THE EFFECT OF ENTERPRISE RISK MANAGEMENT ON FIRM PERFORMANCE: A CASE STUDY ON TURKEY[1]

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Abstract

Enterprise Risk Management (ERM) is a risk management process based on all of the risks faced in business and applied entirely by the enterprise. It is also a risk management process that evaluates risk and opportunity together and provides reasonable assurance that the business objectives are realized. This study attempts to determine the effect of ERM on firms' financial performance and the determinants of ERM. The study sample was prepared by the firms listed in Stock Exchange Istanbul (BIST), within the first 200 of the list of the Top 500 Industrial Enterprises of Turkey which Istanbul Chamber of Industry prepared for 2015. 231 observational values were obtained from a sample of 33 firms in the 2009-2015 period. In panel data analysis, it was seen that the effects of ERM on firm performance were not determined, whereas in the panel logistic regression, firm size was found to be determinant of ERM applications.

Keywords: Risk Management, Financial Performance, Panel Data Analysis, Panel Logistic Regression

JEL Classification: G10, G17, G32

1. Introduction

Historically, it is possible to examine risk management from two perspectives as Traditional Risk Management (TRM) and Enterprise Risk Management (ERM). The first is TRM, in which

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insurance and derivative instruments are used as risk management techniques, the risks are handled separately and independently in the business units, the risk is considered as a threat, and it represents a reactive understanding. The second is the ERM, which represents risks in the form of portfolio management, which is used as a portfolio used in business, and which represents a proactive approach that deals with the opportunity dimension as well as the risk threat dimension. Although there are many definitions of ERM, the literature is mostly based on the definition made by The Committee of Sponsoring Organizations of the Treadway Commission (COSO). According to COSO (2004), 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

In the mid-1990s, ERM, as an understanding of how to deal with risks in modern risk management, emerged as a new approach and idea in risk management (Kleffner et. al, 2003: 54; Simkins ve Ramirez, 2008: 580; Fraser et. al, 2015: 1). ERM first showed improvement in financial sector, then ERM applications started to spread in the real sector. There are undoubtedly many reasons why risk management has gained momentum and reached today.

One reason for its success are the Basel regulations. The main objective in Basel regulation is to regulate capital adequacy for banks to strengthen financial regulations against risk management and supervision. The other reason is the removal of fraud and scandals in the account. For this purpose, the Sarbanes-Oxley (SOX) law in the United States was adopted in 2002. In this regard, Standard and Poor's (S&P) non-financial firms published ERM analyses for credit ratings in 2007 and announced that ERM would be applied in credit ratings in 2008 (Protiviti, 2008: 1). Another important point is that today, with the development of financial markets, the numbers of many partners and public firms have started to increase. The growing scale of the firms reveals the importance of shareholder expectations and the necessity of better governance of the enterprises.

In addition, with the increase of the mass media and the increase of the education and cultural exposure of consumers, concepts such as brand and the firm image have increased and the

firm structure of the environment and collecting has become more sensitive. Despite having a long history of risk management for many organizations, the 2008-2009 global economic and financial collapse has highlighted the importance of healthy organizational structure and long-term sustainability in the ERM framework in general (Hardy, 2015: 27).

The 2008 global crisis revealed the reassessment of risk management insights. Many scholars and experts pointed out that the failure of TRM with the crisis of 2008 (Fraser and Simkins, 2010: 27). The global crisis has shown that risk management is important not only for firms but also for regulators and the global economy as a whole (Eckles et. al, 2014: 247). Organizations, legal regulators, stock exchanges, consulting firms, rating agencies and universities have begun to take ERM into account as a way to combat economic chaos (Bertinetti et. al. 2013, 2).

The main purpose of ERM is to increase firm value and shareholder value. At the point of reaching this basic aim, ERM has the following benefits for firms. ERM benefits for the firms in subjects such as risky danger dimension, demonstrate a proactive management approach to risks, ensuring more efficient use of capital, providing cost advantages through an integrated approach, ensuring sustainability through reduction of operational surprises and losses, provide reasonable assurance that firm objectives will be achieved.

2. Literature review

Firm risk management theory has been developed as an extension of firm finance policy (Eckles et. al, 2014: 248). The issue of risk management has been widely discussed since the 1950s. It is known that the value of the firm is independent of the risk of the firm from the famous Modigliani-Miller approach. Modigliani and Miller (1958) argued that under efficient market conditions, risk management would not affect firm value. In the perfect competition market and in efficient market conditions, it is assumed that the risk will not increase in value despite the increase in the borrowing and debt / equity ratio of the operator (Yıldıran and Tanyeri, 2006: 181). According to this approach; firms must maximize their expected returns regardless of risk formation, securities investors are able to transfer risk with appropriate portfolio allocation (Bertinetti et. al, 2013: 3; Christoffersen, 2003: 2).

ERM theory is based on business risk management theory (Eckles et al., 2014: 248). ERM creates value by influencing the firm both at the macro or firm level and at the micro or firm units level. The macroeconomic risk-return balance that firms face creates value by quantifying and managing senior management. From this perspective, ERM helps to reach firm capital markets and provide other resources needed to implement strategy and firm plans. ERM is a way of life for managers and employees at all levels of the firm on the micro level. Academic literature mainly focuses on ERM's macro-level benefits (Nocco and Stulz, 2006: 8).

