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Why do firms adopt enterprise risk management (ERM)? Empirical evidence from France

Majid Jamal Khan
Department of Management Sciences,
COMSATS Institute of Information Technology, Wah Cantt, Pakistan
Dildar Hussain
ESC Rennes School of Business, Rennes, France, and
Waqar Mehmood
Department of Computer Sciences,
COMSATS Institute of Information Technology, Wah Cantt, Pakistan

Abstract

Purpose – Enterprise risk management (ERM) is a risk management approach that calls for integrating all the organization-wide risks and takes a portfolio view point of managing organizational risks. The purpose of this paper is to investigate the factor that influence a firm's decision to adopt ERM.

Design/methodology/approach – The authors employ a particular technique of survival data analysis, the Cox proportional hazards model, to investigate the factors that lead towards the decision of initiating an ERM programme. The authors constructed a unique sample of French firms derived from the information in 315 corporate news announcements for the hiring of a chief risk officer and information retrieved from publicly available annual reports to identify firms that initiated an ERM programme, over the period from year 1999 to 2008.

Findings – The results suggest that besides the growing international and local regulatory pressure, factors that are internal to the organizations like the expected probability of financial distress and its explicit and implicit costs, poor earnings performance and the existence of growth opportunities play vital role in motivating firms to adopt ERM. It was also found that corporate governance practices such as the independence of the board may also lead towards an initiation of the ERM.

Originality/value – This study makes theoretical and methodological contribution the ERM literature by employing a novel methodology and presenting empirical evidence based on data form French firms.

Keywords France, Enterprise risk management, Survival data analysis, International and local regulations, Internal factors, CAC-40

Paper type Research paper

1. Introduction

Some big corporate failures in the USA in the early 1990s and even onwards contained a message and a wakeup call for the investors and regulatory bodies for emphasizing and improving upon risk management practices. It is not possible for firms to completely eliminate risk but the firms need to manage different types of risk they face (Borghesi and Gaudenzi, 2012). A number of regulations came forth in order to improve financial reporting, compliance to rules and regulations, corporate governance and internal control. Integration of risk management practices and taking a holistic

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approach to manage different types of risk at the same time can be termed as enterprise risk management (ERM) (Bromiley *et al.*, 2015; Froot and Stein, 1998; Grace *et al.*, 2015; Sax and Torp, 2015). This approach has emerged as an important concept in risk management since the mid-1990s (Dickinson, 2001). In this connection, the Committee of Sponsoring Organizations of the Treadway Commission (COSO)[1] in the USA presented a document entitled "Internal Control Integrated Framework" in year 2002 which, for the first time, called for an integration of the risk management practices. In the same year, the Sarbanes Oxley Act of 2002 in the USA on corporate governance was announced which placed more emphasis on internal control and risk management. COSO presented its famous ERM framework for the first time in 2004 and proposed a complete definition and a formal implementation framework for ERM. The Standard & Poor's (S&P) announced in May 2008 to incorporate ERM evaluations in its corporate credit risk ratings. Moody's also have in place since 2003 a Risk Analysis Initiative with Risk Management Assessment as one of its main components in which they intend to integrate the ERM evaluations as well. In France, the French market regulator Autorité des Marchés Financiers (AMF)[2] and the fourth and seventh European directives 2006[3], the Bouton Report on Corporate Governance 2002[4], etc., all place a similar importance on the need for tighter internal controls and risk management programmes.

The increased regulatory and corporate attention to ERM has caught attention of researchers in this field. Earlier research on ERM have mostly sought to focus on the implementation and cost issues of ERM as these two were the key problems when ERM was introduced first and firms were adopting it on experimental basis (Desender, 2007; Lam, 2000; Warrier and Chandrashekhar, 2006).

Some authors have also tried to go a bit further by trying to investigate the reasons why some firms welcomed it more favourably. These studies tried to know the characteristics of firms who have already adopted ERM and thus to established a relationship between firm characteristics and the implementation decision (e.g. Beasley *et al.*, 2005; Liebenberg and Hoyt, 2003; Pagach and Warr, 2011). On the other hand, some other studies have attempted to investigate the performance relationship or benefits that could be attributed to an ERM programme implementation by the firm (e.g. Grace *et al.*, 2015; Paape and Speklè, 2012; Pagach and Warr, 2010). Nair *et al.* (2014) regard ERM as dynamic capabilties mechnism and note that superior ERM capabilty enables a firm to perform better in stock prices and profiatablity in volatile economic conditions.

This study is particularly focused on the French market where ERM was not adopted very quickly and firms shifted towards this kind of risk management rather late. By examining a sample of firms having adopted the ERM approach during the period 1999-2008 from the French CAC-40 index, we attempt to investigate different firm specific factors that contributed to firms' adoption of ERM practices in addition to the already growing regulatory pressure regarding the need for increased corporate governance and integrated risk management practices. The contribution of this study is multi-fold. First, this study applies Hazard model for investigating factors resulting in a firm's decision to adopt ERM programme. Most of the past studies on ERM apply logit models for this type of investigations. We believe that a Hazard model is more appropriate in analysing the situations where the decision under observation is whether or not to implement a certain policy. This model is particularly helpful when we have an event study setup where the event occurs only once and does not repeat again during the observation period. Hazard model enables researchers to adjust for time it takes firms to prepare for an event and implement an action. These methods are widely recognized as meaningful for empirical investigations in finance

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(Thomann *et al.*, 2012; Yamazaki, 2013). Second, we have used a more rigorous approach towards the identification of the firms' using ERM and the actual timing when they started the programme. Instead of relying only on the CRO hiring announcements, we have analysed the annual reports of the ERM adopting firms, using certain criteria based on the different characteristics of ERM and its different definitions. Third, we present empirical evidence from data based on the French firms from CAC-40 index. According to the best of our knowledge, no previous study investigates adaptation and implementation of ERM in French firms hence our study is the first empirical evidence in this regard from France. The French market is relatively conservative in adopting new and modern practices as compared to the British or the American markets. Therefore the current work has improved upon the methodology used in the previous research on ERM and diversified the market evidence.

This paper is organized in six sections. Section 2 presents theory and hypotheses. Section 3 discusses data and variables. Methodology is discussed in Sections 4 and 5 presents data analysis and results. Section 6 concludes the paper by presenting implications of the results and directions for the future research.

2. Factors determining the decision of adopting ERM

A number of factors play vital role to generate a general awareness towards and encourage firms to adopt ERM practices. These factors include a broad range of external and internal forces that place increased importance on corporate governance, internal control and risk management practices of the firms. Based on the relevant literature, we have identified the following most relevant factors for adoption of ERM.

