

IMPACT OF ENTERPRISE RISK MANAGEMENT ON COMPANIES' FINANCIAL
PERFORMANCE AND VALUE DURING CRISIS: EUROPEAN NON-FINANCIAL SECTORS
- ENERGY AND TELECOMMUNICATION

A Thesis

Presented to the Faculty

of ISM University of Management and Economics

in Partial Fulfilment of the Requirements for the Degree of

Master in Financial Economics

by

Akvile Rakauskaite

May 2016

Abstract

Rakauskaite, A. Impact of enterprise risk management on companies' financial performance and value during crisis: European non-financial sectors - energy and telecommunication: Master Thesis: Financial Economics. Vilnius, ISM University of Management and Economics, 2016.

Research focuses to the effect of implementing Enterprise risk management (hereinafter – ERM) to the market value and performance of companies and how it has changed in non-financial sectors energy and telecommunication after crisis. Theoretical framework and research design defines main conceptual relationships between ERM, market value (Tobin's Q) and enterprise performance (ROA) selected measures. Empirical results are based on publicly listed largest European Energy (total 51 company) and Telecommunication (total 21 company) balanced data for two periods 2003-2006 (pre crisis) and 2011-2014 (after crisis). ERM existence is determined by annual reports data about ERM system implementation. Results showed that after crisis ERM effect to companies' value and performance has changed. After crisis investors started to value ERM existence in enterprise as good sign of mature management practices and that was reflected in the market value of company particular in Energy sector. ERM effect to profitability of company had opposite effect as before crisis there was effect in Energy sector and after crisis effect vanished.

KEY WORDS: Enterprise risk management, ROA, Tobin's Q, crisis, Energy, Telecommunication

Table of contents

Abstract	2
Introduction	6
1. Literature review	11
1.1. Concept of ERM its influence to management practices.....	14
1.2. Internal and external factors defining ERM existence.....	19
1.3. ERM and companies performance and value	25
1.4. How investors' attention translates to company's value?	31
1.5. Summary of literature review	33
2. Research methodology.....	36
2.1. Theoretical conceptual model	37
2.2. Methods.....	44
2.3. Data selection.....	50
2.4. Research framework limitations	52
3. Empirical Research Results and Discussion	53
3.1. Descriptive statistics	53
3.1.1. ERM implementation data descriptive statistics.....	53
3.1.2. Financial data descriptive statistics.....	55
3.1.3. Correlation analyses.....	58

Impact of ERM to enterprise value and performance	4
3.2. Selecting model for Hypothesis 1 and 2 testing.....	60
3.3. Hypothesis for the Model 1 test.....	61
3.4. Testing second hypothesis ERM impact to ROA	63
3.5. Discussion.....	64
Conclusions.....	74
References.....	77
Appendices.....	84
Appendix A. ERM implementation in Energy and Telecommunication sector by year ...	84
Appendix B. Stata code and statistical analyzes results	84

List of tables

Table 1 Determinants of ERM existence and quality in literature (compiled by author) .	22
Table 2 ERM effect to enterprise value and performance (compiled by author).....	27
Table 3 Research variables description.....	48
Table 4 Descriptive statistics (2003 – 2014).....	56
Table 5 Telecommunication and energy sectors correlation matrix before crisis	58
Table 6 Telecommunication and energy sectors correlation matrix after crisis.....	59
Table 7 Statistical model selection tests results	61
Table 8 Hypothesis 1 test results.....	62
Table 9 Hypothesis 2 test results.....	63

List of figures

Figure 1 Research design	9
Figure 2 Timeline of important dates for ERM practice development	15
Figure 3 Model selection procedure.	46
Figure 4 ERM implementation by year in Energy and Telecommunication sectors	54
Figure 5 Summary of generalized results of Model 1 and Model 2	65

Introduction

As OECD states “Perhaps one of the greatest shocks from the financial crisis has been the widespread failure of risk management. In many cases risk was not managed on an enterprise basis” (OECD, 2014, p. 12). After crisis importance of risk management in financial market grew considerably (new regulations and requirements for financial institutions Basel III, Solvency II), even though there is no strict regulations in non-financial sector and implementation of integrated view to risk management is left to the will of companies, there are tendencies of growing risk management importance in all sectors.

Although risk management is not a new term yet in corporate governance field attitude to risk management during several decades changed form so called Traditional risk management to integrated enterprise risk management. Changed risk management principles were generalized and formalized into two most often used standards starting with ISO 31000 released in 1995 and COSO Enterprise Risk Management – Integrated Framework released in 2004. Integrated risk management suggested various new ways and tools for managing enterprise risk, but major change in managing risk was integrated view to enterprise risk portfolio connected to enterprise goals and strategy rather than to separate hazards and risk in isolated silos. As managing risk in separate silo is cost effective and easy to determine value (it easy to define how many losses enterprise experienced after change of new interest management policy) new integrated risk management approach called Enterprise risk management (hereinafter – ERM) brought uncertainty concerning its price and value trade off.

As value of ERM was ambiguous and at the same time there were companies implementing this measure into their management practices researchers started to debate what drives companies to invest into expensive project of ERM implementation while net present value of such project is

ambiguous? According to (Spekle, 2012) previous research there are internal and external ERM implementation drivers from pressure of outside measures (government, shareholders, independent board of directors) to internal factors (size of enterprise, business complexity or ERM understanding as value creating activity). Thus we see that not only internal environment (profitability of ERM implementation), but also external factor requires for sophisticated ERM practices. Still one of the most important question does ERM created value for enterprise remains not answered.

After European debt crisis external investor's and market requirements for ERM grew and companies that had announced of having ERM started being appreciated more than others as an example S&P creditworthiness (Standard & Poor's, 2012) rating was supplemented with ERM maturity component. Growing attention of investors to enterprises with sufficient ERM could mean that in future regardless ERM added value the pressure from government and regulatory institutions or even private investors will grow considerably.

Another worth mentioning fact regarding ERM that is being questioned: Does ERM has same effect to all industries? As for many of years risk management was understood as financial and insurance industries privilege non-financial sectors also started to look for measures that could protect their value. At the same time all industries has different industry specific risk yet does market still values ERM same for all industries regales their risk specifics? Existing literature still has no answer to this question.

Although there are signs that ERM receives more and more attention form public and private sectors tendencies are visible just from public opinion. Considering existing context that enterprises still hesitate to invest into sufficient ERM and at the same time there is growing

pressure from outside (investors and government) there is need of clarification whether companies should prepare for their next project ERM implementation.

To address existing problematics **main research question** is being formulated: Did credit default crisis draw investors' attention to companies' ERM practices in non-financial sector considering particular industry specific risks? How investors perceive what value ERM brings to company is being reflected from their actions being made in market which translates to specific company performance measures and company value. Therefore we defined **thesis goal**: to ascertain whether after crisis the effect of implementing ERM to the market value and performance of companies has changed in non-financial sectors Energy and Telecommunication?

In order to reach thesis goal thesis was structured in such way that each part of thesis would serve to the reach of goal. Objectives were formulated the following objectives were defined:

1. To describe ERM implementation determinants in order to identify companies with ERM;
2. To select appropriate companies' measures to evaluate company performance and value;
3. To design appropriate conceptual, technical and statistical model to evaluate ERM effect to company performance and value;
4. To apply model designed and evaluate ERM impact to company's performance and value with regards to particular industry specific risks.

Described main question, thesis goal and objectives are structure through the chapters in *Figure 1 Research design* provided structure and sequence.

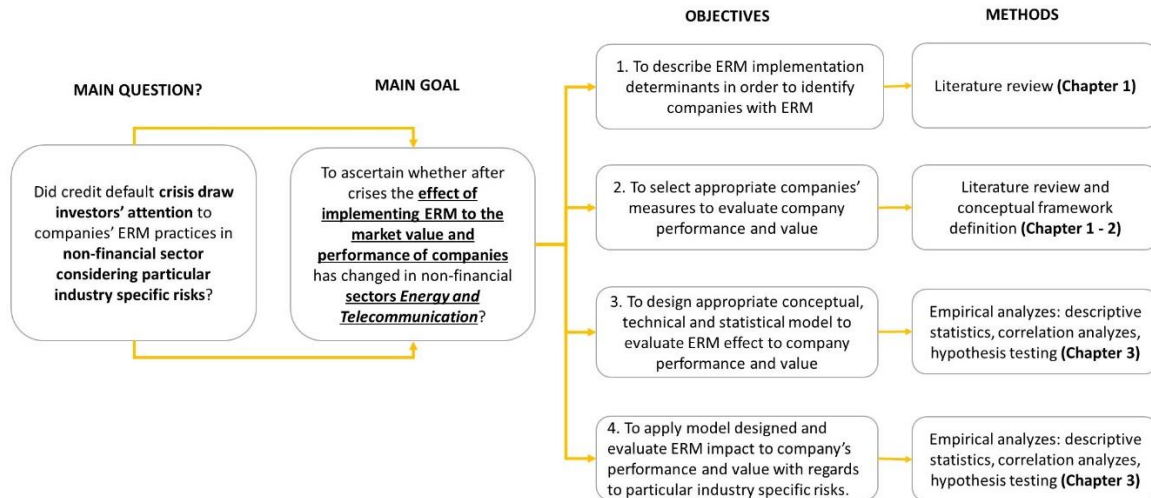


Figure 1 Research design

Raised thesis question is important in practical terms as for today's business in order to make grounded decision for investment into ERM there should be strong evidence of ERM added value. Another important answer to question is whether value of ERM differs because of different inherent risk portfolio if so then approaches to ERM should be as tailored as possible to reflect specifics to organization and its sector.

In order to reach the main goal of thesis empirical research constructing panel data of European companies from energy and telecommunication sectors will be performed for two time periods before (2003-2006) and after (2010-2014) crisis. This most appropriate method to capture ERM implementation effect as ERM implementation for different companies differs in time. Most appropriate panel data regression model will be selected using statistical tests and ERM implementation effect will be measured to selected companies' performance and enterprise value measures.

In order to have publicly available data for empirical research publicly listed companies will be included into the sample. Data for empirical research is provided in publicly available

sources like statistical data basis or annual reports of companies. This type of data collection is most appropriate for the goal or thesis as market view and perception is object of study while alternative methods like surveys would not reflect public perception. For sampling nonprobability judgment sampling is being used as there are objective criteria's to narrow sample.

Empirical research will be carried in following sequence: 1) review of ERM practical application development during decades and current tendencies in regulation of ERM due to better understanding of practical reasons for increased attention to ERM after crisis period; 2) then review of existing literature related to ERM implementation determinants will be performed in order to determine what are driving factors for ERM implementation to select best measure that helps to identify companies with ERM; 3) after that analyzes of current studies in ERM field will be performed to define whether there is theoretical and empirical background to base our research question and to find what performance and enterprise measures are being used in empirical studies; 4) After extensive review of existing literature review theoretical conceptual model will be developed and hypothesis formulated in order to reach our thesis goals and answer to the question; 5) After formulating research methodology statistical tests will be used to test our hypothesis and finally result will be discussed whether we reached thesis defined goal and answered to the question.

1. Literature review

Enterprise risk management is relatively new managerial practice that has been in financial sector for years and slowly started to gain non-financial sectors attention. Current credit default crisis played major role in attracting government's attention to risk management but still question not answered whether attention to risk management is just in conceptual on political level or practitioners also started to notice ERM added value?

For this reason empirical studies showing ERM impact to company performance and value gain more and more attention from researches. Up today there are a lot empirical studies showing ERM impact to firm's value and performance over the globe for instance United states of America (Pagach & Warr, 2010), Europe (Spekle, 2012), Brasilia (Rodrigo Silva De Souza, 2012) and lots of others. There are two main trends in empirical studies of ERM impact to enterprise:

- Empirical studies that analyzes ERM implementation determinants (Spekle, 2012), (Baxter R. , Bedard, Hoitash, & Yezege, 2013), (Liebenberg, 2008), (Gatzert & Martin, 2013) and others;
- Empirical studies that analyzes ERM impact to firms value or performance (Gatzert & Martin, 2013), (Bertinetti, Cavezzali, & Gardenal, The Effect of the Enterprise Risk Management Implementation on the Firm Value of European Companies, 2013), (Saudah Ahmad, 2014) and others.
- Another major differentiating factor of empirical studies regarding ERM impact to firm's value is information source of ERM existence determinants. There are two major tendencies of information sources: surveys and publicly available information, neither of these information source type is better, just both have different application circumstances

and limitations. At the same time it is important to select most appropriate information source in order to design most appropriate research framework.

Considering existing studies there is still gap of empirical studies that shows ERM benefits in extreme situations such as crisis (Baxter R. , Bedard, Hoitash, & Yezegel, 2010). Main reason for that is lack of sufficient data to ground ERM existence. One way to gain knowledge of ERM is to conduct survey that in most cases limits number of companies, or to use secondary sources such as S&P ratings (Standard & Poor's, 2012) that measures corporate risk practices in non-financial sector from 2006 what also limits range of data.

To ascertain context of existing problematic regarding ERM implementation an reach main thesis goal four main sections of literature analyzes are provided in literature review chapter:

At first more **practical review of current ERM tendencies regarding methodologies, standards and external requirements** for companies in order to understand how ERM make impact to company overall management. It is important to understand how external and internal factors influences companies willingness to implement ERM and how implemented ERM could affect general company performance. Review of methodologies, standards and external requirements is limited to the most widely spread and used standards in Europe according to European benchmarking study (Federation of European Risk Management Associations, 2003). **This section will help to reach part of first objective - *To describe ERM implementation determinants in order to identify companies with ERM*** - by understanding main external and methodological determinants of ERM implementation and argumentation regarding ERM implementation from theoretical perspective. Also this part we provide sufficient context of

changes before and arises regarding external requirements to companies from government bodies and investors in form of new regulations, standards and consultants business periodical reviews.

As value of ERM is still ambiguous and at the same time there were companies implementing this measure into their management practices researchers started to debate what drives companies to invest into expensive project of ERM implementation while net present value of such project is ambiguous? Regarding this issue second part of literature review is oriented to **ERM determinants analyzes**. Study of literature regarding ERM determinants is not limited neither to the sector or geography, although researches from Europe non-financial sector would be most appropriate to compare there is lack of researches being made for European non-financial sectors. For this reason while interpreting ERM determinants literature review results context should be considered as major results are from financial and insurance sector. **This part of literature review will allow** to compare different ERM implementation determinants and in research methodology part to select most appropriate measure to determine ERM implementation existence measure.

Third part of literature review **will help to select appropriate companies' measures to evaluate company performance and value (second objective of thesis)**. Different type of researches will be analyzed in order to determine which of the measures are mostly used and most appropriate in order to reach thesis goal. Regarding scope of literature included into analyzes empirical researches are most relevant to our thesis type, therefore this type of researches are main study object. Empirical studies became popular after crisis, but empirical researches covers both pre and post crisis periods data. Researches are being grouped by object of study, country and number of firms analyzed, ERM determinant being used for study and data period analyzed. These criterion are important in order to be able to compare existing literature to our thesis results.

Last part of literature review **will assist in definition of conceptual framework** as one of the most important **links between investors' expectations and firm's value** need to be determined in order to have full connection from main thesis question (Did credit default crisis draw **investors' attention** to companies' ERM practices in non-financial sector considering particular industry specific risks?) to operation research model. For described purpose scope of literature review will be narrowed to the most well know and practically applied investment valuation theories.

1.1. Concept of ERM its influence to management practices

Risk management is not a new term in various disciplines from economic to military or environmental fields. More over traditional risk management approach in finance and insurance sectors was applied for decades in different risk management functions like audit, credit risk management, and market risk management, et cetera. Still these different risks were managed in organizational silos but not in enterprise wide approach so called Enterprise risk management (Committee of Sponsoring Organizations of the Treadway Commission, 2004).

Enterprise risk management as a term could still be considered as quite new discipline. As we can see from *Figure 2 Timeline of important dates for ERM practice* common standards that started to mention integrated risk management were introduced not long time ago in 1995 Australia, while holistic view to risk management was generalized in 2004 when COSO organization introduced COSO Enterprise Risk Management – Integrated Framework.

