive Relation? |
|---|---|---|---|---|---|---|---|---|---|
| BPW (2008) | 120 U.S. companies | 1992–2003 | Linear regression | CRO key words | Shareholder value/equity market reaction to CRO hire announcement | Cumulative abnormal returns after announcement | No general reaction of market reaction to CRO announcement; reaction is firm-specific; mainly for non-financial firms | Significant, positive relation of market reaction (non-financials) to firm size and earnings volatility, negative to leverage and cash ratio | (Yes) (firm specific) |
| HL (2008) | 125 U.S. insurers | 2000–2005 | ML model | ERM/CRO key words | Shareholder value | Tobin's Q | Significant positive relation between firm value and ERM | ERM increases SHV by approximately 17% | Yes |

*(Continued)*

**TABLE 3**
Continued

| Authors | Data | Time Period | Method-ology | ERM Proxy | Objective: Impact of ERM on | Measure for SHV/ Performance | Key Finding 1 | Key Finding 2 | Significant Positive Relation? |
|---|---|---|---|---|---|---|---|---|---|
| GLT (2009) | 112 U.S. companies | 2005 | Linear regression | ERM index (created) | Performance | Excess stock market return | Significant positive relation between ERM and firm performance | Relation contingent upon proper match between firm's ERM system and five firm-specific factors | Yes |
| G et al. (2013) | 523 U.S. insurers | 2004–2006 | Linear regression | ERM activity (survey) | Performance | Cost and revenue efficiency (with DEA) | Significant positive impact of ERM on cost and revenue efficiency depending on ERM activity | CRO or risk committee significant positive effect; but depends on headquarter being the United States or not; life insurers benefit from economic capital models | Yes |

*(Continued)*

**TABLE 3**
Continued

| Authors | Data | Time Period | Method-ology | ERM Proxy | Objective: Impact of ERM on | Measure for SHV/ Performance | Key Finding 1 | Key Finding 2 | Significant Positive Relation? |
|---|---|---|---|---|---|---|---|---|---|
| PW (2010) | 106 U.S. companies | 1992–2004 | Logit / matched sample model | CRO key words | (Financial) performance | Several financial variables | Significant decrease in stock price volatility after introduction of ERM; no further significant effects | Significant reduction in earnings volatility for firms with positive abnormal returns at CRO appointment date | (Yes) (only in parts) |
| HL (2011) | 117 U.S. insurers | 1998–2005 | ML model | ERM/CRO key words | Shareholder value | Tobin's Q | Significant positive relation between SHV and ERM | ERM increases SHV by approximately 20% | Yes |
| MNR (2011) | 82 insurers | 2004–2008 | Linear regression | S&P ERM rating (5 categories) | Shareholder value | Tobin's Q | Significant positive relation between increasing | But no additional increase in SHV when moving from | (Yes) (only for improving TRM) |

(Continued)

**TABLE 3**
Continued

| Authors | Data | Time Period | Methodology | ERM Proxy | Objective: Impact of ERM on | Measure for SHV/ Performance | Key Finding 1 | Key Finding 2 | Significant Positive Relation? |
|---|---|---|---|---|---|---|---|---|---|
| TR (2011) | 528 Malaysian firms | 2007 | Linear regression | Osiris database | Shareholder value | Tobin's Q | Positive but not significant relation between ERM and SHV | traditional RM level (up to first 3 ERM categories) traditional RM to ERM (to categories four and five) | (Yes) (not significant) |

Notes: BPW = Beasley et al.; HL = Hoyt and Liebenberg; GLT = Gordon et al.; G et al. = Grace et al.; PW = Pagach and Warr; MNR = McShane et al.; TR = Tahir and Razali; SHV = shareholder value; ML = maximum likelihood.

in the previous section. As such a model setting may cause an endogeneity problem due to correlations between the decision to adopt an ERM system and the considered differences in the shareholder value, a two-equation system is adopted to jointly model the determinants of ERM and the impact on shareholder value. This allows for the adjusting of the standard errors for firm-level clustering (see Hoyt and Liebenberg, 2008). The sample data in Hoyt and Liebenberg (2008) (Hoyt and Liebenberg, 2011) are made up of 125 (117) U.S. life and nonlife insurers in the time period 2000 to 2005 (1998 to 2005). By means of a linear regression with data from 82 publicly traded U.S. insurers in 2008. McShane et al. (2011) describe the impact of the S&P ERM rating[19] and further company variables on Tobin's Q. A similar approach is used in Tahir and Razali (2011) regarding the Malaysian market (comprising 528 publicly listed companies) in 2007, using a binary ERM variable (ERM is adopted or not) derived from the Osiris database.