2.1 External factors (the international and local regulations)

The external factors mainly include a growing number of international as well as local regulations. The "Cadbury and Turnbull Report on Corporate Governance" in UK[5], the King Report on Corporate Governance in South Africa[6], the COSO's ERM integrated framework in the USA[7], the Risk Management Standard by the European Risk Management Association FERMA[8] and the Australian/New Zealand Risk Management Standard[9] are few such examples. Most of these reports include standards and guidelines for firms on implementing and integrating their risk management processes. Similarly, supranational regulations have also been calling for more integrated risk management approaches, e.g., the amendments to the fourth and seventh European directives[10] on annual accounts and consolidated accounts stipulate that any firm that issues securities traded on a regulated market is required to include a statement on corporate governance in its management report. Similar guidelines have been issued by the French market regulator AMF. Other major external influences that have driven firms to approach risk management in a more holistic manner include factors such as globalization, industry consolidation and deregulation; and technological progress that enables better risk quantification and analysis (Miccolis and Shah, 2000).

2.2 Internal factors (firm characteristics)

Most of the studies on ERM are dedicated to its implementation, costs and benefits (Beasley *et al.*, 2005; Desender, 2007; Nocco and Stulz, 2006; Zhao *et al.*, 2014). There are, however, few other studies that investigate the motives behind and the value effects of ERM implementation (e.g. Beasley *et al.*, 2008; Eckles *et al.*, 2014; Hoyt and

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Liebenberg, 2011; Onder and Ergin, 2012). These studies suggest the following main factors that could motivate firms to adopt ERM.

2.2.1 The probability and the expected costs of financial distress. Financial distress is the evaluation of a firms' capacity to meet its obligations (Pindado *et al.*, 2008). Nocco and Stulz (2006) and Beasley *et al.* (2008) propose, contrary to the modern portfolio theory's arguments of perfect markets, diversification and irrelevance of firm level financial policy, that markets are normally interfered by information asymmetry and higher transaction costs that make shareholders think of the idiosyncratic risk, therefore, risk management at firm level can be value increasing.

On the other hand, there are yet others who argue that even if portfolio diversification and market perfection assumptions may hold to some extent, managing risks at firm level can still be value increasing. Proponents of this view such as Hoyt and Khang (2000) and Liebenberg and Hoyt (2003) argue that risk management or hedging is a value-increasing action for firms because of its impacts on insurance policy, contracting costs and the firm's tax liabilities. The value effects of risk management at firm level are to a greater extent indirect in nature and it potentially reduces the costs associated with conflicts of interest between owners and managers and between shareholders and bondholders, expected bankruptcy costs, the firm's tax burden, and the costs of regulatory scrutiny (Hoyt and Khang, 2000; Mayers and Smith, 1990). A number of other studies have found general support for these theoretical predictions (e.g. Beasley *et al.*, 2008; Liebenberg and Hoyt, 2003; Pagach and Warr, 2011). Thus it leads us to the following hypothesis:

H1. Firms having a higher probability of financial distress and with more expected costs associated with financial distress are more likely to initiate an ERM programme.

2.2.2 Existence of growth opportunities and high level of R&D. The literature proposes that the costs of financial distress can be higher in the case of firms having more of their values tied to future investments in the form of growth options or if the firm is financially opaque (Beasley *et al.*, 2008; Nocco and Stulz, 2006; Pagach and Warr, 2011). Firms that have opaque assets may have difficulty in selling these assets at purchase cost to avert financial distress, as opaque assets are associated with more information asymmetry and thus are more likely to be undervalued. Similarly, firms with growth options have much of the firm's value tied to future, and as yet unrealized cash flows. Because of the uncertain nature of the payoffs from such expenditures, the value of these investments is unlikely to be fully realized in case of a bankruptcy. Thus they argue that such firms are likely to initiate an ERM programme because financial distress reduces liquidity and ERM will enable them to reduce the probability that the firm will be unable to pursue potentially profitable future projects. Other growth related reasons of an ERM initiation, as suggested by Andersen (2008), could be to sustain a competitive edge specially by firms that are in industries which rely highly on research and development or which are in highly technical and knowledge based industries and have to continuously innovate to overcome competition or sustain their competitive edge. Thus we hypothesize:

H2. Firms having more growth opportunities are more likely to initiate ERM.

2.2.3 Capital structure and market performance. The pecking order theory suggests that firms facing information asymmetry and adverse selection problems will have

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poor stock performance and thus face greater difficulty in obtaining funds from the stock market (Myers, 1984; Myers and Majluf, 1984; Shyam-Sunder and Myers, 1999). At the same time the signalling theory (Brealey *et al.*, 1977; Spence, 1973) suggests that in case of higher information asymmetry in the market, a good firm can distinguish itself from a bad firm by sending a credible signal about its quality to capital markets. The signal will be credible only if the bad firm chooses not to mimic the good firm by sending the same signal. Spence (1973) further showed that if the cost of the signal is higher for the bad type than it is for the good type, the bad type may not find it worthwhile to mimic, and so the signal could be credible. Thus it is highly expected that firms which face greater difficulty in generating funds from the stock market and specially which have problems of information asymmetry and poor performance (both market performance as well as operational), can initiate an ERM programme with the intention to give a good signal to the market that the firm is addressing issues of its internal operational weaknesses and risks.

The same view is supported by Andersen (2008) who suggests that effective risk management, by stabilizing the corporate earnings, will reduce the perceived business risk of the firm and will thus increase its chances of being solvent. Thus for a creditor such a firm is a low risk firm and hence more debt will be available for it. Similarly, for the equity holder, the firm have a low bankruptcy risk indicating that its paid-in capital is safe and future dividends and capital gains are also guaranteed. This will have a twofold effect; first, lower financing costs, which mean lower interest payments and hence improved economic performance, and second, with an increased availability of capital, the firm will be able to build and benefit from a strong portfolio of viable business opportunities for current and future investments.

Others like Liebenberg and Hoyt (2003), Beasley *et al.* (2008) and Pagach and Warr (2011) also find that firms that have shown recent poor stock performance and earnings volatility are more likely to start an ERM programme leading towards more stable earnings that will in turn attract investor confidence and hence resulting in an improved stock performance. We therefore hypothesize:

H3. Firms that have seen recent poor performance are more likely to initiate an ERM programme.