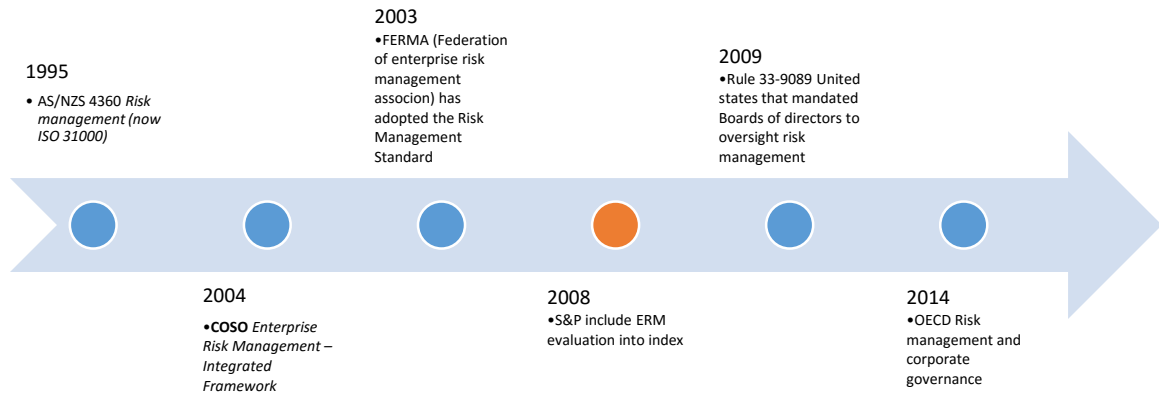


Figure 2 Timeline of important dates for ERM practice development
(compiled by author)

To understand better enterprise risk management principle COSO definition of risk management is provided:

ERM is 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 (Committee of Sponsoring Organizations of the Treadway Commission, 2004, p. 2).

As we can see from widely used ERM definition risk management should start from strategy level and should be transformed to tactical level in order to ensure that organization reaches its objectives. As mentioned before ERM concept shifts risk management from silo practice of specific risk management to process that covers all organizations risks and processes interconnections (Shima, Mahmood, Musriyama, & Akbari, 2013).

So far we could notice from new standards introduced that risk management changed its scope and became widely used in strategic level and decision making. Does this change by itself is enough to have major change on whole enterprises performance?

Scope of risk management in organization is not the only change that makes ERM so important driver of companies' performance, major change mentioned in ERM literature is risk management strategy that with ERM concept became heavily oriented to risk and opportunity optimization and less to the risk mitigation as it was before (Liebenberg, 2008). As ISO 31000:2009 standard states: "Risk is effect of uncertainty on objectives" (International Organization for Standardization, 2009, p. 2). Effect in this case means positive and negative effect of unexpected events that could lead to gain or loss and risk management purpose is to optimize these both sides to ensure sustainable growth of company. Sustainable growth of company in shareholder view means stable performance and safe investment at the same time better companies' profitability measures.

So with new concept ERM risk management is no longer seen as safeguard of companies generated assets but as process or practice generating additional value to company that helps to seize its opportunities (Gates, Nicolas, & Walker, 2012). More and more researches are being made in order to define how does corporate governance structure risk management make influence to companies profitability.

Gates, Nicolas, & Walker (2012) make general conclusion that ERM improves performance by overall enhanced management of company. They come up to this assumption by developing model defining drivers that influence general company performance. For starting point they prove that better objective setting leads to better risk identification, then better risk

identification (using various techniques and external or internal consultation) leads better risk management strategy, oversight and finally better management and better performance. This research illustrates that ERM is integral part of general management and companies performance management. And has sufficient effect to it.

Unlike other modern management practises and methods that are provided in the timeline of ERM development ERM gained attention not only from advanced organizations who wanted to enhance their performance but also from international and governmental level. Regarding Federation of European risk management associations (FERMA) latest European risk management benchmarking survey in 2012 6th edition Regulatory factor remains the most important factor that triggers enterprise risk management within company (61 % of respondents) as the second place goes to clear requirements from shareholders (33 % of respondents). Governmental regulations always played important role in business development and especially in risk management context.

Main reason of international and governmental attention to Enterprise risk management is cumulative effect of risk mismanagement in enterprises level which transforms to general economy uncertainties that could be illustrated by OECD citation from their current Risk Management and Corporate Governance report: "Perhaps one of the greatest shocks from the financial crisis has been the widespread failure of risk management. In many cases risk was not managed on an enterprise basis" (OECD, 2014, p. 12).

Recent credit default crisis is example of risk mismanagement in enterprise level. After huge market shocks there were always lessons to learn and usually it transformed to new laws and acts of regulation. Risk management context after major fraud scandal with Enron there was Sarbanes-Oxley Act (Oxle, 2002) issued in United States of America that until now is mandatory

for all organizations. Even though Sarbanes - Oxley concentrates on to the financial controls side but it well illustrated the start how attention to risk management was drawn after every great shock. Regarding financial and insurance sectors risk management was always one of the major topic regarding regulations but not so long time ago attention was brought to the enterprise wide risk management and that was included into the Basell III for banks and for insurance industry in the heart of new edition of Solvency II there was program Own risk and solvency assessment (ORSA) that requires jointed up approach of the actuarial, internal audit, compliance, risk, underwriting, IT, investment, finance and planning approach (KPMG, 2013). Even though the object of the research is non-financial sector but we can see that practices from financial sector tend to migrate to non-financial sector as enterprise wide risk are getting more attention from regulators. Regarding regulation in EU for non-financial organization core document is 8th European Company Law Directive on Statutory Audit that states “monitor the effectiveness of risk management and control systems” (European Parliament and of the council, 2006, p. 103). This directive highly concentrated into non-financial sector and operational risk management. Peter den Dekker, President of FERMA states in Guidance on the 8th EU Company Law Directive article 41 (2010):

Running a business has always been a matter of risk taking. The recent crisis has reinforced the necessity of managing risk, and has enhanced public expectations for economic actors to be more proactive in risk control. What’s new with the 8th EU Company Law Directive is that there is a clear responsibility given to boards of directors and to their audit committees. Senior management is expected to be involved in risk management and risk taking. Directors have to give direction depending on the risk appetite of shareholders. A good risk management system is

like management systems on a racing car - they help it to go faster, further and more safely (FERMA & ECIIA, 2010, p. 4).

Even though there is strong attention from European Union side to operational risk management in countries they still implements these regulation in different manner. Thus risk mismanagement or lack of integrated approach to risk management could lead to mismanagement of firm and could translate to whole sector or economy meltdown. For this reason not only market leading companies are engaging into Enterprises risk management but various countries leaders understanding importance of ERM are enforcing implementation through regulation.

1.2. Internal and external factors defining ERM existence

Even though there is theoretical background that ERM improves overall management does it remains main determinant why companies implement ERM? We can see from literature analyzes that even though there are external factors that encourages firms to implement sufficient ERM practical value of ERM remains main factor for ERM implementation.

Spekle in *The Adoption and Design of Enterprise Risk Management Practices: An Empirical Study* (2012) evaluated Netherland firms' ERM maturity and governance relationship and found no significant relationship between governance code and ERM maturity and explains that by saying that governance codes encourage enterprises to formally comply but to invest into real ERM (Spekle, 2012). Difficult not to agree that if enterprises do not see value in ERM any governance code will not force them to make ERM effective. Another factor that could lead to governance codes to fail initiate ERM implementation could be difficulties to audit or evaluative ERM maturity in effective way. As discussed before according to Gates, Nicolas, & Walker (2012) risk managemnet is part of overall mananagement thus it could be difficult to audit risk

management separately if it well intergated into management practices. Pratical explanation of companies hesitation to implement ERM even though Government is drawing attention is that company still has to see cost benefit of this investment rather then compliance with general regulation.

Another interesting perspective of external factors that could encourage companies to rethink of ERM implementation could be Standard & Poor's rating agency (S&P). S&P from 2006 started drawing non-financial market professional's attention to the creditworthiness of corporations from whole new perspective by introducing new evaluation criteria - non-financial sectors enterprises risk management practices. This step shows growing importance and attention of financial professionals to the risk management culture and emphasizes importance of evaluating overall corporation performance and creditworthiness. S&P grounded including enterprise risk assessment into the credit rating by stating that if company manages major strategic risks management of company is seen as determined to ensure is operational success and to fulfill defined strategy and business plan. From S&P perspective ERM effectiveness is judged from credit worthiness perspective were good internal control mechanism is more important than value creation by ERM. This view of point contradicts to most commonly used risk management standard ISO 31000 (according FERMA 2014 Benchmarking report) which emphasizes importance of company performance and less to compliance which could lead into long time failure.

As it is defined in the latest updated Standard & Poor's (hereinafter – S&P) methodology *“Management and Governance Credit Factors for Corporate Entities and Insurers”* companies who has integrated, well communicated risk management approach are going to mitigate major risk better that companies who uses opportunistic and reactive approach to risk management.

Defining criteria's for risk management system maturity S&P, as mentioned before, mostly concentrated into the formalization of whole risk management and controls that are designed into the management decision making for example there such questions analyzed as: "Has the enterprise determined limits for acceptable levels of risk, and if so, how are they enforced?" (Standard & Poor's, 2012, p. 10). Also key areas that S&P rating of enterprise risk management concentrates are:

- strategic risk identification process;
- risk management responsibilities;
- risk management alignment with management decisions.

From the way that S&P methodology is defined we can see that S&P defines effective risk management system that helps to fulfill strategic objectives of company as fully integrated into the business activities and decision making with clear risk management organizational structure that is communicated to whole enterprise. How does these new practices for non-financial market could affect enterprises? Main difference from governance codes is that S&P evaluates ERM maturity and include results into the ratings. There are numerous researches that uses S&P as main determinant of ERM implementation as it is one of the most exact measures. Thus S&P shows investors' growing attention to mature ERM practices at the same time does S&P rating could be better influencer for ERM implementation than governance codes? Practically yes as investors bring investments to company and governance codes are seen more like obligation and unnecessary control.

Important part of ERM related researches is ERM implementation determinants. ERM determinants researches direction takes important part of overall ERM impact researches as results

could be strongly influenced by source of information that was used for research. Different researches deal with this problem in their way, but there are 2 main streams: first surveys and second publicly available information about company (Gatzert & Martin, 2013). Summary of recent researches is provided Table 1 Determinants of ERM existence and quality.

Table 1 Determinants of ERM existence and quality in literature (compiled by author)

Article name	Examined period and area	Significant relationship	No significant relationship
(Baxter R. , Bedard, Hoitash, & Yezege, 2013)	Financial services 404 ERM disclosures during the period 2006-2008	- Complexity (larger, more segments, global, foreign) - risk officer and/or a - risk committee - AC risk-oversight - Board tenure	- Board independence and - CEO-duality
(Gatzert & Martin, 2013)	Analyses of 7 different researches regarding determinants of ERM implementation 2003 – 2012	- Company size - Financial leverage - Institutional ownership (strong evidence in all)	- Earning volatility - Stock price volatility - Asset capacity - Growth opportunity - Diversification (industry/international)
(Spekle, 2012)	Netherlands, 825	- CRO and Audit committee combination - Size - Financial sector - Listed firms c.	- Governance codes - Auditor quality - Institutional ownership c.
(Liebenberg, 2008)	Insurance companies US 1995 to 2005	- Complexity - Firm size - Institutional ownership	- No results
(Kleffner, Lee, & McGannon, 2003)	Canadian Risk and Insurance Management Society	- Complexity - Governance codes	- No results

As we can notice there are several factors that almost all studies proves as ERM determinants like CRO or equivalent organizational structure (Baxter R. , Bedard, Hoitash, & Yezegel, 2013), (Spekle, 2012), companies complexity defined by numbers of sectors, different services ((Kleffner, Lee, & McGannon, 2003), (Baxter R. , Bedard, Hoitash, & Yezegel, 2013)), institutional ownership (Liebenberg, 2008), (Gatzert & Martin, 2013). There are several other measures that are common in ERM determinants researches like board independence, governance codes or institutional ownership regardless that fact results varies and in some researches there is strong relationship and in others no significant proof. As ERM determinants are important part of our research we will discuss theses measure in more extended.

CRO appointment. One of them is CRO ore equivalent (head of risk management, risk committee or audit committee with AC risk-oversight). More over according to Gatzert and Martin study “*Determinants and value of enterprise risk management: empirical evidence from the literature*” out of 15 analyzed researches 9 of them uses CRO appointment as ERM existence defining criteria. Does CRO appointment serves best in deciding whether ERM is implemented?

Hypothesis of CRO and ERM existence relationship is very logical and experts of risk management would totally agree that appointment of CRO shows companies’ management attention to this topic as CRO appointment requires maturity of risk management. Still at the same time it is risky to assume certain level of ERM is reached at that point of CRO appointment, because there could be cases when CRO was appointed at same time when decision of ERM implementation was made.

Another contradicting fact regarding CRO appointment measure is that it could be industry specific and serve better for financial and insurance industries and in other industries CRO role

could be performed by other functions. Regardless this assumption there are some researches that shows positive significant relationship in non-financial industries by using ERM proxy CRO announcement (Pagach & Warr, 2010). As there still could be slight differences between industries and risk management organizational structure some researches uses combined criteria's to measure existence of ERM function for instance risk committee or audit committee in order to define ERM existence (Baxter R. , Bedard, Hoitash, & Yezegel, 2013) and founds significant relationship with combinations of CRO, risk manager or risk committee and Tobins' Q.

Complexity. “Is ERM program quality associated with company complexity, financial risk, and corporate governance?” (Baxter R. , Bedard, Hoitash, & Yezegel, 2010, p. 7). Baxter argues that large companies that has international and regional exposure has less coordination and monitoring capabilities and at the same time has wider risk profile. These factors encourages enterprises to implement ERM that would help to control large scale business. In most researches there is positive relationship between complexity and ERM maturity (Kleffner, Lee, & McGannon, 2003), (Liebenberg, 2008). Although complexity encourages companies to implements ERM probably it could not be stand-alone determinant of ERM implementation as there are other tools that could help managing complexity issues.

Institutional ownership. When we are talking about institutional ownership it is good to remember that according FERMA shareholders view is second of the most popular factors that encourages companies to invest into ERM. Main reason could be that mature ERM ensures proactive communications and escalation of possible issues and when business is complex then it becomes great tool for proactive recognition of problems that company will deal in future for investors (Liebenberg, 2008). While considering external factors that could be determinants of ERM implementation Institutional ownership could be one of the most exact determinant as it has

influence to the enterprise more likely than general national governance codes. That means that institutional ownership could be great determinant of ERM implementation.

To summaries what are key drivers of ERM implementation according to current researches firms tend to make investment into such expensive project because of practical grounds. That means that Investors view and practical value (impact to profitability) seems to be main determinant of ERM implementation. That makes ERM effect to firm's performance or investors view important determinants of ERM implementation.

1.3. ERM and companies performance and value

Regarding tendencies of risk management studies recently there is more concentration to the non-financial sectors as previously a lot of attention was dedicated opposite to the financial sectors. Geography is also spreading out of USA were recent decade studies there made to countries like Australia, Malaysia, Brazil and Nordic countries. As geographic dimension is changing it is not difficult to notice that worldwide attention is dawn to this topic. These studies also empowers to make comparison between various countries for instance Australia were ERM maturity study was performed in 2014 there was quiet impressive risk management practices identified (Saudah Ahmad, 2014) as in Brazil and Malaysia practices are still developing.

After crisis Risk management is becoming more and more often mentioned topic not only in academic literature but also in political arena as systemic risk shocks had strike so hard to the economy that recently not only financial market is concerned but also private non-financial enterprises are considering implementing holistic view to the risk management.

There is theoretical background about importance of ERM defined by well know standards like "Risk management creates value" (International Organization for Standardization, 2013, p.

10) or “For a public company, stronger corporate governance should translate into stronger business results and increased share owner value” (McNally, 2013, p. 7). Still companies hesitate to invest into such practices as some well-defined methods are expensive to implement and need great ground for such investment.

Recently there are more and more studies made where this issue is explored from different angles and defines external and internal company factors that influence to have better ERM such as appointment of Chief risk officer (or alternative risk related position), countries requirements to risk management system, ownership, external auditors and similar internal or external factors (Gatzert & Martin, 2013). These types of research make ground for another research method where it is possible to combine evidence from literature about defining strong ERM factors and then measure its effect to company financial performance.

Another issue identified in literature is differences between sectors and how different sectors deal with their specific risks. For instance some sectors have potential for large but very rare catastrophes and another has small but very frequent losses. For this reason it is very important to take into consideration effect of sector and business dynamics. Currently there are no sufficient empirical results that show differences between different industries (Bertinetti, Cavezzali, & Gardenal, The effect of the enterprise risk management implementation on the firm value of European companies, 2013).

For better understanding about particular studies results see *Table 2 ERM effect to enterprise value and* generalized results of recent studies, used ERM determinants and object of study.