The studies dealing with the impact of ERM on performance are even more diverse in their methodology. Gordon et al. (2009) consider the relationship between ERM and firm performance as being dependent on the appropriate match between the firm's ERM and five firm-specific factors, namely: environmental uncertainty, industry competition, size, complexity, and the monitoring of the board of directors. They thus only consider companies that have an ERM system by searching for matching key words.[20] To address the impact of ERM on firm performance (contingent upon a proper match with the firm-specific factors), they first derive the respective firm's ERM index by using four criteria following the COSO framework and, as a second step, derive the relation between the ERM indices for the highest performing (in the sense of excess returns) firms and the five firm-specific factors by means of a linear regression.[21] They thus identify a "best practice" or "benchmark" model for ERM, assuming that firms following this model (i.e., firms with these characteristics) will exhibit a higher performance.[22] To test this assumption, Gordon et al. (2009) revert to a residual analysis by considering the difference in the ERM index of the highest performing companies as a benchmark index and the individual firm's ERM, where this residual value, as the deviation from the benchmark, constitutes the dependent variable in the linear regression of the firm's performance.[23] Firm performance is here measured based on the company's excess returns in the year 2005 for 112 U.S. companies.[24]

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[19] S&P conduct a corporate risk management rating as a proxy for the level of ERM implementation, where five categories are distinguished: a weak, adequate, adequate with a positive trend, strong, and excellent development of an ERM program. For their analysis, McShane et al. (2011) translate the S&P ratings for ERM into numerical scores (1 = weak, ..., 5 = excellent).

[20] The key words are "enterprise risk management," "strategic risk management," "corporate risk management," "risk management committee," "risk committee," and "chief risk officer."

[21] Based on the four ERM objectives from COSO, namely, strategy, operations, reporting, and compliance, the ERM index is calculated by the sum of eight indicators (two for each objective).

[22] They identify 53 high-performing companies (with excess returns higher than 2 percent) and 59 other companies.

[23] Hence, the residual value is assumed to be negatively related to firm performance.

[24] The firm performance $P_i$ is measured by
$$P_i = R_i - \left( R_f + \beta_i \left( R_m - R_f \right) \right),$$
where $R_i$ denotes the 1-year excess stock market return for company $i$, $R_m$ the return for the market, $R_f$ the risk-free interest rate, and $\beta_i$ the beta of company $i$.

Grace et al. (2013) focus on cost efficiency and revenue efficiency as a proxy for performance, which are modeled based on firm characteristics and firm-specific ERM activities.[25] Applying data envelopment analysis (DEA), a benchmark of "best practice" is derived to measure the distance of the company's individual efficiency to this benchmark. The ERM activities stem from a survey in 2004 and 2006 of U.S. life and property–liability insurers conducted by Tillinghast. The ERM activities derived from the survey are a risk management function (CRO or similar), the underlying economic capital model, financial metrics (market value based or not), reporting relationships, executive compensation, and the firm's decision-making process. The overall analysis is then composed of data from the years 2004 and 2006 for 523 insurance companies from the U.S. market of which 215 are life insurers and 306 are U.S.-headquartered, which were matched with the ERM survey results.

The approach in Pagach and Warr (2010) differs from the other works in that they study the impact of an ERM implementation (proxied by the appointment of a CRO) on a firm's key (financial) variables.[26] This is done by comparing the financial variables in the 2 years before and after the appointment of a CRO and by studying the differences between the sample with and without the CRO appointment using a matched sample and logit model. The sample data of 106 U.S. firms, based on the years from 1992 to 2004, are then further divided into financials (56), utilities (15), and others (35).