2.2.4 Corporate governance related factors. The increased regulatory pressure on firms regarding the transparency of their corporate governance and other compliance related regulations such as the Sarbans-Oxley Act 2002[11] in the USA, The Bouton report-2002 in France, The Article 225-37 of the Code of commerce and the recommendations of the French market regulatory authority AMF-2001 and the amendments to the fourth and seventh European directives-2006 has made firms reorganize their corporate governance and internal control and risk management processes. These new regulations have brought enormous changes regarding the composition and rights and responsibilities of the board members and the executives which definitely have implications for risk management and internal controls.

The role and position of the CEO has an important impact on the firm's corporate governance as well as its risk management practices. Specifically, the CEO compensation structure can have direct relation with the way a firm manages its risks. Pagach and Warr (2011) found that when the CEO has a stock and options based compensation such that the value of which increases with the volatility of stock price

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he would try to take risky projects and to increase the stock volatility. Thus as a tool to suppress this risk taking behaviour of the CEO, the board may initiate the adoption of an ERM programme.

However, we can also deduce from the above discussion that this is true as long as the position of the CEO is separate from the board chairmanship. However, if the CEO is also the chairman of the board then it seems improbable that he may initiate an ERM programme. Another corporate governance related factor, the board independence can also affect the firm's risk management practices. Empirical support for these ideas come from Desender (2007) who found that firms with independent boards as well as where CEO and chairman of the board are separate have a greater stage of ERM. Kleffner *et al.* (2003) investigated the Canadian market and found that in the firms which were using ERM, influence from the risk manager and encouragement from the board were the driving forces behind initiating ERM. Thus we can conclude that the decision of ERM initiation can be influenced by the board independence and the CEO's position in the board:

H4. Firms with stronger corporate governance in place (i.e. with independent boards and a separation of the positions of the CEO and chairmanship of the board) may initiate an ERM programme.

3. Data and variables

3.1 Sample

The sample for this study was selected through a multistep procedure, and therefore was not a predetermined one. Consistent with the main objective of the study (i.e. to investigate the reasons and specific firm characteristics behind the firm's decision to implement an ERM programme) we needed to identify a sample of French firms that were using or have just implemented such a programme. Thus, we started with the whole population of French firms and gradually filtered down to our main sample of interest through the following three-step procedure:

(1) Following the approach and arguments of Lam (2000) and Liebenberg and Hoyt (2003), we proxied the appointment of a chief risk officer (CRO) as an indication of the fact that the firm is using ERM. We therefore, searched for corporate news announcements by French firms for the appointment of CRO or a similar position to identify an initial sample of ERM users.

(2) In many cases, the first step did not convey all the needed information for our analysis. Moreover, in most of the cases, we were unable to identify whether the CRO appointed was a first appointment or a subsequent one, therefore we had to conduct a secondary search and analysis of the annual reports of those firms.

(3) Finally, our specific econometric model and the nature of the study required that we have data available on all the relevant characteristics of the ERM adopting sample firms for the whole sample period (i.e. 1999-2008).

This whole procedure resulted in a specific sample of 23-ERM using firms of which 22 belonged to the CAC-40 index and hence provided us with the chance of choosing the CAC-40 firms as a suitable "Risk Set" (as required for the Cox proportional hazards model) where all the firms are considered to be likely to experience the "event of interest" (in this case the ERM adoption) and then gradually with the passage of time

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this particular risk set keeps on reducing as long as firms adopt ERM during the period of observation. We, therefore, deemed it suitable to select the CAC-40 index as a "Risk Set" for our study and retain the 22 ERM using firms belonging to this index as our main ERM sample. The CAC-40 firms are most commonly used for research on French firms and also have a good representation base of different industries (e.g. Jiang *et al.*, 2012; Koliai, 2016). Moreover, owing to the fact that it is the main benchmark index of the whole French market and that it is well integrated internationally, its constituent firms could be better expected to be more likely in adopting new and innovative techniques.

In the following sections, we present a comprehensive detail of our sample selection procedure.

3.2 ERM variables

One of the major problems in research on ERM is that it is hard to identify the firms that are using this programme as firms would normally avoid disclosing much of the details of such strategic programs. Even more difficult than this, once the firms are identified, is to know in most of the cases as to when exactly the programme was initiated. This later information is crucial in particular if one is to study the particular circumstances that led to the decision of its initiation. Firm usually publish very little information regarding the way they manage their risks, besides the increasing regulatory pressure regarding risk management disclosures. For example, AMF's recommendations and reference framework for internal control call for including a detailed report by the president regarding the state and procedures followed for risk management and internal control in the annual report. Although there is a general tendency that firms now disclose their risks in broad categories as compared to the past but in most of the cases, the firms present very little specific details in their annual reports about how they manage those risks.

Thus researchers have used different alternative methods to identify the existence and timing of ERM implementation. In most of the cases the hiring announcements of the CRO, or any other personnel responsible for the overall risk management of the firm, is taken as a proxy for ERM. The main justification behind this approach is that since ERM is an integrated process therefore firms implementing it must have a person or a group of persons dedicated to integrate and coordinate the programme (Beasley *et al.*, 2008; Onder and Ergin, 2012; Pagach and Warr, 2011).

We contribute an important improvement to this approach by identifying the timing and existence of ERM in firms thereby using a combination of two of the above discussed methods. First we searched firms' news announcements for the hiring of the CRO position and then for the timing of the ERM initiation we conducted a critical analysis of the annual reports as well.

3.2.1 Firms' news announcements for hiring of CRO. In order to identify the firms that had an ERM programme in place, we capitalized on the methodology of Liebenberg and Hoyt (2003) and Pagach and Warr (2011),who suggest that the existence or appointment of a CRO could be a clear indication of the fact that the firm has implemented or is implementing an ERM programme. We therefore, conducted an extensive search of the French firms' news releases for CRO hiring announcements on the database of Dow-Jones Factiva over the period of 1999-2009. The Dow Jones Factiva is a database of news announcements consisting of around 100,000 sources of the major international and local business journals e.g., *Wall Street Journal*, *Financial Times*, *Dow Jones*, *Les Echoes*, *La Tribune*, *Le Figaro*.

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We searched the database using specific search criteria keeping in view our market of interest, ERM and CRO terminologies and our desired sample period. Thus we gathered only those news announcements that were relating to French public limited firms over a time period of ten years starting 1 January 1999 and ending 1 March 2009. We focused on news announcements in both French and English languages and in subject areas of corporate governance, corporate restructuring and hiring of personnel and keywords like CRO/Chief Risk Officer, Directeur des Risques, Risk Manager and Chief Risk Manager, Directeur des Risques Groupe, Enterprise Risk Management/ ERM, Gestion Global des Risques, etc.