Table 2 ERM effect to enterprise value and performance (compiled by author)

Author, Year	Object of study	Country and number of firms analyzed	ERM determinant and data period
Before crisis period analyzes			
(Pagach & Warr, 2010)	Earnings volatility (SD(E)), Stock price volatility, leverage, ROE, financial slack	106 firms that Financial and utility institutions	Public sources 1992-2004
(Grace, Leverty, Phillips, & Shimpi, 2015)	Cost and revenue efficiency and Tobin's Q	USA insurance industry	Public sources 2004-2006
(Baxter R. , Bedard, Hoitash, & Yezegel, 2010)	Enterprise performance (ROA)	247 financial services firms	S&P index 2006-2008
After crisis period analyzes			
(Naciye, to be publised in 2016)	Enterprise value (Tobin's Q)	150 Nordic firms	Survey 2009-2011
(Shima, Mahmood, Musriyama, & Akbari, 2013)	ROA, Log Turnover (Annual data)	175 companies that are listed in Bursa Malaysia	Public sources 2010
(Bertinetti, Cavezzali, & Gardenal, The effect of the enterprise risk management implementation on the firm value of European companies, 2013)	Enterprise value (Tobins' Q)	200 financial and non-financial companies	Public sources 2002-2011

As we can see from summary of recent researches that when ERM effect to firm's value is being evaluated as ERM determinant is selected not survey method but public available

information. Main reason is that ERM effects Tobin's Q not directly but from investors' expectations and investors' expectations are partly formed by public information.

Another important notice from summary of most recent researches is that researches differs in time scale, sectors and geography. That makes difficult to compare thesis results. Nevertheless previous researches could show general tendencies.

Pre crisis data analyzing literature review

One of the most often mentioned and cited empirical study of pre- crisis (1992-2004) analyzes of ERM effect to financial of enterprises (Pagach & Warr, 2010). Study explores wide range of enterprise financial measures and how they are effected by ERM implementation using Chief risk officer announcements as proxy variable for ERM determinant. Key financial variable analyzed is earnings volatility as authors defined ERM benefit mostly in the way that ERM should protect firm from unexpected low probability but great consequence events. Conclusion is that authors find little evidence of any changes in financial measures after ERM adoption. Authors explain these kind of conclusion by data noises or another reason is that ERM effect is not instant and it could take longer time to experience real benefit. These conclusions are important for further studies to consider that there could be time lag after ERM implementation and impact to enterprise performance.

Another interesting perspectives even though in insurance industry but shows statistically significant results is Grace, Leverty, Phillips, & Shimpi, 2015 study were United states of America insurance sector is being analyzed. Main conclusion is that ERM improves firms performances by greater cost and revenue efficiency. This study stand out from others as it measures efficiency not from aggregated efficiencies measures like ROA but uses cost and revenue efficiency theory were

these both measures should be optimized in order firm to be fully efficient. Authors evaluate insurance firms input variables (fixed costs like wages, administrative and others) and output variables (revenue from different business segments) and seek them to be optimal. New approach to ERM effect as efficiency measure could serve for specialized analyses of particular industry, on other hand this method is hardly applicable for various industries researches.

There are not many researches that explore how ERM effect changes during crisis and usually because of data shortage. S&P rating supplement by ERM criteria into index let researches to analyze wider period. Baxter, Bedard, Hoitash, & Yezegel (2010) analyzes ERM effect before, during and after crisis to monthly return data and security performance. Pre crisis results showed that ERM is not significant measure as after crisis, during crisis results shows the same that companies with strong ERM do not prevented them self-better than companies without strong ERM practices. As contrast after crisis period shows significant change in market performance after crisis and ERM started to have strong effect. This could mean that firms with strong ERM rebounded much more easily than those without ERM. Another hypothesis that was tested is ERM effect to ROA and Tobin's Q were significant effect was noticed to both measures, exempt is not clear how crisis effected ERM effect and if it's similar before and after crisis.

After crisis data analyzing literature review

We explore after crisis literature in order to see either there is significant change in results regarding ERM effect to firm's values and performance. First article that is interesting to be analyze is Nordic firms analyzes by Naciye, to be published in 2016. This empirical research results contradicts to Pagach & Warr (2010), Baxter, Bedard, Hoitash, & Yezegel (2010) findings and states that there is no significant effect of ERM to ROA or Tobin's Q. Authors comes to the

conclusion that probably shareholder does not see ERM as value adding practice or ERM implementation is lagging indicators and measured period was too short to catch ERM effect. Another interesting assumption that authors comes up with that regarding industries it seems that benefits of ERM are visible in particular industries especially finance industries.

Regarding ERM effect to internal performance measures (ROA) after crisis we see explore Shima, Mahmood, Musriyama, & Akbari (2013) empirical analyzes, this analyzes is interesting regarding its sample and scope as it covers 175 companies that are listed in Bursa Malaysia. As previous studies tend to specialize in specific sector like finance or insurance this study covers all sectors mainly manufacturing, services, raw material and others. Most attention is draw to structure of risk management effect to the performance measures like size of board, number of independent board members and other board of directors specifics. Main conclusion is that existence or risk management committee increases ROA but at the same time large number of committee members could have negative effect to ROA.

One of the most important studies mentioned is Bertinetti, Cavezzali, & Gardenal, 2013. Study is important in our study context as it analyzes 200 European listed companies' regardless industry and country. For ERM proxy their uses financial reports information about ERM implementation and CRO appointment. Results showed that ERM implementation increases firm value measured in Tobin's Q regardless industry. Also another important conclusion is that firm value was affected by financial leverage, profitability, size and beta while dividends and sales growth seems to be insignificant. These determinants could be used in further studies in order to define value model. Main implications are that market perceives ERM as value creating measure and not only spending. For future researches it is recommend to include control variables like performance measures. This study results showed ERM determinants that could be used in

European contexts and proves that regardless industries there is positive value and ERM relationship. Also another important factor is that regardless selected ERM determinant (in this case CRO appointment) it's possible there is positive relationship between firm value.

To sum up analyzes of pre- crisis and post crisis literature we can see that there is lack of consistency regarding results. Main reason why results differs so much could be variety of sectors, industries that are being analyzed.

1.4. How investors' attention translates to company's value?

While ERM effect to ROA is directly through the better performance or protection for shocks or disturbing events, ERM effect to Tobin's Q is through investors' expectations, therefore it is important to understand how investors' expectations reflects in the price of stocks (part of Tobin's Q measure). There are several main theory streams that represents main concept on how investors value stocks:

First one is **efficient market hypothesis** which explains theory behind stock prices changes. Classical definition of efficient market hypothesis by Fama (1960):

An 'efficient' market is defined as a market where there are large numbers of rational, profit 'maximisers' actively competing, with each trying to predict future market values of individual securities, and where important current information is almost freely available to all participants. In an efficient market, competition among the many intelligent participants leads to a situation where, at any point in time, actual prices of individual securities already reflect the effects of information based both on events that have already occurred and on events which, as of now, the

market expects to take place in the future. In other words, in an efficient market at any point in time the actual price of a security will be a good estimate of its intrinsic value (Fama, 1965)

There are several levels of efficient market that (Fama, 1965) identified: weak, semi strong and strong form. As strong form is explained in quote above while weak form of market efficiency means that investors consider just one type of information – historical stock prices. Semi strong is most appealing in practical terms and states that investors react to publicly available information. After (Fama, 1965) introduced Efficient market hypothesis there were empirical evidence for both sides to ground (Jensen, 1978) and reject efficient market hypothesis.

Second theory is “value investing” which is base for well-known fundamental analyzes method. “Fundamental analysis is one of the main instruments used for portfolio formation for many decades” (Kartasova & Venclauskiene, 2014, p. 256). Benjamin Graham and David Dodd in 1934 were the first who introduced “value investing” in their book *Security Analyzes* (Calandro, 2009). Value investing basically refers to investors who seeks for long-term investment, this type of investors basically are looking for undervalued stock and expect that in long run the value will rise. Basically value investors analyzes their potential investment target from business perspective and not relying to external credit rating agencies valuation. Almost all fundamental analysts starts with market value ratios and ends with factors analyzes that could determine long term growth as from our thesis perspective these factors could be same ROA or ERM measures.

Both theories: fundamental analyzes and market efficiency theories contradict in short term perspective. Detail comparison analyzes of these theories was performed by Kartasova & Venclauskiene (2014). Main argumentation against fundamental analyzes theory comes from efficient market hypothesis proponents, they state that prices of stock already reflects all the events

and publicly available information and investors „cannot beat the market“. Leading proponent of efficient market hypothesis Burton Gordon Malkiel stated: “if the flow of information is unimpeded and information is immediately reflected in stock prices, then tomorrow’s price change will reflect only tomorrow’s news and will be independent of the price changes today” (Malkiel, 2003, p. 59).

For both theories there are proponents from practical and theoretical fields, but at the same time it is important to consider these two different approaches to stock pricing. If efficient market hypothesis would make influence to thesis empirical tests then there should be no ERM effect or other measures effect to stock prices as according to theory it would be already reflected in the prices. In context of thesis question and goal it is expected that fundamental analyzes is widely used tool for stock valuation and we expect that investors analyzes company signals that reflect long term company performance.

1.5. Summary of literature review

ERM practice evolved through the years as requirements for sufficient ERM turned to non-financial sectors. As we noticed before crisis period we could call ERM standardization period as major standards that has influence to ERM practices were released (ISO 31000, COSO Enterprise Risk Management – Integrated Framework, FERMA and others). After crisis period we could call regulation period as various regulations in Europe and in the world developed and even creditworthiness agencies started to notice ERM practices as reliability measure. Not answered question remains whether just governments and regulatory bodies draw attention to ERM practices or investors also started to value EMR practices.

Another major discussion in literature is how ERM does makes impact to firms and whether there is ground to state ERM influence to firm performance. Majority of researches relates to standards concept of ERM benefit while Gates, Nicolas, & Walker (2012) analyzes ERM effect path in more detail analyzes by defining major links between general management and risk managamenet. Still Gates, Nicolas, & Walker (2012) does not contradics to the general oppinion regrading ERM effect to better firms performaces thought better objectives setting and performace improvement. Although Standards defined ERM influence to company in simillar way there are still different aproaches how unfluence could be measured for instance Pagach & Warr (2010) ERM effect is narowed to conpect of “avoiding lower tail events” (Stulz, 1996, p. 8), or Grace, Leverty, Phillips, & Shimpi (2015) eveluated revenue and cost efficiency. Although approaches are differend and in some cases effect of ERM is narowwed but main concept remains the same that **ERM should help company to procect and create enetrprices value.**

As theoretical background of ERM benefits are stated in literature and standards is that sufficient cause for companies to invest into quite expensive practices like ERM? There are various studies that analyzes ERM implementation determinants. As some determinants are more related to properties of company (size, ownership, diversifications and geography spread) other determinants are related more to the risk management aspects like existence of risk committee, CRO or audit committee, third type of measures are related to factors that had major influence to implement ERM like governance codes, shareholder view and other aspects. Some determinants are consequence of decision to implement ERM like CRO, risk committee or risk committee and other has major role in decision to implement ERM. Still we can see that there are inconsistencies between different studies regarding determinants of ERM implementation and practical aspects of ERM implementation remains important. **Regarding our main thesis question - Did credit**

default crisis draw investors' attention to companies' ERM practices in non-financial sector considering particular industry specific risks? – It is important to select such ERM implementation determinants that it be understood as ERM quality not only from theoretical but also from practical terms that investors would also perceive that measure as ERM measure. At the same time that measure should be not just signal for investors but also real ERM existence measure that would have effect to internal profitability measures.

ERM affect to company's performance remains main studies object before and after crisis periods. There are several major streams regarding ERM effect: the one related to internal performance measures such like ROA, cost and revenue efficiency and another related to market view and shareholders view (in most cases measured by Tobin's Q). Even though we analyzed before and after crisis literature there were no major tendencies regarding results whether effect of ERM changed. Main reason stated in majority of studies is lack of studies that analyzes before and after crisis periods and usually analyzes is limited to one of the periods. Another reason is that we can see from existing studies that they differ in scope regarding geography and industries being analyzed. As a consequence results of ERM are very different while some researches find significant ERM effect to ROA and Tobin's Q (Bertinetti, Cavezzali, & Gardenal, The effect of the enterprise risk management implementation on the firm value of European companies, 2013) others conclusions are different and they find no significant effect (Pagach & Warr, 2010). We could make conclusion what also most of the author's state is that effect of ERM is dependent on particular industry and geography (Spekle, 2012). This issue represent opportunity for further research as there is no consistent prove for ERM effect to firm's profitability or value. Also another interesting conclusion is that there is lack of sufficient prove that ERM affects all industries the same way therefore there is gap for further research to find industry specific results. Exception

from majority studies is study that covers wide geography (Europe) and sectors (financial and non-financial) is Bertinetti, Cavezzali, & Gardenal (2013) were analyzes period covers both before and after crisis periods. According to this study there is positive relationship between ERM and ROA and Tobin's Q. Although time and geography periods are wide this study lacks comparison of before and after crisis periods. This part of analyses helped to select appropriate companies' measures to evaluate company performance and value.

Last important section of literature review findings relates to investors' expectations translation to the value of company. In order to answer to this question most popular stock valuation theories were discussed in order to understand weather in theoretical and practical terms ERM could affect stock prices of enterprise. To conclude literature review findings in this section there are two main contradicting theories efficient market hypothesis and fundamental analyzes. These theories contradicts in context of publicly available information reflection to stock prices. While Efficient market hypothesis states that everything is already reflected in prices fundamental analyzes proponents states that there are some company specific measures or signals (one of them could be ERM implementation) that could help for investors to select companies that will be successful in long term. These contradiction are important and need to be considered while defining conceptual framework.

2. Research methodology

Literature review contributed to description of ERM implementation determinants in order to identify companies with ERM. At the same time it is important task for methodology part to select the most appropriate ERM determinant measures as ERM determinant measure should be not just signal for investors but also real ERM existence measure that would have effect to internal

profitability measures. Another major literature review contribution is overview of most widely used measures to evaluate company performance and value, considering major discussions and arguments against these measures during design of appropriate conceptual framework, technical and statistical model in methodology chapter these arguments should be taken into consideration. Therefore in methodology chapter we finalize execution of objectives: to describe ERM implementation determinants in order to identify companies with ERM by selecting most appropriate for our thesis goal and to select appropriate companies' measures to evaluate company performance and value.

And finally in order to prepare for sufficient empirical analyzes one of the major goal of this chapter is to design appropriate conceptual, technical and statistical model to evaluate ERM effect to company performance and value.

2.1. Theoretical conceptual model

Considering previous researches gaps in empirical studies our main goal of research is not only to find relationship between ERM and companies' value or performance as it was done in other researches (Bertinetti, Cavezzali, & Gardenal, The Effect of the Enterprise Risk Management Implementation on the Firm Value of European Companies, 2013) but also to find differences between periods before and after crisis. Moreover to explore differences between different sector specific risk by selecting – energy and telecommunication industries. These industries selected due to their tendencies to implement ERM and differences regarding their sector specific risk.

In order to reach thesis goal conceptual theoretical framework was design to understand initial relationships within ERM and company performance and values measures in order to select best methods to reach thesis goal.

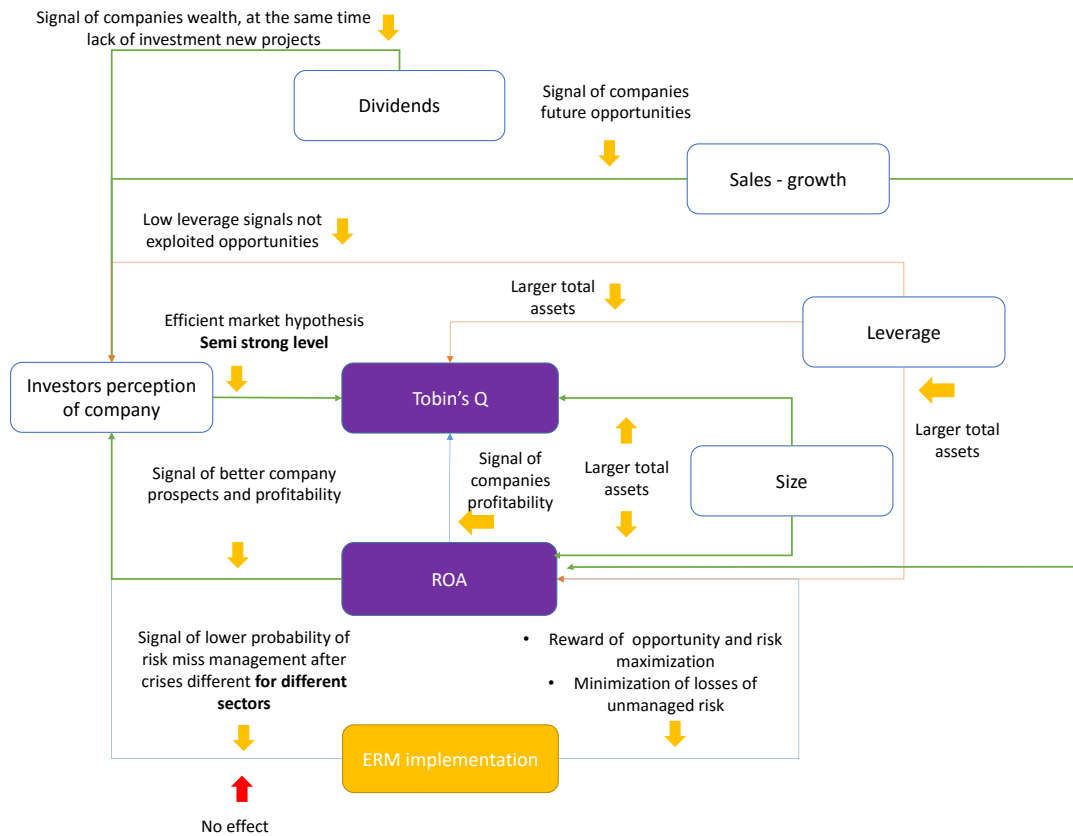


Figure 1 Conceptual theoretical framework (compiled by author)

As mentioned before there are two main streams of empirical studies of ERM effect to company - profitability measured by ROA and market value measured by Tobin's Q. These measures besides others like earnings variability or stock price variability are included into almost all ERM studies (see Chapter 1.3). At the same time it's important to differentiate different purposes that these two measures are used to measure. ROA is interpreted as historical accounting measure that could show internal ERM effect to firms performances while Tobin's Q the one that reflects expectations of investors (Liebenberg, 2008). There are debates which measure reflects better ERM effect but as we noticed in most studies Tobin's Q is more desirable indicator that

others accounting measures because there is less probability that it have been manipulated by management (Lindenberg & Ross, 1981). Although main thesis question is related to the investors perception of company and it follows that to Tobin's Q we use ROA measure in order to control whether ERM affected directly investors opinion or through ROA. Also ROA is included in order to track whether investor's view to ERM follow together with ERM impact to internal financial profitability measures.