## Empirical Results Regarding the Value of Implementing an ERM System

Regarding the key findings in the empirical studies, we find that a positive relation between the implementation of an ERM system and the shareholder value or performance is evident in all studies, but to a different extent and depending on the respective objective (see Table 3). Among the five studies that analyze the impact of ERM on shareholder value, Hoyt and Liebenberg (2008, 2011), for instance, find a positive and highly significant impact of ERM on their insurance sample, which results in a higher shareholder value of approximately 17 percent to 20 percent. This is partly consistent with the results from McShane et al. (2011), who find a significant positive relationship with shareholder value, but only in the case of an increasing level of traditional risk management, whereas moving from a traditional to an ERM system does not additionally increase shareholder value in the considered sample of insurers.[27]

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[25] Cost efficiency is defined by the ratio of the minimum required costs and actual utilized costs to produce a given level of output; revenue efficiency is given by the ratio of the company's revenues and the revenues of a fully efficient company with the same input vector and output prices.

[26] The key variables comprise earnings and stock price volatility, financial leverage, ROE, financial slack, assets' opacity, growth opportunities, and research and development expense. Pagach and Warr (2010) additionally focus on the banking sector including bank-specific characteristics such as the duration ratio, loan loss provision, and the tier 1 risk-adjusted capital ratio.

[27] The first three (of five) S&P ERM rating categories are assumed to reflect a traditional risk management approach, while levels 4 and 5 represent holistic ERM concepts. Further results show, for instance, a significant negative relation of financial leverage, systemic risk and cash flow volatility to shareholder value, and firm profitability as significantly positive. No significant results were found for company size.

Furthermore, Beasley et al. (2008) do not find an equity market reaction to the announcement of a CRO being hired in general, but only in the case of nonfinancial firms. Hence, they identify a significant positive market reaction for firm-specific characteristics, including firm size and earnings volatility, as well as a negative reaction for financial leverage[28] and cash ratio.[29] For the Malaysian market, Tahir and Razali (2011) find a positive but not significant relation between ERM and shareholder value.[30]

Of the three studies that conduct an analysis of the impact of ERM on the firm's performance, two find a significant and positive relationship. First, Grace et al. (2013) find a significant positive effect of ERM on cost and revenue efficiency, which, however, depends on the type of ERM activity. In particular, the existence of a CRO or (with an even higher significance level) a risk management committee as well as the application of market-value-based risk measures significantly impact cost efficiency in a positive way. The results further show a significant positive relation of the sophistication of life insurers' economic capital models to cost efficiency, which is not the case for property–liability insurers. For revenue efficiency, the identified (significant) variables are similar to before, but particularly the relation of a CRO to revenue efficiency is reversed.[31] In contrast to cost efficiency, the risk metric is not detected as being significant, whereas risk management reporting is positive and significant. When looking at U.S.-headquartered insurers, the empirical results are generally robust for cost efficiency. For revenue efficiency, statistical significance is particularly reduced for the presence of a CRO or a risk management committee.[32] Second, Gordon et al. (2009) also find strong evidence for the positive impact of an ERM system on firm performance, measured by the 1-year excess stock market return. The results reveal that this relation is contingent upon a proper match between the firm's ERM system and the five firm-specific key variables described in the previous subsection. Third, Pagach and Warr (2010) only partially detect significant positive effects of a CRO being hired and this depending on the financial variable considered. For instance, the authors find a significant decrease in the stock price volatility of firms after the introduction of an ERM system (proxied by a CRO being hired). Furthermore, when restricting the sample to companies that supposedly benefit more from ERM as defined by a positive 1 day abnormal stock return on the date of the announcement of the CRO being hired, a significant decrease in earnings volatility is observed as well as a significant increase in financial leverage and ROE.

These empirical findings are generally consistent with theoretical arguments regarding the positive impact of an ERM implementation on shareholder value and company performance (see, e.g., Hoyt and Liebenberg, 2011, pp. 797–798). In particular, firms with an

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[28] Financial leverage is here measured by the liability to equity ratio.

[29] In the case of financial firms, only the cash ratio (negative), financial leverage (positive), and the change in the firm's $\beta$ (negative) significantly impact the equity market reaction after the announcement of a CRO being hired.

[30] The study further indicates a significant positive relation of financial leverage and (international) diversification to shareholder value and a significant negative relation of company size and profitability.

[31] Grace et al. (2013) argue that CROs or a risk management committee may prevent insurers from offering high-risk products, thus limiting the potential for revenue.