Thus as a result, 315 news announcements were obtained out of which 39 firms were initially identified as using ERM or having a CRO. The firms which were neither French nor operating or registered in France were excluded. We also excluded firms that had ceased their operations, were delisted, merged into or overtaken by another firm later on during the course of the ten years of study period i.e., 1999-2009 or were subsidiaries of parent firms already present in the sample. The final number of identified firms was 26 that entered the next step for the identification of exact timing of the ERM initiation.

3.2.2 Timing of ERM initiation (or first CRO hire). The previous step was sufficient for identifying the firms that had a CRO; however, this information was not sufficient for our study as we needed to know the exact timing the ERM was initiated by the firm. In other words, we needed to know whether the CRO in the news announcement was a first appointment because the timing of initiation of ERM could be linked only to the first appointment. In most of the cases, it was not directly mentioned in the news whether it was the first CRO appointment. Another weakness in the above procedure is that it does not account for the possibility that a firm had ERM initiated long before they could hire a CRO. Thus for this purpose the 26 firms identified in the first stage were further analysed from their financial reports for the exact timing of initiation or the CRO hiring. The parts of the financial reports analysed for this purpose included the "Report of the President on Corporate Governance and Internal Control", "Risk Management", "Risk Factors" and "Composition of the Board and Executive Committees" as well as the "Firm's Hierarchy".

This exhaustive exercise finally resulted in a sample of 22 ERM users that were all members of the CAC-40 index. The rest of the data concerning different independent variables of interest was collected using the database of Thomson Financial's "Datastream Advance".

3.3 Predictor variables

The variables used in the study are grouped into the following major categories reflecting the hypothesized motives for adopting the ERM programme. Details of their description definitions and formulas are also given.

3.3.1 Financial distress. Financial distress can be defined as firms's capacity to meet its obligations (Pindado *et al.*, 2008). Firms having high financial leverage are more probable to have financial distress and in particular if they have low cash ratios and highly opaque or intangible assets that are normally hard to be readily converted to cash in case of financial distress. Therefore, we use the percentage of intangible assets to total assets (*Leverage*), the ratio of intangible assets to total assets (*Opacity*) and the ratio of cash to total assets (*Cash Ratio*) were taken in this study as indicators of the firms' financial distress. Similar indicators have been used in the previous studies (e.g. Hill *et al.*, 2011).

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3.3.2 Growth opportunities. Based on the previous studies (Chan *et al.*, 2001; Chen, 2004; Titman and Wessels, 1988), we use the ratio of market value of ordinary equity to book value of ordinary equity (*MTB*) and the ratio of research and development cost to total assets (*R&D*) as indicators of growth opportunities.

3.3.3 Performance related variables. Firm performance was measured by three variables including, earnings variability measured as the natural log of the standard deviation of the pre-tax income in the years around ERM adoption (*EVOL*), the annual volatility of stock price measured as the stock's average annual price movement to a high and low from a mean price for each year (*SVOL*) and value change i.e., the percentage change in the firm's market value over the year prior to ERM initiation (*VCHANGE*).

3.3.4 Corporate governance related variables. Two variables on corporate governance were also included in the study; first was the CEO's position in the board (Kim *et al.*, 2009) i.e., whether he also holds the chairmanship of the board (*CEO*) and the second was the board's independence level (Sitthipongpanich and Polsiri, 2013) measured by the number independent members of the board (*BRD IND*).

3.3.5 Additional model-specific variables. In addition to the above stated independent variables, two additional variables were also included in the study in order to run the analysis. These include a *Time* variable to capture the survival time until the event happens and a Status Indicator to tell the happening or not of the event.

The *Time* variable. It was calculated for each firm as the number of years passed since the beginning of the study period until the year an ERM programme was initiated. The variable was labelled as *SURV-YEARS* to indicate the survival period in years. This variable is an essential and the most crucial one in survival analysis. The main condition associated with a survival analysis is that the whole sample is observed over a "period of vulnerability". In other words, it is done during that specific time period where the chances of the happening of the event started and were present till the end of the study period and even beyond. In our case, since the emphasis on the ERM and the regulatory attention to it in the world and in French market started in around the early 2000s. Therefore, it seemed more appropriate to choose the year 1999 as the start of our sample period as well as that of the "time variable" in contrast to choosing the date of incorporation of each individual firm.

The *Status Indicator*. The *Status Indicator* variable which is a binary variable that indicates the happening or otherwise of the event, in this case the initiation of an ERM programme, was labelled ERMINIT which took the value 1 in a particular year in case of a firm who initiated the ERM in that particular year and 0 for other firms.

4. Methodology

Event studies, in particular those involving a binary dependent variable, often use logit model. In the ERM literature, we find one such study done by Liebenberg and Hoyt (2003) for creating a "CRO" dummy variable which they coded 1 for the firms that had hires in some particular year, while the other non-hire firms were coded 0 in the same year. However, this method does not tell anything about the event's evolution and about whether the event is a one time or repetitive one. Also it uses information available only on certain points of time and ignores the time period before the event's occurrence hence it is kind of a "Static Model" in which it ignores the evolution of the problem through time until the event happens.

A suitable solution to this problem is to use a survival data analysis model borrowed from the medical sciences and epidemiology into many social sciences and business

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research these days. This method has been previously used in business research in studies analysing bankruptcy survival IPO issues decisions, executive turnover and other policy initiation related studies (e.g. Bekele and Worku, 2008; Deshmukh, 2003; Pagano and Panetta, 1998).

4.1 Survival data analysis and the hazards model

Survival data analysis models are a family of statistical models that use the distribution of time to the happening (the survival time) of a particular event to predict the effect of certain underlying predictors (called covariates) associated with the happening of that event. The event is normally "death" as these models are typically used in cancer research, and where the terms "survival time" (time to death or event) and "survival analysis" come from. Normally a time frame or study period is chosen during which the event history is observed. However, still there are some individuals who may survive or may not yet have had the event even until the end of the study period. Such observations are called "censored" or sometimes "right censored" observations. These data also contain information on survival probability and thus if ignored, may results in a bias in the results. The important advantage of Hazard models is that censored observations are also taken into account as compared to other survival data analysis (Willett and Singer, 1988). In addition, Hazard models allow adjustments for time firms need to prepare for an event and to produce more efficient out-of-sample forecasts as they utilize more data by taking every firm year as a separate observation (Shumway, 2001).