Another interesting factor is before and after crisis periods and how ERM implementation effect to companies changed during this period. As comparing to the one of the most relevant studies regarding geography (200 European companies) Bertinetti, Cavezzali, & Gardenal, (2013) results showed that ERM implementation increases firm value measured in Tobin's Q regardless industry. At the same Bertinetti, Cavezzali, & Gardenal, (2013) study had no differentiation of periods and as model was run for the 2002-2011 period, for this reason it's not clear whether effect was before or after crisis. In order to get better understanding about pre and post crisis effect to Tobin's Q empirical results Baxter, Bedard, Hoitash, & Yezegel (2010) showed that ERM is not significant measure and had no effect before crisis as ERM do not prevented company from systemic risk, although it is noticed that companies with ERM rebounded better. As we can see there are initial signs for literature review that before and after crisis period had some major differences. As from theoretical stand point we expect that crisis made investor more risk averse and their started to notice companies with implemented ERM. As some other factor like S&P index change by including ERM introduction should have changed view towards ERM importance.

What are channels for ERM effect to ROA? Argumentation for ROA effect comes from COSO framework as there has always been high emphasis on ERM integration into strategic management and risk management was understood as measure for company to reach it defined

goals in strategy by protecting from obstacles (COSO, 2014 review). As it follows ERM should help to improve overall performance by maximizing risk and reward trade-off and minimize low tail events probability. Literature review showed that results often differs from sector and geography. As our geography is European countries and most of them are in European Union there is less dependency on particular country regulation or political environment as most of the countries shares same market conditions. Industry specifics remains main issue while we are analyzing two industries Energy and Telecommunication. As from ERM perspective there is no theory that base differences between sectors although ERM practices or particular tools and application for particular sectors could differ. The only assumption regarding differences in sectors could be that if particular sector has sufficient number of companies that practices ERM they could share tools and practices and in such way increase whole sectors ERM maturity. In this case Energy sector could have advantage regarding this theory as in most researches energy sectors is mentioned as third sector after finance and insurance which has mature ERM practices (Pagach & Warr, 2010). Another theoretical sectors difference could be inherent sectors risks that influences companis regardless their manigerial practices or paticulary ERM.

What are channels for ERM effect to Tobin's Q? As methods used in studies seems to have similar approaches and methods to evaluate ERM effect to enterprises there is still lack of studies covering wide range of periods for instance crisis effect. Only recent study shows that rebound period after crisis seems to have effect to firm's value more than before crisis (Baxter R. , Bedard, Hoitash, & Yezegel, 2010).

As our theoretical hypothesis states that there should be certain effect to Tobin Q by change in particular company corporate governance principals (in this case enterprise risk management) then it's important to consider stock valuation methods discussed in literature review (see Chapter

1.4). As our event is ERM implementation and source of information is publicly available annual reports data we expect that “rational profit maximizers” (Fama, 1965) will react to the newly available information instantly and that would reflect in the price of stocks.

Both theories: fundamental analyzes and market efficiency theories contradict in short term perspective. Main argumentation against fundamental analyzes theory comes from efficient market hypothesis proponents, they state that prices of stock already reflects all the events and publicly available information and investors „cannot beat the market“. Leading proponent of efficient market hypothesis Burton Gordon Malkiel stated: “if the flow of information is unimpeded and information is immediately reflected in stock prices, then tomorrow’s price change will reflect only tomorrow’s news and will be independent of the price changes today” (Malkiel, 2003, p. 59).

For both theories there are proponents from practical and theoretical fields, but at the same time it is important to consider these two different approaches to stock pricing. If efficient market hypothesis would make influence to thesis empirical tests then there should be no ERM effect to company stock prices (as part of Tobin’s Q) according to theory this signal would be already reflected in the price of stocks. Fundamental analyzes in context of research question would better reflect concept of ERM effect than efficient market hypothesis as we expect that investors **analyzes company signals** that reflect long term company performance.

Fallowing idea of fundamental analyzes and signals that investors analyzes event study is one of the methods that helps to explore how market reacts to new information regarding particular company. Using financial companies’ data event study examines how companies’ value changes after specific events (MacKinlay, 1997). This kind of study would allow us to determine is the effect of Tobin’s Q is instant, or it takes time for market to take into consideration such information.

Although event study would help to say more about ERM effect usually event study requires long period of data and exact event dates. In our particular case annual reports are issued by the companies about the same time, but exact dates are not known for this reason there is data limitation to perform such analyses that could be an area for further analyses. For this study we measure ERM effect for the next investment period that could have an effect on the quality of our model.

As Tobin's Q is affected not directly but through the market expectations what are the differences between sectors regarding market risks? Considering the Energy sector's main impact on the industry according to the Euler Hermes Group report 2016 Sector risk analyses (Euler Hermes, 2016) is:

- raw material variations (mainly oil prices);
- risk of bankruptcy regarding sudden raw material prices variation;
- possible M&A opportunities because of low oil sectors asset valuation;
- general sectors meltdown after alternative energy sources introduction.

As for the telecommunication sector according to the Euler Hermes Group report 2016 is (Euler Hermes, 2016):

- new products quickly change existing technologies;
- high merged probability;
- Price pressure regardless investment into innovation.

As we can notice from the current risk profile that risks of these sectors are quite standard. Thus, what are the main drivers that define a sector as more risky than others. From a conceptual side Energy

sectors seem to have more external risks and risk that could have “lower tail outcomes” (Stulz, 1996). In most cases Energy sector was defined as riskier sector because of wide sector specific risk has not only commodities price fluctuation, but also has complicated regulation environment, potential risk of major accidents or financial fraud. Regarding sector specific risk it is expected that investors will draw attention to the Energy sectors after crisis and as a consequence ERM would have effect to the Tobin’s Q.

Regardless different approaches to evaluate ERM there is consistency in empirical studies regarding control variables to control Tobin’s Q or ROA. Most popular are size of company, growth opportunities, leverage, dividends and market measures that reflect companies risk (beta). Companies leverage is one of the key measure is being analyzed while analyzing ERM financial effect (Pagach & Warr, 2010). These measure are selected to control ROA and Tobin’s Q variables. In order to control our main observed variables we defined other variables according to literature review that could have significant effect to the ROA or Tobin’s Q:

Why size of company is important to Tobin’s Q and ROA or ERM? Size of company is often mentioned as one of the determinants of the ERM implementation as larger companies tend to need more sophisticated management tools to ensure that communication in the organization about important issues is exalted in prompt manner. At the same time size of company directly affect Tobin’s Q and ROA measures. Hoyt (1999) finds a positive relation between firms’ size and performance.

Why leverage of company is important to Tobin’s Q and ROA? Leverage measure usually in business context is measure that should be in certain level between boundaries as to large leverage ratio could mean that companies are risking too much and there is possibility of

bankrupt. At the same time too low leverage ratio could mean that company is not using its potential and leverage ratio could increase profitability measures and firm value. Another interesting aspect is that financial leverage could increase firm value because of less cash for corrupt managers (Jensen, 1986).

Why sales growth is important to Tobin's Q and ROA? Sales growth is one of the measure that shows investors a sign that company is in expanding phase and there are great future prospect regardless internal operational excellence. On other hand this measure has direct effect to the ROA ratio as increase in sales without productivity decrease should increase general return.

Why dividends are important in the context of Tobin's Q? "Dividends payment can signal either a lack of new projects with positive NPV or the good status of the company, which can distribute the earnings produced" (Bertinetti, Cavezzali, & Gardenal, The Effect of the Enterprise Risk Management Implementation on the Firm Value of European Companies, 2013, p. 9).

To sum up with this chapter 2 objective was reached "to select appropriate conceptual model to evaluate company performance and value" and two main measures to measure company performance and value were selected ROA and Tobin's Q. In addition several other measures were select as important measures that has impact ROA and Tobin's Q in order to control other factors that are not related to ERM and mentioned measures. From conceptual framework discussion we can formulate hypothesis in order to reach objective 3 and 4.

2.2. Methods

As discussed in theoretical conceptual model part (see chapter 2.1) in order to reach thesis main goal we raise two hypothesis that will help to define statistical model and evaluate ERM

impact to company's performance and value with regards to particular industry specific risks. These hypothesis will be tested for separate periods before and after crisis in order to see changes before and after crisis periods:

Hypothesis 1: $H1_0$: *Tobin's Q will be affected by ERM implementation*

Hypothesis 2: $H2_0$: *ROA will be affected by ERM implementation*

Regarding hypothesis 1 we expect $H1_0$: *rejected before crisis, $H1_0$: **not** rejected after crisis.* Such results as we discussed before are expected because after crisis market started to value firms that has sufficient ERM and complex business environment more than before crisis, so it is expected that enterprises value will be higher due to ERM existence during crisis rebound period. As for industry effect we expect that Industry variable will be significant after crisis.

Hypothesis 2: $H2_0$ **not** rejected before crisis, $H2_0$ **not** rejected after crisis.

As for Hypothesis 2 we expect that industry variable will have no significant influence to the ROA. However ERM is expected to have same effect to firm's effectiveness ratio before and after crisis as ERM effect do not depend on market perception.

In order to test hypothesis there will be regression models selected that best fit data. For statistical analyzes we use statistical program STATA (for programing syntax see Annex B). In order to find best fitted model for our specific case there statistical tests will applied to determine which model reflects data specifics. In order to find best model to fit our data several tests will be

run in order defined whether fixed or random effects models should be used. Structure of procedures is provided below:

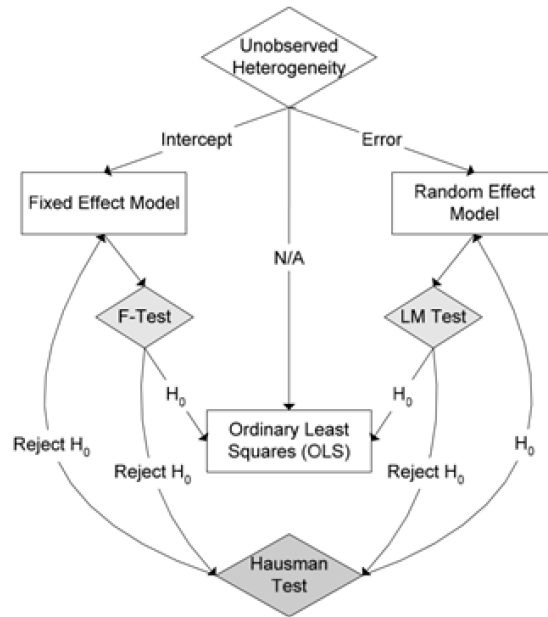


Figure 3 Model selection procedure.

From “Practical Guides To Panel Data Modeling: A Step by Step Analysis Using Stata” by Hun Myoung Park, 2011, p. 16

In order to find best fitted model for our specific case there were statistical tests will be applied to determine which model reflects data specifics: Breusch-Pagan Lagrange multiplier (LM) to estimate random effects, F-test for fixed effects and Hausman to determine which effect is stronger if in both case H_0 will be rejected). P significance value for these model will be used 0,05 see test results chapter 3.2. After that model selection in order to test hypothesis model will be evaluated according two main model quality determinants P value and R^2 . As for P value model will be considered model valid if value will be less 0,05 significant level. As seen from previous researches it's not expected R^2 to be very high for instance for similar research for European countries (Bertinetti, Cavezzali, & Gardenal, The effect of the enterprise risk management

implementation on the firm value of European companies, 2013) model R^2 value is between 0,12 and 0,16 what is considered relatively low R^2 value. Whether to reject or not to reject hypothesis will be tested by beta coefficient in regression model. Hypothesis will be accepted if beta coefficient in regression model will be not equal to 0 with p value lower than 0,05 significance level. In order to test hypothesis we construct such models:

Model 1 (for Hypothesis: Tobin's Q will be affected by ERM implementation)

$$Q = \alpha + \beta_1 ERM_{dummy} + \beta_2 Size + \beta_3 Leverage + \beta_4 Sales_growth + \beta_5 ROA + \beta_6 Dividends_dummy + \beta_7 Industry_dummy + \varepsilon$$

(1)

Model 2 (for Hypothesis: ROA will be affected by ERM implementation)

$$ROA = \alpha + \beta_1 ERM_{dummy} + \beta_2 Size + \beta_3 Leverage + \beta_4 Sales_growth + \beta_7 Industry_dummy + \varepsilon$$

(2)

Model 1 was used to test **Hypothesis number 1** and should reflect market reaction to the ERM implementation and show whether investors care about ERM practices. Original measure states that equity market value should be divided by equity book value but for practical terms we use more often used version in practices by investors. **Model 2** was used to test **Hypothesis number 2** and should reflect whether ERM influences company performance. For detail description of model variables see *Table 3 Research variables description*:

Table 3 Research variables description

No.	Variable	Abbreviation	Measurement	Source
1	Tobin's Q	Q	Outstanding stock * stock price (average open and close prices) / Total assets (Tobin & William, 1968)	Bloomberg data base
2	Return on assets	ROA	Net income/ total assets	Bloomberg data base
3	Enterprise risk management implementation date	ERM	0 – value for that year if no information about ERM implementation 1 – value for next year after ERM mentioned in annual report	Annual reports of companies
4	Size	S	Log Total assets	Bloomberg data base
5	Leverage	L	Total debt/ total equity	Bloomberg data base
6	Sales - Growth	SG	Sales (current year) – Sales (previous year)	Bloomberg data base
8	Dividends dummy	D	0 – if there is no payment of dividends 1 – if dividend less than 2 EUR per share 2 – if dividend more than 2 EUR per share	Bloomberg data base
9	Industry dummy	I	0 – if Energy industry 1 – if telecommunication industry	Amadeus data base

In order to define what indicates that there are ERM implemented literature review was performed and most popular ERM determinants were selected that could lead to mature ERM practices like risk CRO appointment or equivalent organizational structure risk committee, risk department (Baxter R. , Bedard, Hoitash, & Yezegel, 2013) establishment. This way of ERM dummy selection allows us extend period of analyzes as alternative ERM determinants make limits

in time (S&P ratings is available only from 2008) or limits in number of possible respondents (in case of survey). Even though considering this type of studies usually for ERM determinants survey methods is being used for our hypothesis public available information serves better as firm's value much relates to the investors' expectations and in most cases investors have information about companies from public sources. Although our second model relates more to the accounting measure ROA and in this case qualitative information would serve better we make compromise as public information such as CRO appointment also has influence to internal measures.

While ERM effect to firm's value could be analyzed by using publicly available information then firms performance usually need more precise measures than publicly available information which usually does not reflect ERM maturity. In order to find effect to accounting measures like ROA, leverage, ROE or others ERM should be at certain maturity that is hardly determined by CRO appointment or another ERM determinants from publicly available information although there are researches that shows possible relationship between firms financial performance and CRO appointment (Pagach & Warr, 2010).

As survey or indexes are popular and seems to be most exact methods to identify ERM what are drawbacks of this method? Considering FERMA report there are still majority of companies that has customizes enterprise risk management systems and in that sense there is lack of studies that applies customizes risk management models. For this reason survey could show not more than compliance to certain ERM model. For this reason such results would lead us to conclusion that certain ERM practices increases firms performance. As alternative for survey ERM determinant appointed CRO has increasing requirements for efficiency of ERM regardless specific model for ERM being used. As ERM is still huge investment for companies there is pressure for CRO to make ERM as competitive advantage that helps company to generate stabile and profitable

performance. New tendencies of risk management pressure ERM transformation to become competitive advantage (Platt, 2004).