[32] A further analysis accounts for the impact of ERM activities on ROE. Here, a significantly positive relation between a CRO or risk committee and the ROE could be found.

ERM system are assumed to benefit from the holistic perspective and the improved coordination between the various risk management departments as well as the exploitation of natural hedges within the firm. In particular, as ERM constitutes a holistic framework based on an integrated approach to the company's entire risk portfolio, it allows for a comprehensive identification and measurement of interdependencies between risk sources (see Hoyt and Liebenberg, 2008, 2011). Inefficiencies in the risk management process can thus be reduced since decisions are reached across all risk classes and a duplication of risk management activities can be avoided. The improved understanding of aggregated firm risk and better resource allocation may further contribute to an improved capital efficiency and ROE. ERM can also contribute (as one main objective) to reducing the probability of failure or financial distress by decreasing earnings and cash flow volatilities (see Pagach and Warr, 2010; Gordon et al., 2009). A further benefit of ERM is the improved communication of the company's risk profile within the company (for decision making) as well as with investors and stakeholders to evaluate the firm's financial and risk situation (see Hoyt and Liebenberg, 2011). Thus, ERM may contribute to reducing regulatory costs as well as external capital costs (see Hoyt and Liebenberg, 2011).

Hence, while the empirical evidence is generally in line with theoretical considerations and despite their consistent findings regarding the (generally positive) impact of ERM on firm value or performance, the comparability is still limited in several ways. In particular, the approaches used in the literature to assess the value of ERM partly differ with regard to the estimation methodology as well as the approximation used for ERM or the measurement of firm value and performance. In addition, the underlying data, industries, and time periods vary substantially (see also Tables A1 and A2 in the Appendix). However, our comparative analysis of the empirical evidence in the literature still emphasizes that ERM can have a (significant) positive effect on firm value and performance in various ways.

## CONCLUSION

In this article, we study the literature regarding empirical evidence on (1) the determinants of an ERM implementation in firms and (2) the value generated by ERM. Toward this end, we conduct a comparative assessment of the quantitative literature that provides statistical evidence on these questions and in doing so take into account the differences in the underlying sample data and methodology. We focus on seven studies that deal with the identification of determinants for ERM based on multivariate methods, and eight studies that consider the value of ERM. We find that due to often insufficient information regarding the degree of an ERM implementation, most studies revert to the existence of a CRO or respective ERM key words as a signal for ERM, while other studies (especially regarding the value of ERM) make use of surveys. Obtaining data regarding the extent to which ERM is implemented in a firm thus appears to be one main challenge in the empirical literature.

The results of our comparative assessment of the seven studies regarding the determinants of an ERM system are partly ambiguous. On the one hand, we find broad consistency in the empirical literature with respect to specific firm characteristics such as company size and institutional ownership that almost all studies detect as

significant and positively related to the existence of an ERM system. On the other hand, the relationships of other determinants of ERM are either shown with different directions (e.g., financial leverage) or are found not to be significant (e.g., assets' opacity, growth opportunity). Other determinants such as earnings and stock price volatility were found to be significantly positively related to ERM only in one study, whereas other studies only found a positive but not significant sign.

Regarding the impact of implementing an ERM system on shareholder value (five of eight studies on ERM value), we find that Tobin's Q is mostly used as a proxy for shareholder value, while one study considers equity market reactions to the announcement of a CRO being hired, using cumulative abnormal returns after the announcement. Concerning the performance of ERM (three of eight studies), focus is mostly on financial variables as well as cost and revenue efficiency. Our comparison shows that all the studies at least to some extent identify a positive (and mostly significant) relation between ERM and shareholder value or performance. While two studies even provide statistically strong evidence for this relation, further works find significance only for restricted data (nonfinancials; companies that are expected to benefit more from an ERM program) or a restricted implementation level (high level of traditional risk management). One further analysis provides a positive indication based on Malaysian firm data, which, however, is not significant.