A typical Hazards Model incorporates the individual characteristics or factors with the survival times in the following mathematical form:

$$h_i(t, X) = e^{(\alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \ldots + \beta_k x_{ik})} \quad (1)$$

where $h_i(t,X)$ is a hazard rate function which is the probability that a randomly selected individual i with a set of characteristics X will undergo the event (or die) between time t and t+1 provided that he has survived up to at least time t, i.e., the beginning of that interval. βs the regression coefficients, which are common to all subject of study, describe the direction and magnitude of the relationship between the predictors and the hazard rate function. The estimation of these parameters is of principal interest in the model. The constant (α) represents a kind of Log-baseline Hazard, since $\log h_i(t) = \alpha$[or $h_i(t) = e^{\alpha}$] when all of the x's are 0.

4.2 The Cox proportional hazards model

The Cox proportional hazards model is a particular type of survival data analysis, which separates the time dependent factor or functions from the predictors and is represented by the following expression:

$$h_i(t, X) = h_0(t) \times e^{(\beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \ldots + \beta_k x_{ik})} \quad (2)$$

where $h_O(t)$ is the baseline hazard function, when all the predictors have 0 values (such that $\alpha(t) = \log h_0(t)$).

By providing that the predictors are time-invariant, the Cox proportional hazards model separates out the universal time dependence of the hazard rate function from its dependence on the predictors (Fox, 2002). Thus the overall hazard rate for the ith observation is a product of two distinct parts; a term that depends solely upon time and

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is the same for all observations, and a term that is unrelated to time but depends upon a linear combination of the values of the predictors for a specific individual. The statistical model in Equation (2) above is then estimated in two stages by the method of partial-likelihood. First, by focusing only on the term, the exponential one, without the necessity of specifying the functional form of the baseline hazard rate. Thus the base line hazard rate needs never be specified upfront unless its estimates are needed. And that's what makes the Cox proportional model a semi parametric one which does not require the specification of a particular probability distribution for the waiting times (Willett and Singer, 1988).

4.3 The hazard ratio

Another important measure in the Cox proportional hazards model is the hazard ratio which tells us about the relative risks of two individuals or characteristics in the sample. Since in Cox regression the baseline hazard rate function $h_0(t)$ is not specified and is held constant for all individuals of the sample therefore the hazard ratio between any two individuals, for a particular characteristic for example, can be calculated independently of $h_0(t)$ as follows:

$$HR = \frac{h(t, x_1)}{h(t, x_2)}$$

$$= \frac{h_0(t)e^{(\beta x_1)}}{h_0(t)e^{(\beta x_2)}}$$

$$= e^{((x_1 - x_2)\,\beta)} \tag{3}$$

It means that the hazard for one individual is proportional to that of the other by an amount of the hazard ratio which is constant and is independent of time as we see that the time dependent factor $h_0(t)$ is already cancelled out in the above equation. This ratio indicates the expected change in the risk of the terminal event for an individual as relative to another individual such that they differ from each other by the characteristic (x) (Fox, 2002).

The same concept can thus also be applied to know the relative risks among particular characteristics rather than among the individuals by using the formula:

$$HR = e^{(\beta_k)} \tag{4}$$

This shows the relative increase or impact on the hazard rate, by a unit change in that particular characteristic or predictor k. For example if $\beta = 0.5$, then hazard ratio is exp $(0.5) = 1.65$, which means that a one unit change in a particular characteristic or predictor x increases the hazard of the event by 65 per cent. Further we can also extend the same concept to include any number of degrees of change in the characteristic of interest for which we want to know the relative impact on the hazard for example if for a particular characteristic Z the coefficient $\beta = -0.08$ and we want to know the effect of a 40-unit shift in Z, hazards ratio is $\exp[-0.08(40)] = \exp(-3.2) = 0.04$, which means that the effect of a 40-unit increase in Z is to decrease the hazard by 96 per cent. This approach was used by Pagach and Warr (2011) to calculate the relative risks of different variables due to a change of 10 per cent-of-mean in the variable.

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4.4 Application of the model

The Cox proportional hazards model requires that the sample of the firms that are exposed to a certain risk or probability of happening of a certain event must be observed over a certain period of time. So that at the end there are some cases which had undergone the event and still there are the others which did not, the censored ones, during the same period of time. Thus it is a kind of comparison of not only the different characteristics of the same firms as concerned the risk of that particular event but also it compares the two sets of individuals (the ones with the event happened and the censored ones) as regards the variation of the same characteristics and their impact on the risk. Thus the model was applied to the whole main sample of the 40 firms (The CAC-40 firms) including those which initiated ERM during that period as well as those which did not initiated it even up to the end of the study period (1999-2008).

The data of the current study was a panel data with firms from the CAC-40 index having ERM initiated in different years as well as some censored data such that each time when the ERM is initiated (i.e. the event happens), the corresponding observation is dropped out of the panel with the ERMINIT variable, or the status indicator, getting value 1 at that point. So that in this way a particular observation can take the value 1 on its dependent variable only once. While for those which did not initiate ERM even until the end of the study period, i.e., the censored cases, they stayed in the panel until the end. Survival times were then calculated and data simplified to another form suitable for applying the model with a firm having a single record on different independent variables or predictors having values as recorded at the beginning of the financial year in which ERM was initiated and with the ERMINIT status indicator variable having value 0 or 1 accordingly as being a censored or an effected observation. The equation of the applied model thus becomes:

$$h_i(t,X) = h_0(t) \times e^{(\beta_1 Lev_{i1} + \beta_2 Opacity_{i2} + \beta_3 CRatio_{i3} + \beta_4 MTB_{i4} + \beta_5 RND_{i5} + \beta_6 SVOL_{i6} + \beta_7 EVOL_{i7} + \beta_8 VCH_{i8} + \beta_9 BIND_{i9} + \beta_{10} CEO_{i10})}$$

$$h_i(t,x) = h_0(t) \times e^{(\beta Leve + \beta Opacity + \beta MTB + \beta CashRatio + \beta R\&D + \beta SVOL + \beta EVOL + \beta VCH + \beta BIND + \beta CEO)} \quad (5)$$

hazard ratios for each of the firm related characteristics were then calculated to know the impact of each of them on the hazard (i.e. the probability of adopting the ERM programme).