In order to evaluate differences before and after European Sovereign Debt Crisis effect there will be model run two times for pre-crisis period and rebound period as defined below:

- Pre-crisis period: from 2003 to 2006 (including)
- Rebound period: from 2010 to 2014 (including)

Crisis period from 2008 to August 31st, 2009 to December 31st will not be included into research because effect to Tobin's Q and ROA will be because of crisis and not ERM. Although ERM has second purpose not just to increase firm's value and effectiveness but also to protect company from long tail events European Sovereign Debt Crisis is not the best example as this crisis had systemic effect to the economy and market was too destabilized.

2.3. Data selection

In order to test our hypothesis there were several data collection stages:

- Overall data of both sectors enterprises collection in Europe (Amadeus data base);
- ERM determinant data collection (Annual reports);
- Financial data collection (Bloomberg data base).

Starting point for data collection was to define general energy and telecommunication sectors enterprises set. In order to limit our data set of companies' very large companies were selected from Amadeus data base. Such set limitation was selected after literature review as we noticed that size of company is important criteria of ERM implementation. Thus large enterprises

with higher complexity (expressed by industry and products spread) tend to implement ERM practices (Baxter R. , Bedard, Hoitash, & Yezegel, 2013). After this limitation we had 152 energy sector companies and 78 telecommunication companies. According to sample size usually for similar researches varies from 106 to 300 firms. Sample size also depends on the method chosen if there is publicly available information being analyzed then it is easier to collect bigger sample of data if qualitative method is being chosen then smaller samples are being used. Also by defining sample size it is very important to have sample sufficient for country or region size.

For ERM implementation existence data collection annuals reports were selected as best source of reliable information. Large and publicly traded enterprises tend to have separate section for investors in their corporate websites. Information of ERM existence was searched from each by analyzing different period's annual reports looking for information about ERM implementation or risk committee/ risk department or risk management responsible appointment and date when it was mentioned in annual report.

Even though for ERM maturity qualitative (survey) analyzes method would be more valid as risk management specifics could be different in every company but this method of data collection is more expensive and smaller sample usually is collected than using second sources or publicly available information. For this reason in majority of studies ERM implementation is indicated by Chief risk officer announcement, S&P index results or other publicly available sources in data bases. After ERM information for companies was selected set of data narrowed to 68 for energy sector and 28 for telecommunication sector. Financial data for Model 1 and Model 2 calculations was selected from Bloomberg data base and in order to balance panel data several companies were rejected as there was missing data for several time periods. Finally after balancing data for energy sector we have 51 company and for telecommunication 21 company.

2.4. Research framework limitations

Major limitations regarding this particular research design relates to the ERM existence measure. As we discussed previously first major weakness that could influence research results is that ERM effect to ROA could be lagging and there is no general rule when effect should be detected. For this reason we will be using 1 year lag of ERM implementation date for ROA calculation but at the same time 1 year period is not general rule that could be used in all cases so problem of unpredicted effect of ERM to ROA remains. At the same time alternative methods to collect ERM maturity for stated period are too expensive has other limitations usually smaller sample size and geography spread. As alternative methods would not allow us to gather data to base our main question we use existing ERM determination factor with certain limitations. In Tobin's Q case effect should be instant but at the same time event study method could help to capture whether effect of ERM implementation remains same in long period or there is just instant reach for short period. As there is not available data to construct sufficient model for event study there could be limitations while interpreting results regarding ERM effect to Tobin's Q as there could be just short term effect that will not be reflected in analyzes results.

Also there is limitation regarding ERM maturity. It could be that ERM implementation is announced in cases when ERM is enough mature to go public or in other cases just at the start of ERM implementation. This factor could affect studies results interpretation as effect to ROA or Tobin's Q could be lagging. Furthermore period of ERM implementation vary in time. For this reason panel will not be balanced for all periods (pre-crisis, crisis and rebound periods). Also after crisis period according other researches seems to be catalyst for ERM implementation.

Another limitation less related to the ERM implementation is structural differences between countries regarding Tobin's Q and ROA. There are a lot of changes in Europe before and

after crisis. Some countries joined European Union and in these countries could be influence because of investment injection from European Union and not natural business environment. These facts could decrease our model reliability.

Some of mentioned limitations could be eliminated by selecting different ERM measure but at the same time other methods like surveys and indexes have other limitations that would not allow to perform pre and post crisis analyzes.

3. Empirical Research Results and Discussion

In order to reach thesis goals and prove hypothesis there were several statistic techniques used at first descriptive statistics to be familiar with basic variables measures and evaluate whether data used for regression model is balanced, then correlation analyzes for better understanding about internal model correlation and then hypotheses were tested using best fitted panel data models.

3.1. Descriptive statistics

In order to be able to reach thesis objective with defined research design we need to evaluate properties of our data collected. In this chapter ERM implementation and companies financial data properties will be evaluated using descriptive statistics model starting with ERM implementation data.

3.1.1. ERM implementation data descriptive statistics

Although to run Panel data model we can use balanced and unbalanced data besides that “unbalanced panel data entail some computation and estimation issues” (Hun Myoung Park, 2011, p. 5). As we have relatively small number of time periods (4 years for before crisis and 4 years for

after crisis period) unbalanced model would be difficult to interpret. At first companies with unbalanced financial data were omitted from further analyzes (see 2.3 chapter) and companies with no annual reports data (no ERM existence source). At this section we want to see whether ERM implementation is balanced between periods that we want to analyze see table *Figure 4 ERM implementation by year in Energy and Telecommunication sectors* for ERM implementation by periods and for detail statistics of ERM implementation see Annex A.

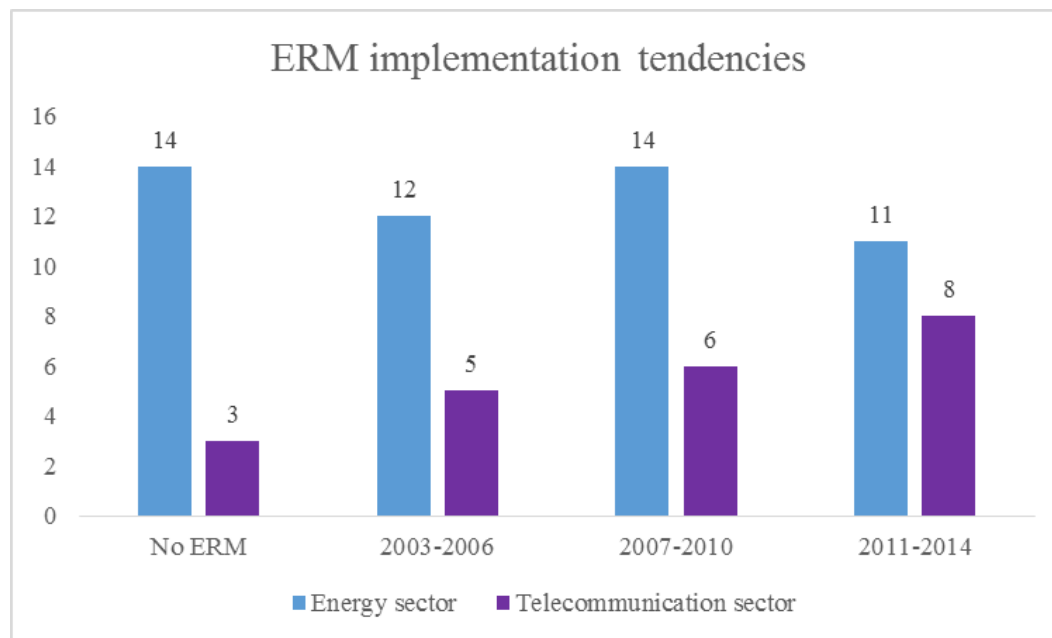


Figure 4 ERM implementation by year in Energy and Telecommunication sectors (compiled by author)

As we can see from Figure 4 in both sectors ERM implementation among large energy and telecommunication companies was popular tendency before and after crisis. Until year 2014 year 73 % of Energy sector companies implemented ERM, as in telecommunication sector 86 %. While evaluating these results we should take into consideration that we omitted companies with unbalanced financial data and whole sample could have different results as companies that

provided consistent information for public could be more eager to impress investors by sophisticated ERM practices.

Another important factor regarding provided data is that we have in both industries balanced data of companies that implemented ERM and have not implemented ERM. This property of our data allows us to perform panel data analyzes. Regarding telecommunication sector we could notice that from the 2003 the number of ERM implementation cases increased in liner tendency as in energy sector there is small decline in implementation cases. Another interesting tendency to notice is that before crisis Energy sector had twice more ERM implementation cases compared to Telecommunication sector while after crisis new ERM implementation cases in both sectors equalized.

From these tendencies we can see that Energy sector could have better experience in ERM implementation before crisis as Telecommunication sector just started to implement ERM practices. Another note important to mention that after crisis period both sectors had more ERM implementation cases than before crisis, that could mean two things 1) companies started to understand value of ERM or 2) external environment (investors, government or shareholders) put pressure for companies management to introduce such practices.

3.1.2. Financial data descriptive statistics

In order to understand how crisis affected our models variable we performed descriptive statistics of financial data. This analyzes could help to identify what effect crisis had to general tendencies of models variables, if variables are strongly affected by structural sectors changes or decline than these tendencies should be taken into consideration while interpreting our hypothesis tests. See *Table 4* Descriptive statistics (2003 – 2014) for pre-crisis and after crisis periods models variables mean and standard deviation changes.

Table 4 Descriptive statistics (2003 – 2014)

Variable	Mean (2003-2006)	Mean (2011-2014)	Mean change	Standard deviation (2003-2006)	Standard deviation (2011-2014)	Standard deviation change
Tobin Q (E)	0,77	0,40	-48 %	0,53	0,27	-49 %
Tobin Q (T)	0,98	0,65	-33 %	0,75	0,46	-39 %
ROA (E)	8,32	3,49	-58 %	6,74	6,19	-8 %
ROA (T)	4,24	4,53	6%	8,10	8,97	11 %
Sales gr. (E)	18,52	3,2	-82%	30,59	17,28	-44 %
Sales gr. (T)	7,28	-3,22	-144%	19,52	8,94	-54 %
Leverage (E)	30	32,35	+7%	17,07	13,59	-20 %
Leverage (T)	29,47	36,23	+22%	16,16	21,06	30 %
Log Size (E)	3,90	4,31	+10%	0,72	0,61	-15 %
Log Size (T)	3,85	3,85	0 %	0,98	1,01	3 %

Note. Here E- Energy sector, T – telecommunication sector.

From first glance at data there is substantial decrease in value of our dependent models variables as Tobin's Q decrease decreased in both sectors by large percentage (Energy – 48%, Telecommunications – 33%). Main reasoning behind it is that both sectors as mentioned before are capital intensive and while assets does not change so quickly stock prices fluctuation mainly determines Tobin Q value. On another hand we can see substantial decrease in standard deviation of Tobin's Q that could signal that crisis effect was systemic and affected all sectors companies quite similar and prices of stocks decreased to similar level.

In general Tobin's Q value between 0 and 1 usually considered as low value, which means that replacement of total assets of firm is higher than market value of firm (Tobin & William, 1968). Another reason for these specific sectors Tobin's Q decreased value could be new innovations and technologies that requires companies to change their assets and technologies. Our sample covers just largest sector companies so this effect is stronger as assets could not be quickly

replaced. From our thesis goal perspective effective enterprises wide risk management should help companies to cope with these problems better so after crisis period is decent period to notice risk management effect. Standard deviation is also import measure to consider and has effect to our models results. We can see from standard deviation of **Tobin's Q** in all cases it's considerably high and this could have effect to our statistical model results and quality of model.

Another import measure to discuss is ROA. This measure tend to be industry specific measure and we can see it from results, as Energy sector has average ROA of 8.32 and telecommunication 4.24. Apart from that after crisis period seems to equalize this measure in both industries. Standard deviation remains almost the same and comparing to absolute value of ROA measure standard deviation seems to be high.

Energy sector ROA decile could be explained by - 82 % of sales growth decrease and regression analyzes should show this relationship. **Major drawback of such decline that other dependencies could be difficult to detect in regression.** Similar situation with telecommunication sector as decrease is even bigger that in Energy sector and reaches -144 %. This major decrease could also affect model and decrease other independent variable effect to dependent variable.

Considering other two measures leverage and size of company these measures seems to be more stable than previously discussed measures and are similar among industries for this reason no major expected effect to quality of model.

To sum up descriptive statistics chapter there are structural changes in selected industries that could have dual effect 1) on the one hand structural changes could show how ERM help companies to deal with volatile environment and changing market and 2) on the another hand huge

decline of specific variables could affect model too strong and eliminate other important variables effect. For instance sales growth decline could strongly affect ROA and reduce effect of ERM.

3.1.3. Correlation analyses

Before defining regression model we run correlation analyzes for our models data separately **for both industries in order to define main differences between sectors before and after crisis**. See *Table 5 Telecommunication and energy sectors correlation matrix before crisis* to see how model independent variables and dependent model variables correlate.

Table 5 Telecommunication and energy sectors correlation matrix before crisis

Telecommunication before crisis								Energy sector before crisis							
	Q	ROA	ERM	SG	L	S	D		Q	ROA	ERM	SG	L	S	D
Q	1							Q	1						
ROA	0,53	1						ROA	0	1					
ERM	-0,25	0,04	1					ERM	0,05	0,29	1				
SG	0,15	0,04	0	1				SG	-0,04	0,09	0,05	1			
L	0,15	-0,08	0,08	-0,12	1			L	-0,33	-0,27	-0,1	-0,01	1		
S	-0,47	0,05	0,18	-0,18	0,5	1		S	-0,33	0,17	0,14	-0,16	-0,30	1	
D	-0,04	0,37	0,08	-0,08	0,25	0,58	1	D	-0,28	0,14	0,09	0,07	-0,15	0,20	1

Here *Q* – Tobin's *Q*, *ROA* – return on assets, *ERM* – ERM dummy, *SG* – sales growth, *L* – leverage, *S* – size, *D* – dividends. *Very week* – [0;0,19]; *Week* – [0,20-0,39]; *Moderate* [0,40;0,59] according to (Evans, 1996).

As we can notice from correlation matrix results moderate correlation is strongest degree among our variables. While in energy sector strongest level of correlation is week. Week correlation could be due to random individual effects among groups as we saw in Chapter 3.1.2 standard deviation of variables is quite large. Even though correlation between variables is week, we have some level of correlation among independent variables. For instance **Tobin's Q** in telecommunication sector is considered to be quite significant -0,25 as in Energy sector we have

almost 0 correlation. ERM effect to **ROA** is detected in Energy sector with week correlation degree while in 0,29 while in telecommunication sector there is no correlation.

Same with ERM effect to other dependent variables. We can see that there are major differences between industries as expected with ERM, but also among other dependent variables. **This preliminary analyzes show us that industry specifics should be accounted and included into model.** Another interesting relationship that we see is **ROA** and **Tobin's Q** correlation (moderate in Telecommunication sector), even though this correlation is expected we need to consider this relationship in our hypothesis tests.

As before crisis there were major differences between sectors we perform after crisis correlation analyzes see *Table 6 Telecommunication and energy sectors correlation matrix after crisis results.*

Table 6 Telecommunication and energy sectors correlation matrix after crisis

Telecommunication after crisis								Energy sector after crisis							
	Q	ROA	ERM	SG	L	S	D		Q	ROA	ERM	SG	L	S	D
Q	1							Q	1						
ROA	0,57	1						ROA	0,35	1					
ERM	0,04	0,06	1					ERM	0,29	0,12	1				
SG	0,33	0,08	-0,06	1				SG	0,2	0,18	-0,02	1			
L	-0,59	0,15	-0,01	-0,25	1			L	-0,05	-0,01	-0,02	0,01	1		
S	-0,29	0,02	0,25	-0,12	0,17	1		S	-0,04	0,09	-0,14	-0,14	-0,4	1	
D	0,27	0,38	0,33	0,08	-0,31	0,3	1	D	0,1	0,25	0,02	-0,07	0	0,2	1

Note. Here Q – Tobin's Q, ROA – return on assets, ERM – ERM dummy, SG – sales growth, L – leverage, S – size, D - dividends. Very week – [0:0,19]; Week – [0,20-0,39]; Moderate [0,40:0,59] according to (Evans, 1996).

For post crisis period we could notice stronger Tobin's Q relationship with ROA, and stronger ERM and Tobin's Q relationship but mainly in Energy sector. **From first sight that correlation analyzes proves that after crisis market started to value ERM more that before**

crisis in Energy sector. While we can see that ERM and ROA relationship decreased, main reason could be dividends effect to ROA.