Thus, even though the comparability of the studies on determinants and performance is partly limited due to the differences in sample data and methodologies, the empirical evidence shows several common determinants regarding the implementation of an ERM system, and most importantly, all empirical studies demonstrate (to a different extent) the positive effects of implementing an ERM system with respect to shareholder value or firm performance. For the insurance industry, the empirical literature shows even more significant results than for companies in general, which can be an indicator of the higher relevance of a holistic risk management system in the insurance sector. However, further research regarding the determinants of ERM and its impact on firm value appears necessary. Larger and international data samples could reveal further geographical and industrial differences regarding the determinants and the performance of an ERM program. One particular problem that needs to be addressed in this context is the availability of reliable data and the challenge of data collection. To overcome this issue, future research could focus on newer methods, such as data and text mining approaches. This is also of relevance as the importance of ERM can be expected to further increase in the future, especially in the banking and insurance sector, where new and revised risk-based regulatory frameworks are introduced, which require comprehensive risk management systems to assess and manage risks in a holistic way according to the proportionality principle, that is, depending on the complexity of risks firms are exposed to. The empirical literature thus contributes to understanding the actual drivers and value of ERM.

**APPENDIX**

**TABLE A1**
Details Regarding the Studies on the Determinants of ERM in Table 2

| Authors | Market | Sample Size | Industry (Sample Size) | Analyzed Subsamples | Additional Industrial/ Geographical Variable (Dummy) |
|---|---|---|---|---|---|
| LH (2003) | United States | 26 | Financial (15) Energy (11) | | Financial services Subsidiary in United Kingdom or Canada |
| BCH (2005) | International | 123 | | | Banking, education, or insurance Headquarter in United States |
| HL (2008) | United States | 125 | Fire, marine, and casualty insurance (73) Life insurance (25) Other insurance (27) | | Life insurance |
| HL (2011) | United States | 117 | Life insurance (NS) Nonlife insurance (NS) | | Life insurance |
| PW (2011) | United States | 138 | Financial (77) Utility (18) Other (43) | Financial Banking | |
| RYT (2011) | Malaysia | 528 | Industrial (139) Trading/services (124) Property (79) Other (186) | | International diversified (no further specification) |
| GR (2012) | Malaysia | 90 | | | Headquarter or subsidiary in United Kingdom, Canada, Australia or New Zealand |

Notes:  LH = Liebenberg and Hoyt; BCH = Beasley et al.; (2005); HML (2008), HL = Hoyt and Liebenberg; PW = Pagach and Warr; RYT = Razali et al.; GR = Golshan and Rasid; ML = maximum likelihood; NS = not specified.

**TABLE A2**
Details Regarding the Studies on the Performance Impact of ERM in Table 3

| Authors | Market | Sample Size | Industry (Sample Size) | Analyzed Subsamples |
|---|---|---|---|---|
| BPW (2008) | United States | 120 | Financial (47) | Financial |
|  |  |  | Energy (24) | Nonfinancial |
|  |  |  | Insurance (15) |  |
|  |  |  | Others (34) |  |
| HL (2008) | United States | 125 | Fire, marine, and casualty insurance (73) |  |
|  |  |  | Life insurance (25) |  |
|  |  |  | Other insurance (27) |  |
| GLT (2009) | United States | 112 | Utility (30) |  |
|  |  |  | Financial trading (13) |  |
|  |  |  | Business services (9) |  |
|  |  |  | Insurance (9) |  |
|  |  |  | Other (51) |  |
| G et al. (2013) | United States | 523 | Life insurance (NS) | U.S. headquartered |
|  |  |  | Property-liability insurance (NS) | Non-U.S. headquartered |
| PW (2010) | United States | 106 | Financial (56) | Firms that expectedly |
|  |  |  | Utility (15) | benefit more from |
|  |  |  | Other (35) | ERM |
| HL (2011) | United States | 117 | Life insurance (NS) |  |
|  |  |  | Nonlife insurance (NS) |  |
| MNR (2011) | International | 82 | Insurance (82) |  |
| TR (2011) | Malaysia | 528 | Industrial (139) |  |
|  |  |  | Trading/services (124) |  |
|  |  |  | Properties (79) |  |
|  |  |  | Consumer (79) |  |
|  |  |  | Other (107) |  |

Notes:  BPW = Beasley et al.; HL = Hoyt and Liebenberg; GLT = Gordon et al.; G et al. = Grace et al.; PW = Pagach and Warr; MNR = McShane et al.; TR = Tahir and Razali; NS = not specified.

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