5. Results

5.1 Descriptive analysis of the sample

Figures 1 and 2 show the industry wise breakup of the two sub-samples of ERM adopters and non-adopters, respectively, during the period 1999-2008. For this purpose, we classified firms into industries by using their Standard Industrial Classification Codes and in some cases using the NAF Codes[12] where the former were not available. As expected, among the adopters, a visibly high proportion of 23 per cent of the sample firms come from the financial sector. This is quite consistent with the fact that ERM is adopted by firms that are financially opaque and are in volatile industries. Due to its specific risky nature of this industry, the regulatory environment around the banking

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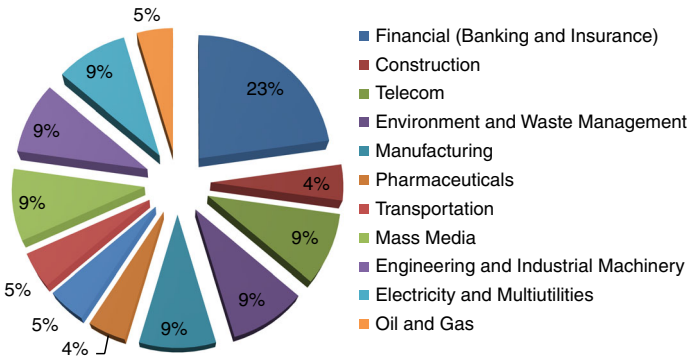

Figure 1.
ERM adoptions by industry

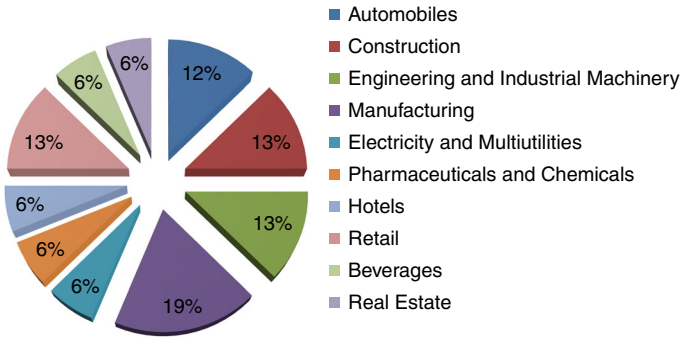

Figure 2.
Non-adopters by industry

and finance firms also calls for stricter compliance of risk management and corporate governance which may also have played a role in their decision to adopt ERM. Other remarkable adoptions in the sample represent industries like telecom, engineering and highly technical, and energy (electricity and oil and gas). This again is consistent with the fact that firms which are highly technical and specialized will try to keep up with their competition through research and development and innovation for which they need investments which are very specific to their characteristics and needs. Thus they adopt ERM in a hope to have more investor confidence and thus more capital and firm-specific investments available for future projects.

On the other hand the non-adopters' sample comprises a much broader range of industries including retail, real estate, hotels, automobile and beverages, etc. The remarkable representations are seen in case of the manufacturing, construction and engineering sectors.

Table I shows that most of the adoptions took place in the period from 2002 to 2004 which represent a 64 per cent of the ERM sample while 35 per cent of the main sample. This is consistent with the fact that it was the era of actual growth of ERM, with the publication of COSO's internal control framework in 2002 and then later the COSO's ERM framework in 2004 that made ERM being widely emphasized and practiced.

Similarly, Table II shows that bankings and finance firms are ahead of the other firms in adopting ERM. A huge proportion, i.e. four out of 16 of the adoptions, in the first half of the study period up to 2004, is by financial firms. This again evidences the effect of regulatory pressure on these firms e.g., the Basel II[13] regulations (1998) and (2001)

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Survival in years	Year	Risk set	ERM adoptions	Censored	Proportion of ERM adoptions in main sample	Proportion of ERM adoptions in ERM sample
0	1999	40	1	0	0.025	0.045
1	2000	39	1	0	0.025	0.045
2	2001	39	0	0	0.000	0.000
3	2002	38	2	0	0.050	0.091
4	2003	36	5	0	0.125	0.227
5	2004	31	7	0	0.175	0.318
6	2005	24	1	0	0.025	0.045
7	2006	23	3	0	0.075	0.136
8	2007	20	2	0	0.050	0.091
9	2008	18	0	18		
Total	9 years	40 firms	22	18	0.550	1.000

Notes: This table shows the distribution of ERM adoptions through time along with proportions of adoptions in the main sample as well as in the ERM sample. The column Censored contains the firms that did not adopted ERM until the end of the study period while risk set is the number of firms that entered each year with probability of adoption at a particular point of time

Table I. Distribution of ERM adoptions through time (1999-2008)

Industry	Adoptions	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Financial (banking and insurance)	5	1	1	0	0	1	1	1	0	0	0
Construction	1	0	0	0	0	0	1	0	0	0	0
Telecom	2	0	0	0	0	1	0	0	1	0	0
Environment/waste management	2	0	0	0	0	1	1	0	0	0	0
Manufacturing	2	0	0	0	1	0	1	0	0	0	0
Pharmaceuticals	1	0	0	0	0	0	0	0	1	0	0
Transportation	1	0	0	0	1	0	0	0	0	0	0
Mass media	2	0	0	0	0	0	1	0	0	1	0
Engineering and heavy machinery	2	0	0	0	0	0	1	0	0	1	0
Electricity and multiutilities	2	0	0	0	0	1	1	0	0	0	0
Oil and gas	1	0	0	0	0	1	0	0	0	0	0
Other	1	0	0	0	0	0	0	0	1	0	0
Total	22	1	1	0	2	5	7	1	3	2	0

Note: This table shows the total number of ERM adoptions as well as the number of adoptions in each industry in each of the ten years study period 1999-2008

Table II. Distribution of ERM adoptions through time and by industry

for banking firms that pushed them towards ERM adoptions quite early. Manufacturing, electricity and environment firms were others to mention that adopted ERM earlier than the normal regulatory pressure could build up for these firms in the French market.

Tables III and IV show the descriptive statistics of the adopters and non-adopters, respectively.

A general comparison of the descriptive statistics in Tables III and IV reveal that as compared to the non-adopters, firms that adopted ERM were larger in size on the average, had larger debt obligations, more volatile cash flows and stock prices and had larger proportions of the board being independent. Table V presents a univariate comparison of the average differences in major characteristics of these two sub-samples respectively. We applied a *t*-test over the difference of the means of the key variables between adopters and non-adopters (i.e. mean of adopters vs mean of

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non-adopters) to derive statistical significance of the difference. The results confirm again that the ERM adopting firms were larger having high leverage, weak stock performance and profitability problems and were having independent boards. The difference between the means on almost all the characteristics, except for opacity and R&D spending, are positive. In particular, the difference is positive and significant in case of stock price and earnings volatility, board independence and firm size.