To sum up correlation analyzes results we could conclude that some relationships are visible but still in correlation is considered weak in most cases one of explanation could be great differences among enterprises and standard deviation of variables. **Another important conclusion is that there are major differences between industries as expected and excepted to be considerably significant in the model.**

3.2. Selecting model for Hypothesis 1 and 2 testing

In order to detect presence of random or fixed effects in our model set of tests were applied by determined sequence in Chapter 2.2. Before testing for best model test was performed in order to detect heterogeneity problem. For all models 1 and 2 and before and after crisis period's heterogeneity problem was detected ($p > 0,05$) (see detail results Annex 0). To control data Heteroscedastic of models Robust Standard Errors were used (Hoechle, 2007).

As defined in Chapter 2.2 we performed Breusch-Pagan Lagrange multiplier (LM) test to test for random effects and Hausman test for all models (see results in the table F-test to test whether there is fixed effect). For detail results see Annex B.

Table 7 Statistical model selection tests results

Model	LM1 test H_{lm0} = there is no random effect	F – test H_{f0} = there is no fixed effect	Hausman Test H_{h0} = there is random effect
2003-2006			
Tobin's Q	H_{lm0} - rejected	H_{f0} - rejected	H_{h0} rejected
ROA	H_{lm0} - rejected	H_{f0} - rejected	H_{h0} not rejected
2011 - 2014			
Tobin's Q	H_{lm0} - rejected	H_{f0} - rejected	H_{h0} not rejected
ROA	H_{lm0} - rejected	H_{f0} - rejected	H_{h0} not rejected

As we can see almost all models qualify for random effect models, except Tobin's Q (2003-2006), even though as LM H_{lm0} rejected was reject we still can chose random effect model for consistency with other models and dummy variables that are important in our analyzes, for instance, industry, that Fixed effect model omit it due to collinearity. Radom model show us that that there are individual level effects that in our cases could be differences between European countries as most of the countries has just several large Energy industry and Telecommunication industry companies. Autocorrelation we test with hypothesis tests and no of the models has autocorrelation see annex 0.

3.3. Hypothesis for the Model 1 test

Our first hypothesis is more relate to market view towards ERM benefit rather than true ERM effect to the enterprise results. It was formulated:

Hypothesis 1: H_{1o} : *Tobin's Q will be affected by ERM implementation*

¹ The Breusch-Pagan Lagrange multiplier

In order to capture pre- and post- crisis differences to Tobin's Q two model were constructed and separate regressions were performed. Result provide in the table below, for detail results see Annex B.:

Table 8 Hypothesis 1 test results

Variable	2003-2006		2011-2014	
	Coef.	p value	Coef.	p value
ROA	0,006	0,434	0,09	0,004***
ERM	0,15	0,072*	0,01	0,004***
Industry	-0,19	0,281	-0,21	0,004***
Sales growth	0,00	0,600	0,009	0,411
Leverage	-0,06	0,024**	-0,006	0,002***
Size	0,24	0,028**	-0,110	0,006***
Dividends	-0,0038	0,950	0,062	0,176
Coef.	2,07	0,000***	1,15	0,00 ***
Model fit measures				
R ² (overall)		0.21		0.38
P value		0.00004		0.0000
Wald chi		26.69		40.39

Note. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

As we can see from the table above from model fit measures model fits our data with quite low R². However, when we have cross-section data R square could be lower due to differences in individual entities. As in both industries cases there are just several companies in one country and in most cases just one company from country, then specific countries effect becomes entities effect. Countries differences could be due to different regulation policy for instance regulation plays major role in Energy sector where prices of services are being regulated by the regulating authority in country.

For pre-crisis period we reject H₀ as ERM coefficient p value is $p < 0,1$, when we expected 0,05, for after crisis period we do not reject H₀ as ERM coefficient is 0,004 and lower than 0,05 and has beta coefficient value larger than 0 (0.01).

Hypothesis we see no effect to Tobin's Q before crisis, while after crisis we see strong relationship between ERM and Tobin's Q while coefficient larger than 0 ($\beta=0,01$). As seen from results we could not reject hypothesis that after crisis relationship between Tobin's Q is stronger than before and investors are looking back to mature corporate governance practices. Regarding industry specifics we see difference just after crisis as before there were no significant impact and mainly in energy sector.

3.4. Testing second hypothesis ERM impact to ROA

Second hypothesis is more relate to profitability measures reflection of ERM benefit rather and it was formulated: **Hypothesis 2: H_{2o} : ROA will be affected by ERM implementation.** See results in table *Table 9 Hypothesis 2 test results*, for detail results see Annex B.

Table 9 Hypothesis 2 test results

Variable	2003-2006 Coef.	2003-2006 p value	2011-2014 Coef.	2011-2014 p value
ERM	2,8	0,021**	0,79	0,431
Industry	3,8	0,036**	-2,40	0,098*
Sales growth	0,006	0,467	0,078	0,000***
Leverage	-0,14	0,000***	-0,12	0,000***
Size	0,674	0,476	-0,16	0,840
Coef.	3,95	0,370	7,8	0,040**
Model fit measures				
R ² (overall)		0.16		0.16
P value		0.0000		0.000
Wald chi		114.55		38.75

Note. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

As we can see from the table above from model fit measures model fits our data with quite low R². Reasoning behind such low R² is probably the same as in the first hypothesis testing. We can see that our hypothesis could be considered as not rejected as we see ERM effect to the ROA

before crisis with industry differences mostly in energy sector. After crisis period seem not to go align with our initial hypothesis as there is no significant effect of ERM and major influence to the ROA is made by growth of sales and leverage measure. Major reasoning behind this assumption could be structural changes in both sectors as Energy sector is currently changing drastically (from traditional sources of energy to alternative sources), same changes in telecommunication sector were developing new technologies could very quickly change leaders of sectors, also as we so from descriptive statistics part Telecommunication sector is changing and general ROA decreased after crisis drastically. For pre-crisis period we do not reject H_0 as ERM coefficient p value is $p(0,021) < 0.05$ and ERM beta coefficient value is larger than 0 and is equal to 2,8 for after crisis period we reject H_0 as ERM p value is higher than 0,05.

3.5. Discussion

Goal of thesis was to ascertain whether after crisis the effect of implementing ERM to the market value and performance of companies has changed in non-financial sectors Energy and Telecommunication?? There were 4 objectives raised in order to reach main thesis goal.

As **Objective 1** was to describe ERM implementation determinants after literature review we find out that some ERM implementation determinants are more related to 1) properties of company (size, ownership, diversifications and geography spread) other determinants are related more to 2) the risk management aspects like existence of risk committee, CRO or audit committee, 3) third type of measures are related to factors that had major influence to implement ERM like governance codes, shareholder view and other aspects. In order to reach our thesis main goal 2) type of determinants was chosen in order to reflect investors view to ERM.

Objective 2 was aimed to select appropriate conceptual model to evaluate company performance and value. Two main measures were selected **Tobin's Q** and **ROA**, while first measure was directly related to research question and investor's perception of ERM practices, ROA measure was chosen in order to control whether investors react to ERM implementation fact or Tobin's Q is affected by ERM because ROA was effected in first places and investor's value.

As for **Objective 3 and 4** we tested chosen hypothesis regarding our constructed model. For detail test results see chapter 3.3, for generalized results see Figure 5.

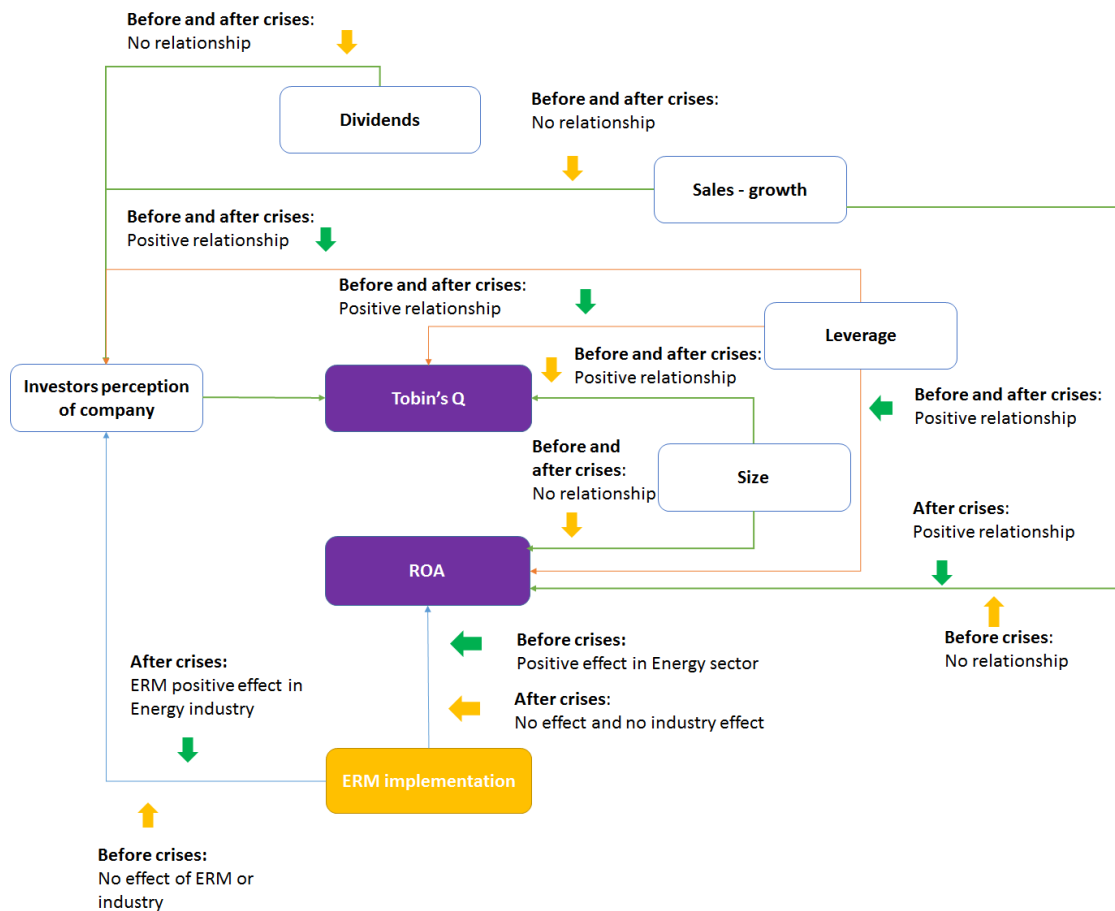


Figure 5 Summary of generalized results of Model 1 and Model 2 (compiled by author)

At first it's important to discuss results of **Model Tobin's Q** as this model is directly related to our main question. **As we can see from results provided before crisis there were no effect of ERM to Tobin's Q measure at any industry.** These results complies with our initial assumptions that before crisis investors were not interested into ERM as there were not expectations that market of market collapse. As comparing to the one of the most relevant studies regarding geography (200 European companies) Bertinetti, Cavezzali, & Gardenal, 2013 results showed that ERM implementation increases firm value measured in Tobin's Q regardless industry. At the same time main difference between these studies was that in Bertinetti, Cavezzali, & Gardenal, 2013 study there was no differentiation of periods and model was run for the whole period from 2002-2011, for this reason it's not clear whether effect was before or after crisis. In order to get better understanding about pre and post crisis effect to Tobin's Q empirical results from financial sector - Baxter, Bedard, Hoitash, & Yezegel (2010) showed that ERM is not significant measure and had no effect before crisis as ERM do not prevented company from systemic risk, although it is noticed that companies with ERM rebounded better.

Complementary arguments to explain why ERM does not affect Tobin's Q before crisis could be windrowed from context of ERM management discipline development. As we noticed before Enterprises risk management term become mentioned widely around 2004 (COSO, 2014 review) and there were lack of studies explaining benefits of integrated risk management. Even though ERM practices were practically implied before crisis in several enterprises (see Chapter 3.1.1) publicly it was standardization period and there were just initial steps in discussing benefits of ERM or analyzing different standards and practices. As we determined in our conceptual framework ERM affects Tobin's Q through investors perception of company so even though investors new about ERM implementation in particular company there could have been no united

opinion about benefits of ERM. From before crisis data descriptive statistics we could notice that Tobin's Q in both sectors had quite large standard deviation and these differences between companies could have affected the results.

As for after crisis results regarding Tobin's Q we see that ERM has significant impact to Tobin's Q in Energy sector. These results confirm *Bertinetti, Cavezzali, & Gardenal, 2013* results were ERM had significant effect to Tobin's Q in European large enterprises from financial and non-financial industries. This effect was expected before hypothesis tests as we presumed that market after market and investors experienced systemic risk investors became very precautions. Another argument why after crisis period investors started to value ERM more could be increasing number of companies that had implemented ERM this means that experience in ERM in non-financial sectors also grew. Another important trigger could have been S&P creditworthiness rating which showed importance of such practices for company's reliability. Baxter, Bedard, Hoitash, & Yezegel (2010) analyzed ERM effect before, during and after crisis to monthly return data and security performance using S&P rating as ERM implementation knowledge source. Even though monthly return data and security performance does not directly implies that Tobin's Q should be effected but stock price is one of the Tobin's Q components, therefore we could state that S&P rating had significant effect to investors view after crisis towards companies with mature ERM practices.

Another interesting aspect of results towards Tobin's Q after crisis is differences between sectors. From performed panel data regression we can see that ERM had effect to Tobin's Q particularly in Energy sector. Potential differences between sectors we noticed from literature review as there were no consistency between results of empirical studies performed for different sectors. At the same time there are studies that showed regardless industries that there is positive

value between ERM relationship and firm's value (Bertinetti, Cavezzali, & Gardenal, The Effect of the Enterprise Risk Management Implementation on the Firm Value of European Companies, 2013). Although particular study showed that there is no dependencies regarding industry but statistical model did not had industry variable to control differences between sectors. Another research that analyzed industries dummies (services, manufacturing, raw material and others) stated that "Any study on relationship between ERM and firm performance would be better if it is narrowed on specific industries because level of risk in any industry could be different" (Shima, Mahmood, Musriyama, & Akbari, 2013, p. 694). So far we could state that majority of studies find industry effects to be significant regarding ERM effect to Tobin's Q and thesis results are consistent.

Another question that remains open why in particular sectors firm's value and performance is effected more by ERM than others? Although there are no particular studies regarding non-financial industry specifics reasoning for our results in Energy sector comes from context of ERM implementation in both our explored sectors. As we noticed from the descriptive statistics after crisis period Energy sector had twice more ERM implementation cases comparing to telecommunication sector. Also energy sector always was seen as second after financial sector that had higher sector specific risk level regarding commodities risks, disaster risk and others.

Finalizing discussion about Tobin's Q and ERM effect it's is important to mention that other independent variables like sales growth, dividends had no significant effect to the Tobin's Q measure while leverage and company sizes had one. Initial observation from such results is that variables that affected Tobin's Q from investor's perception of company had no effect to Tobin's Q while variables directly affect Tobin's Q had one (as leverage directly affect total assets). "Results also indicate that firms with greater financial leverage are more likely to appoint a CRO

and company size is significant in explaining the ERM adoption” (Bertinetti, Cavezzali, & Gardenal, The Effect of the Enterprise Risk Management Implementation on the Firm Value of European Companies, 2013, p. 6). As from investors perspective it could be that companies with higher leverage and size are seen as riskier and could initiate investors to consider ERM efficient for such companies.

In order to reach achieve Objective 3 (*To design appropriate conceptual, technical and statistical model to evaluate ERM effect to company performance and value*) and 4 (*To apply model designed and evaluate ERM impact to company's performance and value with regards to particular industry specific risks*) completely we are interested in ERM effect to ROA. Starting with pre crisis results we noticed that there is ERM effect to ROA before crisis but particularly in Energy sector. As for ERM effect to ROA there are numerous studies that proves relationship between ERM and ROA as previously mentioned Shima, Mahmood, Musriyama, & Akbari (2013) empirical study were most attention is directed to structure of risk management effect to the performance measures. Risk management organizational function structure is defined by size of board, number of independent board members and other existence of risk committee. Main conclusion was that existence of risk management committee increased ROA but at the same time large number of committee members could have negative effect to ROA. Even though our ERM existence criteria was broader (from risk management department existence to risk management function appointment to audit department) results shows that regardless industry there is ERM effect to the ROA. Another aspect of ROA results was that none of the studies identify differences between sectors regarding ROA as there were differences regarding Tobin's Q. Our initial hypothesis assumption was that there will be no differences between sectors. This test results are

important as emphasizes differences between sectors not only in investor's perception that are translated through Tobin's Q but also to profitability measures of company.

In order to explain differences between sectors there is no information from the literature review to explicitly validate such results and sectors differences could be object for further studies. At this point considering best available information argumentation for sectors differences comes from the standards theory and conceptual framework. Risk management should be tailored to organization culture, capabilities and contexts (ISO, 2009). As in practical terms that means that even though there are common practices in risk management and tools besides that every company tailor tools and practices best to their contexts and organizations. As we noticed from descriptive statistics Energy sector was the one who started implementing ERM practices quite widely in its practice at the same time it could be that overall more extensive sectors experience in Energy sectors risk management had major influence to tools and practices development for that particular sectors. Another important factors is that regarding ROA measure in different industries as in Energy sector standard deviation (6,74) value is lower that average value (8,32), in telecommunication sector standard deviation (8,10) is twice higher than average value (4,24). These results showed that telecommunication sector companies had major differences and ROA variation was significant and could have affected model by making telecommunication sector results of ERM less visible. Regardless main reason of differences in industries it's visible that sector has own internet risk portfolio and one template or unified process could not control different sectors risks portfolio.

ROA after crisis. If we found significant relationship between ROA and ERM before crisis than after crisis there is no significant impact on ROA. Our initial assumption based on literature

and theory review did not showed signals of ROA effect possible decrease after crisis. Reasoning for no ERM effect could be structural changes in sector and effect of systemic risks.

As we can notice from models test results after crisis sales-growth started to have major effect to the ROA regardless industry. As we could notice from descriptive statistics results Energy sector average sales growth dropped by -82%, while telecommunication sectors sales growth dropped even more by -144%. As for conclusion sectors decline was major effect to main profitability measures and ERM does not helped companies to protect their profitability even with ERM. Unanswered question remains why ERM does not meet its main goal to protect enterprises value (COSO, 2014 review). One powerful argument regarding failure of ERM risk management is opposite effect of investor's pressure to invest into enterprises ERM. As we noticed from Tobin's Q analyzes and discussion part before crisis there was no effect to Tobin's Q this suggests that there was no external pressure for companies to invest into ERM and those who did invested probably did it because their understood value and wanted this investment to have value for company. As when some practices becomes as one of the requirement from outside and companies does not see any value they will declare that they comply with stated requirement but there will not integrate these practices for real. Literature review results confirms our assumptions. Great example is Spekle (2012) study that evaluated Netherland firms' ERM maturity and governance relationship and found no significant relationship between governance code and ERM maturity and explains that by saying that governance codes encourage enterprises to formally comply but to invest into real ERM (Spekle, 2012). Difficult not to agree that if enterprises do not see value in ERM any governance code will not force them to make ERM effective. Another factor that could lead to governance codes to fail initiate ERM implementation could be difficulties to audit or evaluative ERM maturity in effective way. As discussed before according to Gates, Nicolas, &

Walker (2012) risk management is part of overall management thus it could be difficult to audit risk management separately if it well integrated into management practices. Practical explanation of companies hesitation to implement ERM even though Government is drawing attention is that company still has to see cost benefit of this investment rather than compliance with general regulation.

As we noticed from model 1 results and correlation analyses there is relationship between Tobin's Q and ROA. Theoretical background and initial source of relationship is that investors analyzes main profitability measures of company and that there is indirect affect to company's value. If this assumption would be correct than ERM could have effected to Tobin's Q not directly but through the ROA measure. Even though statistical tests showed that this assumption is incorrect and ROA and Tobin's Q has opposite results, that would lead to assumption that these measures are related not through ERM effect and there are other variables that could be included into the model.

We reached last of our raised objectives by demonstrating that crisis changed ERM implementation effect to companies' performance and value (objective 3) as after crisis Tobin's Q started to be effected by ERM implementation and ROA was not effected by ERM afterwards, even though our hypothesis presumed that ROA will be affected equally before and after crisis. Last objective that ERM has impact to company's performance and value depends on sector specific risk (objective 4) we demonstrated with sectors specifics as Energy sector was the one where ERM had effect to Energy sector companies.

Our research makes contribution to ERM theory as there are significant differences between sectors noticed. For further analyzes sectorial differences could be explored in microlevel by performing case study analyzes in order to defined what factors determines differences between

sectors whether it is ERM practices or some specifics of particular industry factors. In practical terms these differences between sectors are important in regulation perspective. More and more countries are discussing ERM implementation to raise as mandatory requirement, our study suggest sectors specific should be taken into consideration as ERM effect highly depends on the sectors specific risk.

Another important contribution to theory is analyzed crisis effect that was insufficiency analyzed in existing literature. As our study showed crisis changed not only investors view towards ERM but also real ERM value to enterprise profitability measures. For practical implications its important message for enterprises that investors interest towards ERM is increasing and external pressure for ERM implementation is growing at the same time while pressure from external environment is growing for companies to implement ERM added value is less visible after crisis and while investing into such practices value could be judged.

Limitations

Main limitations regarding this study remains ERM existence identification sources. All analyzed studies had this limitation and balances between reach each objective and data sources available. For instance best way to include ERM dummy into study is to have independent ERM maturity valuation of particular enterprise. This method of data sampling is expensive to collect and there are limitations regarding time period and sample range of geography that could be collected. In order to be able to collect data for wider geography and large sample then publicly available information is most convenient method to deal with this issue. Drawback of publicly available information is that there is changes that information is declarative and does not reflect real ERM maturity. As mentioned before every method of ERM existence measure has drawback that

creates limitations for study. As this study had goal to measure crisis effect and time period was important then publicly available information best met raised goal for study.

Another important limitation to mention is that there could be lag between publicly announced ERM implementation and real ERM effect. But at the same time this limitation is important just to the second Model (ROA) as Tobin's Q reflects investors reaction to the ERM and not reflect the profitability. To deal with this problem survey method of ERM collection would serve but as mentioned before survey method would limit in geography and sample size.

Conclusions

This main question was: *Did credit default crisis draw investors' attention to companies' ERM practices in non-financial sector considering particular industry specific risks?* In order to answer to this question main goal and objectives were set: 1) description of ERM implementation determinants, 2) selection of value and performance measures, 3) design appropriate conceptual, technical and statistical model and finally 4) testing selected hypothesis.

In order to reach thesis objective literature review was performed. Main results from literature review showed that before crisis period could be called ERM standardization period as major standards that has influence to ERM practices were released (ISO 31000, COSO Enterprise Risk Management – Integrated Framework, FERMA and others). After crisis period we could call regulation period as various regulations in Europe and in the world developed and even creditworthiness agencies started to notice ERM practices as reliability measure.

Another major discussion in literature was how ERM makes impact to firm value and performance. Majority of researches relates to standards concept of ERM importance and states

that ERM has effect to better firms performances through better objectives setting and performance improvement. Although approaches are different and in some cases effect of ERM is narrowed but main concept remains the same that **ERM should help company to protect and create enterprise value.**

Regarding ERM determinants there are various studies that analyze ERM implementation determinants. As some determinants are more related to properties of company (size, ownership, diversifications and geography spread) other determinants are related more to the risk management aspects like existence of risk committee, CRO or audit committee, third type of measures are related to factors that had major influence to implement ERM like governance codes, shareholder view and other aspects. Some determinants are consequence of decision to implement ERM like CRO, risk committee or risk committee and other has major role in decision to implement ERM.

ERM affect to company's performance remains main studies object before and after crisis periods. There are several major streams regarding ERM effect: the one related to internal performance measures such like ROA, cost and revenue efficiency and another related to market view and shareholders view (in most cases measured by Tobin's Q). Even though we analyzed before and after crisis literature there were no major tendencies regarding results whether effect of ERM changed.

Last important section of literature review findings relates to investors' expectations translation to the value of company. While Efficient market hypothesis states that everything is already reflected in prices fundamental analyzes proponents states that there are some company specific measures or signals (one of them could be ERM implementation) that could help for

investors to select companies that will be successful in long term. These contradiction are important and need to be considered while defining conceptual framework.

Literature review created basis for further conceptual framework definition. Based on literature review synthesis Tobin's Q and ROA were selected as best measures to value investor's perception of companies ERM implementation. For ERM determinant risk management functions organizational structure was chosen as best signal of mature ERM practices.

Results showed that after crisis Tobin's Q started to be affected by ERM as before crisis there was no effect. Effect particular were visible in Energy sector. We got opposite results with ROA measure as there were effect in Energy sector before crisis and vanished after crisis.

Thesis results are important for further studies on differences regarding sectors as we noticed ERM effect is highly dependent to the industry specifics. As pressure from investors and regulators is growing in order to invest into sufficient ERM practices industries differences should be taken into consideration.

References

- Andersen, T. J. (2010). *Strategic Risk Management Practice. 1st ed.* London: Cambridge University Press.
- Baxter, R., Bedard, J. C., Hoitash, R., & Yezegel, A. (2013). *Enterprise Risk Management Program Quality: Determinants, Value Relevance, and the Financial Crisis* (4 ed., Vol. Vol. 30). Contemporary Accounting Research.
- Baxter, R., Bedard, J., Hoitash, R., & Yezegel, A. (2010). *Enterprise Risk Management Program Quality: Determinants, Value Relevance, and the Financial Crisis*. New South Wales: Bentley University and University of New South Wales.
- Beasley, M. S. (2015). *Report on the Current State of Enterprise Risk Oversight: AICPA*. Raleigh: Americanv institute of CPA's.
- Bertinetti, G. S., Cavezzali, E., & Gardenal, G. (2013). *The effect of the enterprise risk management implementation on the firm value of European companies*. Venice: Department of Management, Università Ca' Foscari Venezia Working Paper No. 10/2013.
- Bertinetti, G. S., Cavezzali, E., & Gardenal, G. (2013, July). The Effect of the Enterprise Risk Management Implementation on the Firm Value of European Companies. Retrieved from <http://ssrn.com/abstract=2229271>
- Calandro, J. (2009). Lessons for strategists in Graham & Dodd's Security Analysis, 6th edition. *Strategy & Leadership*, 45-49 .

Committee of Sponsoring Organizations of the Treadway Commission. (2004). *Enterprise Risk Management Framework*. New York: COSO. Retrieved from http://www.coso.org/documents/coso_erm_executivesummary.pdf

COSO. (2014 review). *COSO Internal Control - Integrated Framework*.

David L. Eckles, R. E. (Forthcoming). The Impact of Enterprise Risk Management on the Marginal Cost of Reducing Risk: Evidence from the Insurance Industry. *Journal of Banking and Finance*.

DeLoach, J. (2004). The new risk imperative – an enterprise-wide approach. *Handbook of Business Strategy*, 29 - 34.

Desender, B. P. (2007). On the Determinants of Enterprise Risk Management Implementation. *Enterprise IT governance, business value and performance measure*.

Diers, D. (2012). A multi-year risk capital concept for international models and enterprises risk management. *The Journal of Risk Finance*, 424 – 434.

Duncan Galloway, R. F. (2000). The challenges of enterprise risk management. *Balance Sheet*, 22-25.

Euler Hermes. (2016). *Global sector report - Energy*. Retrieved from <http://www.eulerhermes.com/economic-research/sector-risks/Pages/default.aspx>

European Parliament and of the council. (2006, May 17). Directive 2006/43/EC of the European Parliament and of the council on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/. *Official Journal of the European Union*, 87-107.

- Evans, J. D. (1996). *Straightforward Statistics for the Behavioral Sciences*. the University of California: Brooks/Cole Publishing Company.
- Fama, E. (1965, January). The Behaviour of stock Market Prices. *Journal of Business*(38), 34-105.
- Federation of European Risk Management Associations. (2003). *A Risk Management Standard*. Brussels: FERMA.
- FERMA & ECIIA. (2010). *Guidance on the 8th EU Company Law Directive article 41*. FERMA & ECIIA.
- Gates, S., Nicolas, J.-L., & Walker, P. L. (2012). Enterprise risk management: A process for enhanced management and improved performance. *Management Accounting Quarterly*, 28-38.
- Gatzert, N., & Martin, M. (2013). Determinants and value of enterprise risk management: empyrical evidence from the literature. *Risk Management and Insurance Review (Forthcoming)*.
- Grace, M. F., Leverty, J. T., Phillips, R. D., & Shimpi, P. (2015). The Value of Investing in Enterprise Risk Management. *Journal of Risk and Insurance*, 82(2), 289-316.
- Hoechle, D. (2007). Robust standard errors for panel regressions with cross–sectional dependence. *The Stata Journal*, 7(3), 281-312.
- Hun Myoung Park, P. (2011). *Practical Guides To Panel Data Modeling: A Step by Step Analysis Using Stata*. Public Management and Policy Analysis Program Graduate School of International Relations International University of Japan .

- International Organization for Standardization. (2009). *ISO 31000:2009, Risk management - Principles and guidelines*. International Organization for standardization.
- International Organization for Standardization. (2013). *ISO/ TR 31004:2013. Risk management – Guidance for the implementation of ISO 31000*. International Organization for Standardization.
- ISO. (2009). *ISO 31000:2009, Risk management – Principles and guidelines*.
- Jensen, M. C. (1978). Some Anomalous Evidence Regarding. *Journal of Financial Economics*, 6, 95-101.
- John Fraser, B. S. (2010). *Enterprise Risk Management: Today's Leading Research and Best Practices for Tomorrow's Executives*. New York: John Wiley & Sons.
- Kartasova, J., & Venclauskiene, D. (2014). Valuation of fundamental analysis reliability in stock pricing. *9th International Scientific Conference "Business and Management 2014"*. Vilnius.
- King, J. L. (2001). *Operational Risk: Measurement and Modelling*. Chichester: John Wiley & Sons.
- Kleffner, A., Lee, R., & McGannon, B. (2003, February). The Effect of Corporate Governance on the Use of Enterprise Risk Management: Evidence From Canada. *Vol. 6*, pp. pages 53–73.
- KPMG. (2013). *At the heart of Solvency II is the ORSA*. London: KPMG.
- Lane, J. C. (2006). An introduction to the Enterprise Risk Scorecard. *Measuring Business Excellence*, 31 – 40.

- Liebenberg, R. E. (2008, January 31). *The Value of Enterprise Risk Management: Evidence from the U.S. Insurance Industry*. Retrieved from http://www.aria.org/meetings/2006papers/Hoyt_Liebenberg_ERM_070606.pdf.
- Lindenberg, E. B., & Ross, S. A. (1981). Tobin's q Ratio and Industrial Organization. *The Journal of Business*, 54(1), pp. 1–32.
- Lundqvist, S. A. (2014). An Exploratory Study of Enterprise Risk Management: Pillars of ERM. *Journal of Accounting, Auditing & Finance*, 393–429.
- MacKinlay, A. C. (1997). Event Studies in Economics and Finance. *Journal of Economic Literature*, 35(1), 13-39.
- Malkiel, B. G. (2003). Efficient Market Hypothesis and its Critics. *The Journal of Economic Perspectives*, 17, 59–82.
- Mark S. Beasley, R. C. (2005). Enterprise risk management: An empirical analysis of factors associated with the extent of implementation. *Journal of Accounting and Public Policy*, 521-531.
- McConnell, J. J. (1990). Additional evidence on equity ownership and corporate value. *Journal of Financial Economics*, 595-612.
- McNally, S. (2013). *The 2013 COSO Framework & SOX Compliance*. The Committee of Sponsoring Organizations of the Treadway Commission.
- McShane, M. N. (2011). Does Enterprise Risk Management Increase Firm Value? . *Journal of Accounting, Auditing, and Finance*, 641-658.

- Moeller, P. M. (2007). Value of Corporate Risk Management. *The Journal of Finance*, 1379-1419.
- Naciye, S. (to be published in 2016). Does Enterprise Risk Management Create Value for Firms?: Evidence from Nordic Countries. In T. Andersen, *The Routledge Companion to Strategic Risk Management Edited by* (p. 608). London: Routledge.
- Nadine Gatzert, M. M. (n.d.). Determinants and Value of Enterprise Risk Management: Empirical Evidence from the Literature. *Risk Management and Insurance Review (Forthcoming)*.
- OECD. (2014). *Risk Management and Corporate Governance, Corporate Governance* . OECD Publishing.
- Oxle, P. S. (2002, 03 20). *Sarbanes-Oxley Act. Section 302*. Retrieved from SARBANES-OXLEY : <http://www.soxlaw.com/s302.htm>
- Pagach, D., & Warr, R. (2010). *Social Science Electronic Publishing*. Retrieved from The Effects of Enterprise Risk Management on Firm Performance: <http://ssrn.com/abstract=1155218>
- Parvaneh Saeidi, S. S. (2014). A Proposed Model of the Relationship between Enterprise Risk Management and Firm Performance. *International Journal of Information Processing and Management(IJIPM)*, 70-80.
- Platt, G. (2004). Beyond Compliance: When Risk Management Becomes a Competitive Advantage. *Global Finance*, 22-24.
- Rodrigo Silva De Souza, S. M. (2012). Enterprise Risk Management and Performance Improvement: A Study with Brazilian Nonfinancial Firms. *Performance Measurement and Management Control*, 275 - 298.