5.2 The Cox proportional hazards model results

The data were tested using the Cox regression. At each time step between the years 1999-2008, a particular risk set was created consisting of the firms that were expected

Table III. Summary statistics of the ERM adopters' sample

Variable	Obs.	Mean	SD	Min.	Max.
Size (mill. €)	22	57,624.01	5.05	2,809.96	1,023,915.66
Leverage	22	29.47	14.30	4.19	69.03
Opacity	22	17.39	19.15	0.24	72.36
MTB	20	3.09	6.58	−2.60	30.40
Cash Ratio	22	8.84	8.47	0.86	32.69
R&D	13	1.87	2.31	0.15	7.46
SVOL	20	28.07	9.67	16.28	47.19
BRD IND (%)	20	47.55	28.83	6.00	94.12

Table IV. Summary statistics of the ERM non-adopters' sample

Variable	Obs.	Mean	SD	Min.	Max.
Size (mill. €)	18	18,632.72	2.26	2,618.13	57,258.69
Leverage	18	27.70	10.63	6.14	47.09
Opacity	18	28.23	18.59	2.05	61.94
MTB	18	2.27	1.03	0.81	4.04
Cash Ratio	18	8.08	4.33	0.64	17.34
R&D	13	2.69	3.95	0.10	15.06
SVOL	18	24.27	5.79	15.27	33.55
BRD IND (%)	17	28.98	29.06	4.00	91.67

Table V. Mean comparisons of the adopters' and non-adopters' characteristics

		Mean				
Variable	Obs.	Adopters	Non-adopters	Difference	*T*-statistic	$p(T > t)$
Leverage	22	29.469	27.704	1.7651	0.434	0.6665
Opacity	22	17.391	28.227	−10.8379	−1.804**	0.0396
MTB	20	3.092	2.267	0.8243	0.525	0.6026
Cash Ratio	22	8.836	8.076	0.759	0.345	0.732
R&D	13	1.872	2.685	−0.8130	−0.641	0.5276
SVOL	20	28.065	24.274	3.7906	1.445*	0.0786
EVOL	22	13.354	12.818	0.5362	1.363*	0.0904
VChange	20	23.687	−17.516	41.2034	1.491*	0.0723
BRD IND	20	47.546	28.978	18.5674	1.945**	0.0299
Size (Ln *T.Assets*)	22	17.870	16.740	1.1290	2.689***	0.0053

Notes: *,**,***Statistical significance at the 10, 5 and 1 percent levels respectively

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for (at a risk of) initiating ERM programme but had not yet initiated one. The risk set reduced in a time step whenever there was an ERM initiation in the previous time step due to which the corresponding firm went out of the risk set. Hazard probabilities and the effect of various explanatory characteristics of the firms were then calculated along with hazard ratios for each of them.

Table VI shows the results of the Cox regression. The results show that, out of the ten predictors considered for the study, the decision of initiating an ERM programme is effected closely by six predictors. Financial leverage (*Leverage*), market to book ratio (*MTB*), cash ratio (*Cash Ratio*), stock volatility (*SVOL*), earnings volatility (*EVOL*) and board's independence (*BRD IND*) were found to be significantly affecting the ERM adoption decision's probability.

5.2.1 Financial distress. We found a strong support for the Stulz's (1996) argument that firms in financial distress and those facing lower tail earnings would be more likely to implement an ERM programme as such firms benefit the most from such a programme. Table VI shows that Leverage and EVOL are highly correlated with the ERM initiation decision (with $\Pr > \chi^2 = 0.005$ and 0.004, respectively) reflecting a good support of the financial distress hypothesis that firms with more probability of financial distress and volatile earnings may start an ERM. A number of previous studies found similar results (e.g. Beasley *et al.*, 2008; Liebenberg and Hoyt, 2003; Pagach and Warr, 2011).

5.2.2 Existence of growth opportunities. The existence of growth opportunities was proxied by two variables i.e., market to book ratio (*MTB*) and research and development cost (*R&D*). The coefficient of R&D in the analysis got a negative sign which is contrary to the hypothesis that *R&D*, being a measure of growth, is positively correlated to the ERM initiation. However, since most of the observations were missing data on this variable and were thus deleted by the model therefore the results could not be considered realistic and that could be one explanation of *R&D* not being significant ($\Pr > \chi^2 = 0.364$). On the other hand, the second measure of the existence of growth options, *MTB*, for which almost all observation had complete data was significant and with a positive sign as expected on the coefficient. This is showing the effect of existence of growth options on the decision of ERM initiation. The higher the market to book ratio, the more a firm have growth opportunities or profitable future projects and the more likely it is to start an ERM programme.

Variable	Coefficient	$\Pr > \chi^2$	Hazard ratio	Lower bound (95%)	Upper bound (95%)
Financial distress					
Leverage	0.138	0.005	1.148	1.042	1.266
Opacity	0.048	0.095	1.049	0.992	1.110
Cash Ratio	0.281	0.007	1.325	1.081	1.624
Growth opportunities					
MTB	0.162	0.016	1.176	1.030	1.343
R&D	−0.218	0.364	0.804	0.503	1.287
Recent performance					
SVOL	−0.152	0.017	0.859	0.759	0.973
EVOL	1.374	0.004	3.952	1.561	10.008
VCHANGE	0.002	0.539	1.002	0.996	1.008
Corporate governance					
BRD IND	0.057	0.031	1.058	1.005	1.114
CEO	1.106	0.180	3.022	0.600	15.227

Table VI. The Cox model results

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5.2.3 Recent performance. The firm's performance in the market as well as in operations and its profitability was measured by value change and earnings volatility. Earnings volatility (*EVOL*) was found to be highly significantly related to ERM adoption which reinforces the fact as hypothesized that firms which have had recent volatile earnings performance may adopt ERM as an effort to improve profitability and performance. Similar results were found by Pagach and Warr (2011) and Andersen (2008) who suggested that firms may implement ERM in order to stabilize earning performance. However, no significant relation was found for the value change variable (*VCHANGE*).

5.2.4 Corporate governance. Board independence (*BRD IND*) was found significantly positively related to the decision of initiating an ERM programme. This is consistent with previous findings by Kleffner *et al.* (2003) and Desender (2007) and reflects the fact that a more independent board composition will favour the shareholders and hence may implement ERM in an effort to boost performance but also to avoid the management from risk taking activities hence protecting against a shareholder-management agency conflict. However, the *CEO* variable was not significant meaning that the position of the CEO in the board does not have significant impact on ERM adoption decision.

5.3 The hazard ratios

The hazard ratio ($HR = \exp(\beta)$) indicates the expected change in the risk of the terminal event for characteristics relative to the other characteristics. The single unit hazard ratios (i.e. in which a single unit change in the characteristic of interest is checked for an effect on the risk or probability of the events taking place) for the four significant and important variables were calculated.

Table VI also shows the different hazard ratios along with their 95 per cent confidence intervals. The hazard ratio for earnings volatility is the highest i.e. 3.952 showing that a one unit increase in earnings volatility will increase the chances of adopting the ERM by a huge 295 per cent. Thus this evidence strongly supports the idea that firms adopt ERM to reduce earnings volatility and to improve performance. Similarly market to book ratio and leverage have hazards ratios of 1.17 and 1.14 meaning that a one unit increase in market to book and leverage can cause the probability of adopting ERM to increase by 17 and 14 per cent, respectively. Board independence is however not strongly linked with the hazard with a hazard ratio of 1.058 meaning that a 1 per cent increase in the proportion of independent members on the board will increase the probability of adopting ERM by 5.8 per cent.

6. Conclusion

This study was conducted to investigate the determinants of the decision of adopting ERM by the French firms listed on the CAC-40 index during the ten years period, i.e., 1999-2008. We use the news announcements of the appointment of CRO and information from publicly available documents of the firms to identify the firms that were using ERM and the timing of their initiation of such a programme. An overview of the regulatory literature and corporate environment shows that some big corporate failures in the recent past, the current financial crises, rapid shifts in risk management practices during the last decade and international and local regulatory obligations have led towards an increased firm level awareness and regulatory pressure towards adopting integrated risk management practices.

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The firm level factors that affect the decision of adopting ERM were investigated using the Cox proportional hazards model. It was found that firms having more leverage and growth opportunities and firms which have seen poor performance in terms of variability in their profits were more likely to adopt ERM. This supports the reason that they implement ERM in order to improve their poor performance and to reduce the chances of lower tail earnings outcomes which may cause ultimately financial distress and thus high costs of not pursuing profitable projects in the presence of growth options. This is in line with a number of theoretical and empirical studies such as Stulz (1996), Liebenberg and Hoyt (2003), Beasley *et al.* (2008) and Pagach and Warr (2011) who argue that implement an ERM strategy is more probable for firms that have seen recent poor performance and are prone to a higher risk of default. This also reflects the fact that firms may adopt ERM if they have more growth opportunities because this may help them attract and retain firm specific investments especially if they are in highly competitive and technical industries because ERM may make available more capital at reasonable price.

Similarly, we also found results which were consistent with the fact that increased corporate regulations regarding internal control and integrated risk management might have played a major role in pushing firms to initiate an ERM programme. In particular, consistent with Kleffner *et al.* (2003) and Desender (2007), we found that firms are more likely to initiate ERM if the board is composed of more independent members. This may be due to two reasons; first, the fact that the board being independent, may exert more pressure on management to adopt sophisticated risk management practices, and second, since it is the board who normally take the decision and responsibility for ERM adoption therefore they may implement such risk management practices in order to prevent the management-shareholder conflict thereby avoiding the management from taking excessively risky projects.

This research has several important implications for theory and practice. The research on ERM is still in its infancy stage and lacks in broad empirical evidence and consistency. Our study makes an important contribution towards enhancing our understanding of how and why firms adopt ERM by presenting empirical evidence from French firms. Most of the previous ERM research largely assumes that firms are likely to adopt sophisticated risk management practices due to incentives or to achieve certain objectives (Bromiley *et al.*, 2015). However, our findings suggest that in corporate regulations are important for wide adoption of ERM practices. The firms in a rather conservative market like France are less likely to adopt ERM without pressure from regulators and without having independent boards. The regulators need to clearly incorporate such requirements and expectations in the regulatory and corporate governance framework. Our findings also suggest that firms with lower performance and in financial distress can send a positive signal to the market by adopting ERM and may increase the confidence of investors and other stakeholders. In addition, the firms with more growth opportunities should have a higher focus on the implantation of ERM initiatives as growth may also present extra challenges and risks to the firms (Welbourne *et al.*, 2012).

The findings of this study are subject to certain limitations. First, a major problem in ERM research is the identification of the fact that a particular firm or organization is using ERM, because firms usually publish minimum details of their risk management strategies in publicly available documents. Also, even if it is identified that a certain firm is using ERM, it is still hard in most of the cases to know as to when exactly they started the programme. Thus, proxies and alternative methods were used to identify

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the timing and existence of ERM such as the news announcements for CRO hiring and analysing the financial reports of the firms in an effort to search for some criteria relating to ERM. This practice, being a very subjective criterion, may have resulted in some bias in the results. There could have been firms in the control sample (i.e. non-ERM adopting sample) that might be using ERM and still could not have been identified. Also in the ERM sample the point of time of ERM initiation may not have been the same as identified through the subjective criteria used for that purpose. Another important fact is that since ERM is still considered a rather new-born concept in France and Europe, therefore, the sample of firms adopting ERM was small that may have resulted in some of the results against the expectations. Missing data and the requirement of the model regarding deletion of observations with missing data also did not allow us to use all observations for the analysis.

The future research can address the limitations mentioned above by introducing some other indicators of ERM, for example the amount of "provision for risks" can be a good indicator of the extent of focus on risk management. Similarly, the proxy for financial distress in the current study was based on leverage only which can be improved by taking other alternative measures into consideration, e.g., changes in dividend pay-out ratios and changes of firms' credit ratings. The credit rating agencies like S&P and Moody's have already introduced ERM in their evaluation criteria; therefore, credit ratings of firms can also be used for identifying ERM firms. It would also be interesting to further delve into the consequences of adopting ERM to find empirical evidence whether or not the benefits associated with ERM are realized in the reality as the most of literature in this field assumes that firms will benefit from ERM. Not all the firms may benefit from risk management practice and ERM implementation in particular (Pagach and Warr, 2010; Stulz, 1996). As ERM is an integrated approach, therefore, it could be quite difficult to separate ERM-based consequences for the firms. Hence the future research should also focus on efforts to segregate performance consequences of ERM implementation from general and overall performance of the firms.

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Corresponding author
Dildar Hussain can be contacted at: dildar.hussain@esc-rennes.com

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