- Saudah Ahmad, C. N. (2014). Enterprise Risk Management (ERM) Implementation: Some Empirical Evidence from Large Australian Companies. *Procedia - Social and Behavioral Sciences*, 541-547.
- Shima, N., Mahmood, z., Musriyama, M. H., & Akbari, A. (2013). Enterprise Risk Management and Performance in Malaysia. *Interdisciplinary journal of contemporary research in business*, 670-707.
- Spekle, L. P. (2012, September). The Adoption and Design of Enterprise Risk Management Practices: An Empirical Study. *European Accounting Review Vol. 21, No. 3*, 533–564.
- Standard & Poor's. (2012, July 22). *Methodology: Management And Governance Credit Factors For Corporate Entities And Insurers*. Retrieved from erm.ncsu.edu: https://erm.ncsu.edu/az/erm/i/chan/library/SP_MandG_Methodology.pdf
- Stulz, R. M. (1996). Rethinking Risk Management. *Journal of Applied Corporate Finance*, 9(3), 8-24.
- Tobin, J., & William, B. (1968). Pitfalls in Financial Model Building. *American Economic Review*, 2(58), pp. 99–122.

Appendices

Appendix A. ERM implementation in Energy and Telecommunication sector by year

Sector	ERM implementation date													
	N	No ERM	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14
Energy	51	14	6	2	3	1	2	2	3	7	1	3	5	2
Telco	21	3	4	0	0	1	0	3	3	0	4	2	0	2
Total	72	17	10	2	3	2	2	5	6	7	5	2	5	4

Appendix B. Stata code and statistical analyzes results

```
xtset com year, yearly // Panel data set up
```

```
// Heteroscedastic test - Breusch-Pagan / Cook-Weisberg test for heteroscedasticity
```

```
xtgls tq2 erm_ROA roa industry sales_growth leverage size div if year <2007, igls panels  
(heteroskedastic)
```

```
xtgls tq2 erm_ROA roa industry sales_growth leverage size div if year <2007, igls panels  
(heteroskedastic)
```

```
estimates store hetero
```

```
xtgls tq2 erm_ROA roa industry sales_growth leverage size div if year <2007
```

```
local df=e(N_g)-1
```

```
display e(N_g)-1
```

```
lrtest hetero, df(`df')
```

```
xtgls roa erm_ROA industry sales_growth leverage size div if year <2007, igls panels  
(heteroskedastic)
```

estimates store hetero

xtgls roa erm_ROA industry sales_growth leverage size div if year <2007

local df=e(N_g)-1

display e(N_g)-1

lrtest hetero, df(`df`)

xtgls tq2 erm_TobinQ roa industry sales_growth leverage size div if year >2010, igls panels
(heteroskedastic)

estimates store hetero

xtgls tq2 erm_TobinQ roa industry sales_growth leverage size div if year >2010

local df=e(N_g)-1

display e(N_g)-1

lrtest hetero, df(`df`)

xtgls roa erm_ROA industry sales_growth leverage size div if year >2010, igls panels
(heteroskedastic)

estimates store hetero

xtgls roa erm_ROA industry sales_growth leverage size div if year >2010

local df=e(N_g)-1

display e(N_g)-1

lrtest hetero, df(`df`)

// LM test

xtreg tq2 erm_TobinQ roa industry sales_growth leverage size div if year <2007, re i(com)

xttest0

xtreg roa erm_ROA industry sales_growth leverage size div if year <2007, re i(com)

xttest0

xtreg tq2 erm_TobinQ roa industry sales_growth leverage size div if year >2010, re i(com)

```

xttest0

xtreg roa erm_ROA industry sales_growth leverage size div if year >2010, re i(com)
xttest0

// F-test

xtreg tq2 erm_TobinQ roa industry sales_growth leverage size div if year <2007
test

xtreg roa erm_ROA industry sales_growth leverage size div if year <2007
test

xtreg tq2 erm_TobinQ roa industry sales_growth leverage size div if year >2010
test

xtreg roa erm_ROA industry sales_growth leverage size div if year >2010
test

// Hausman test

// TobinQ pre crisis

xtreg tq2 erm_TobinQ roa industry sales_growth leverage size div if year <2007, fe
estimates store fixed

xtreg tq2 erm_TobinQ roa industry sales_growth leverage size div if year <2007, re
estimates store rand

hausman fixed rand

// ROA pre crisis

xtreg roa erm_roa industry sales_growth leverage size div if year <2007, fe
estimates store fixed2

xtreg roa erm_roa industry sales_growth leverage size div if year <2007, re
estimates store rand2

hausman fixed2 rand2

// Tobin's Q post crisis

xtreg tq2 erm_TobinQ roa industry sales_growth leverage size div if year >2010, fe

```

estimates store fixed

```
xtreg tq2 erm_TobinQ roa industry sales_growth leverage size div if year >2010, re
```

estimates store rand

```
hausman fixed rand
```

```
// Tobin's Q post crisis
```

```
xtreg roa erm_ROA industry sales_growth leverage size div if year >2010, fe
```

estimates store fixed2

```
xtreg roa erm_ROA industry sales_growth leverage size div if year >2010, re
```

estimates store rand2

```
hausman fixed2 rand2
```

```
// Tobin's Q post crisis
```

```
xtreg tq2 erm_ROA roa industry sales_growth leverage size div if year <2007, re vce(robust)
```

```
. xtreg tq2 erm_ROA roa industry sales_growth leverage size div if year <2007, re vce(robust)
```

```
Random-effects GLS regression              Number of obs   =       280
Group variable: com                       Number of groups  =       70

R-sq:  within = 0.0509                    Obs per group: min =        4
      between = 0.2509                      avg           =       4.0
      overall  = 0.2147                      max           =        4

Wald chi2(7)          =       26.69
corr(u_i, X)         = 0 (assumed)      Prob > chi2         =       0.0004
```

(Std. Err. adjusted for 70 clusters in com)

tq2	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
erm_ROA	.1511397	.0839344	1.80	0.072	-.0133687	.3156481
roa	.0060615	.0077506	0.78	0.434	-.0091293	.0212523
industry	-.1980039	.1837797	-1.08	0.281	-.5582054	.1621976
sales_growth	.0003373	.0006433	0.52	0.600	-.0009234	.0015981
leverage	-.0066233	.0029274	-2.26	0.024	-.012361	-.0008856
size	-.2437104	.110772	-2.20	0.028	-.4608196	-.0266013
div	-.0038584	.0616639	-0.06	0.950	-.1247174	.1170007
_cons	2.070985	.5470066	3.79	0.000	.9988718	3.143098
sigma_u	.42991945					
sigma_e	.28216922					
rho	.69892454	(fraction of variance due to u_i)				

```
xtreg tq2 erm_TobinQ roa industry sales_growth leverage size div if year >2010, re vce(robust)
```

```
. xtreg tq2 erm_ROA roa industry sales_growth leverage size div if year >2010, re vce(robust)
```

Random-effects GLS regression Number of obs = 280
Group variable: com Number of groups = 70

R-sq: within = 0.1821 Obs per group: min = 4
 between = 0.4204 avg = 4.0
 overall = 0.3819 max = 4

Wald chi2(7) = 40.39
corr(u_i, X) = 0 (assumed) Prob > chi2 = 0.0000

(Std. Err. adjusted for 70 clusters in com)

tq2	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
erm_ROA	.098235	.0343472	2.86	0.004	.0309156	.1655543
roa	.0103074	.0035958	2.87	0.004	.0032598	.017355
industry	-.2154514	.0738275	-2.92	0.004	-.3601506	-.0707522
sales_growth	.0009506	.0011554	0.82	0.411	-.0013139	.003215
leverage	-.0063603	.0020801	-3.06	0.002	-.0104372	-.0022834
size	-.1109282	.0399921	-2.77	0.006	-.1893111	-.0325452
div	.0622318	.0459989	1.35	0.176	-.0279245	.152388
_cons	1.155001	.2504565	4.61	0.000	.664115	1.645886
sigma_u	.22583436					
sigma_e	.14776829					

—more—

xtreg roa erm_ROA industry sales_growth leverage size div if year <2007, re vce(robust)

```
. xtreg roa erm_ROA industry sales_growth leverage size div if year <2007, re vce(robust)
```

Random-effects GLS regression Number of obs = 280
Group variable: com Number of groups = 70

R-sq: within = 0.1850 Obs per group: min = 4
 between = 0.1658 avg = 4.0
 overall = 0.1687 max = 4

Wald chi2(6) = 114.55
corr(u_i, X) = 0 (assumed) Prob > chi2 = 0.0000

(Std. Err. adjusted for 70 clusters in com)

roa	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
erm_ROA	2.885811	1.251253	2.31	0.021	.4334007	5.338221
industry	3.816681	1.816092	2.10	0.036	.2572067	7.376156
sales_growth	.0062364	.0085816	0.73	0.467	-.0105832	.0230559
leverage	-.1400718	.0242239	-5.78	0.000	-.1875497	-.0925938
size	.6740487	.9449117	0.71	0.476	-1.177944	2.526042
div	1.706694	.5494097	3.11	0.002	.6298705	2.783517
_cons	3.95843	4.476855	0.88	0.377	-4.816045	12.7329
sigma_u	5.6636027					
sigma_e	3.7196411					
rho	.69864758					(fraction of variance due to u_i)

—more—

xtreg roa erm_ROA industry sales_growth leverage size div if year >2010, re vce(robust)

```
. xtreg roa erm_ROA industry sales_growth leverage size div if year >2010, re i(com)

Random-effects GLS regression              Number of obs      =       280
Group variable: com                       Number of groups   =        70

R-sq:  within = 0.0927                    Obs per group: min =         4
      between = 0.2133                      avg =       4.0
      overall  = 0.1676                      max =         4

                                           Wald chi2(6)       =       38.75
corr(u_i, X)  = 0 (assumed)               Prob > chi2        =       0.0000
```

roa	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
erm_ROA	.7937887	1.00715	0.79	0.431	-1.180189	2.767767
industry	-2.405556	1.452303	-1.66	0.098	-5.252017	.4409064
sales_growth	.0782784	.0205405	3.81	0.000	.0380198	.118537
leverage	-.1276518	.0364674	-3.50	0.000	-.1991266	-.056177
size	-.1696702	.8385182	-0.20	0.840	-1.813136	1.473795
div	2.456961	.9787401	2.51	0.012	.5386658	4.375257
_cons	7.882412	3.84115	2.05	0.040	.3538956	15.41093
sigma_u	4.4456428					
sigma_e	4.6823377					
rho	.47408672	(fraction of variance due to u_i)				

// Tobin's Q post crisis

```
. xtreg roa erm_ROA industry sales_growth leverage size div cd, re
```

```
Random-effects GLS regression           Number of obs   =       840
Group variable: com                     Number of groups  =        70

R-sq:  within = 0.1646                  Obs per group: min =        12
      between = 0.0732                                avg   =       12.0
      overall  = 0.1155                                max   =        12

                                           Wald chi2(7)      =       154.73
corr(u_i, X)  = 0 (assumed)              Prob > chi2       =       0.0000
```

roa	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
erm_ROA	-.3862023	.5419402	-0.71	0.476	-1.448386	.675981
industry	.7049325	1.374358	0.51	0.608	-1.988759	3.398624
sales_growth	.0423896	.0076545	5.54	0.000	.027387	.0573922
leverage	-.0780677	.0184591	-4.23	0.000	-.1142469	-.0418885
size	-1.231599	.6610133	-1.86	0.062	-2.527161	.0639632
div	3.622236	.5372787	6.74	0.000	2.569189	4.675283
cd	-1.290815	.4292132	-3.01	0.003	-2.132058	-.4495729
_cons	10.21533	2.795974	3.65	0.000	4.735319	15.69534
sigma_u	4.7534139					
sigma_e	4.8760818					
rho	.48726329	(fraction of variance due to u_i)				

```
. xtreg roa erm_ROA industry sales_growth leverage size div if year >2010, re vce(robust)
```

Random-effects GLS regression	Number of obs	=	280
Group variable: com	Number of groups	=	70
R-sq: within = 0.0927	Obs per group: min =		4
between = 0.2133	avg =		4.0
overall = 0.1676	max =		4
	Wald chi2(6)	=	49.51
corr(u_i, X) = 0 (assumed)	Prob > chi2	=	0.0000

(Std. Err. adjusted for 70 clusters in com)

roa	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]
erm_ROA	.7937887	1.111386	0.71	0.475	-1.384488 2.972065
industry	-2.405556	1.411979	-1.70	0.088	-5.172983 .3618721
sales_growth	.0782784	.0170506	4.59	0.000	.0448598 .1116969
leverage	-.1276518	.0500029	-2.55	0.011	-.2256557 -.029648
size	-.1696702	.6421079	-0.26	0.792	-1.428179 1.088838
div	2.456961	1.054885	2.33	0.020	.3894254 4.524497
_cons	7.882412	3.416717	2.31	0.021	1.18577 14.57905
sigma_u	4.4456428				
sigma_e	4.6823377				
rho	.47408672	(fraction of variance due to u_i)			

// correlation

corr tq2 roa erm_TobinQ erm_ROA sales_growth leverage size div if year <2007 & industry >0

corr tq2 roa erm_TobinQ erm_ROA sales_growth leverage size div if year >2010 & industry >0

corr tq2 roa erm_TobinQ erm_ROA sales_growth leverage size div if year <2007 & industry <1

corr tq2 roa erm_TobinQ erm_ROA sales_growth leverage size div if year >2010 & industry <1

```
. corr tq2 roa erm_TobinQ erm_ROA sales_growth leverage size div if year <2007 & industry >0
(obs=204)
```

	tq2	roa	erm_Tc~Q	erm_ROA	sales_~h	leverage	size	div
tq2	1.0000							
roa	-0.0004	1.0000						
erm_TobinQ	0.0215	0.2651	1.0000					
erm_ROA	0.0508	0.2993	0.8474	1.0000				
sales_growth	-0.0455	0.0921	-0.0227	0.0591	1.0000			
leverage	-0.0518	-0.2795	-0.0531	-0.1009	-0.0141	1.0000		
size	-0.3381	0.1793	0.1552	0.1419	-0.1658	-0.3014	1.0000	
div	-0.2846	0.1435	0.0725	0.0937	0.0779	-0.1559	0.2234	1.0000

```
. corr tq2 roa erm_TobinQ erm_ROA sales_growth leverage size div if year >2010 & industry >0
(obs=204)
```

	tq2	roa	erm_Tc~Q	erm_ROA	sales_~h	leverage	size	div
tq2	1.0000							
roa	0.3571	1.0000						
erm_TobinQ	0.3136	0.1214	1.0000					
erm_ROA	0.2960	0.1246	0.8932	1.0000				
sales_growth	0.2091	0.1872	-0.0443	-0.0214	1.0000			
leverage	-0.0565	-0.0184	-0.0530	-0.0259	0.0195	1.0000		
size	-0.0489	0.0926	-0.1174	-0.1407	-0.1478	-0.4094	1.0000	
div	0.1034	0.2542	0.0280	0.0205	-0.0748	-0.0818	0.2226	1.0000

```
. corr tq2 roa erm_TobinQ erm_ROA sales_growth leverage size div if year <2007 & industry <1
(obs=76)
```

	tq2	roa	erm_Tc~Q	erm_ROA	sales_~h	leverage	size	div
tq2	1.0000							
roa	0.5373	1.0000						
erm_TobinQ	-0.2673	0.0461	1.0000					
erm_ROA	-0.2533	0.0483	0.9620	1.0000				
sales_growth	0.1544	0.0497	-0.1412	-0.1084	1.0000			
leverage	-0.4365	-0.0821	0.1712	0.0879	-0.1207	1.0000		
size	-0.4787	0.0576	0.1883	0.1874	-0.1878	0.5767	1.0000	
div	-0.0454	0.3766	0.1011	0.0820	-0.0881	0.2307	0.5882	1.0000

```
. corr tq2 roa erm_TobinQ erm_ROA sales_growth leverage size div if year >2010 & industry <1
(obs=76)
```

	tq2	roa	erm_Tc~Q	erm_ROA	sales_~h	leverage	size	div
tq2	1.0000							
roa	0.5714	1.0000						
erm_TobinQ	0.0460	0.0658	1.0000					
erm_ROA	0.0501	0.0873	0.8090	1.0000				
sales_growth	0.3332	0.1534	-0.0992	-0.0642	1.0000			
leverage	-0.5999	-0.6074	-0.0118	-0.0152	-0.2598	1.0000		
size	-0.2983	0.0208	0.3236	0.2587	-0.1245	0.1757	1.0000	
div	0.2748	0.3830	0.3079	0.3347	0.0855	-0.3984	0.3193	1.0000