Academic and industry commentators have been discussing ERM's ability to reduce earnings and equity price volatility, lower foreign currency costs, increase capital efficiency, and create synergies between different risk management activities. ERM encourages risk awareness, which allows better strategic and operational decision making (Hoyt and Liebenberg, 2011, 795). Uncertainty presents both risk and opportunity in relation to potential depreciation or appreciation. ERM enables management to effectively deal with uncertainty and associated risk and opportunity and therby enhance the entity's capacity to build value (COSO, 2004: 13).

Studies on ERM fall into three main areas: ERM implementation studies, analyzes of ERM applications' determinants or factors affecting ERM practices, and studies of the effects of ERM on value or firm performance (Monda and Giorgino, 2013: 1, Eckles et. al, 2014: 248).

In the majority of academic studies on ERM, the effects of ERM on firm value were investigated. These studies; It is in the form of Şekerci (2011), McShane et. al (2011), Hoyt and Liebenberg (2011), Bertinetti et. al (2013), Li and others (2014) and Farrell and Gallagher. Besides, the effects of ERM on the financial performance indicators and the determinants of ERM were tried to be determined. Studies on the impact of ERM on performance indicators; Gordon et al. (2009), Pagach and Warr (2010), Baxter et al. (2013), Grace and others (2015), Eckles et al. (2014). Studies of ERM determinants are consist of Liebenberg and Hoyt (2003), Beasley et al. (2005), Önder and Ergin (2012), Baxter et al. (2013), Bertinetti et al. (2013) and Farrell and Gallagher.

Studies investigating the effects of ERM on firm value.

Şekerci (2011) has examined the effects of ERM application on firm value, which is derived from the evaluation of questionnaire-

derived data in a study on 150 Nordic firms registered in Sweden, Denmark, Norway and Finland stock exchanges. She found that there was no statistically significant relationship between ERM and firm value.

McShane et al. (2011) used S&P ERM credit rating scores representing ERM, control variables which can influence firm value, and Tobin's Q as representative of firm value. In their study, there was a positive relationship between ERM and firm value, but they found that firm value did not increase as ERM application level increased. Hoyt and Liebenberg (2011) found positive effects of ERM on firm value in the study of the American insurance industry between 1998-2005.

Bertinetti et al. (2013) sought to test the impact of the 200 financial and non-financial European firm examples and ERM practices on firm value. For this, while Tobin's Q was used to represent firm value, ERM applications were made from firms' annual financial statements. A positive relationship was found between the firm value and ERM practice in the study, which was also found to be statistically significant. Li and et al. (2014) used return on equity to represent firm value, sample of 135 insurance firms in China (in 2010). The Pearson correlation matrix between ERM and firm value was found to be positive and significant in the study, but in the regression analysis it was found that the level of relationship was statistically lower than the significance level.

There are also studies on the effects of ERM on financial performance indicators:

Gordon et al. (2009) developed an ERM index primarily to investigate the relationship between ERM and firm performance in their work. The work was done by the US Securities and Exchange Commission (SEC) on the 112 US firms from the 2005 list. As a result, it was observed that there is a strong positive relationship between ERM and firm performance. Pagach and Warr (2010) investigated the effects of ERM on long-term firm performance by explaining how ERM changed financial, asset and market characteristics. In a study conducted using 106 firms that were disclosed to the public and risk manager (Chief Risk Officer-CRO), it was found that in some firms ERM reduced earnings volatility, but in general it was found that ERM effect on firm variables was low. The results of the study fail to find that the ERM will support the situation regarding value creation.

Baxter et al. (2013) used S&P ratings and Tobin's Q in 165 firms and banking and insurance sectors between 2006 and 2008. Using the S&P credit rating measures, they found a positive relationship between ERM quality and firm performance. Eckles et al (2014) tested the hypothesis that ERM implementation would reduce firms' risk reduction costs. In the study, it was seen that the fluctuations of the earnings belonging to the shares of ERM applying firms decreased and the profitability of operating per risk (fluctuation of return on assets / return of shares) increased after ERM applications. Grace et al. (2015) tested the impact of ERM on cost and revenue effectiveness. In the study, efficiency was measured from zero to one by data envelopment analysis and a comparison of firms was produced. Later, multiple regression analysis showed that ERM applications provide economically and statistically significant increases in cost and revenue effectiveness.

These following studies focus on the factors that affect ERM determinants or ERM implementations.

Liebenberg and Hoyt (2003) based their work on the appointment of the CRO, who is responsible for the implementation and management of the ERM to determine the determinants of ERM use. In the study, it was determined that size and leverage are determinants of ERM applications. Exploratory study of Beasley, Clune and Hermanson (2005) examined factors associated with the stage of ERM implementation at a variety of US and international organization. They found the stage of ERM implementation to be positively related to the presence of CRO. Önder and Ergin (2012) tried to determine the factors affecting the ERM implementations in the financial sector firms which registered in the BIST. In the study, it was determined that leverage is important and firm size is less important to ERM implementations.

Baxter et al. (2013) addresses using a sample of 165 firm-year observations in the banking and insurance industries with S&P rating in 2006-2008. The study investigate company characteristics associated with ERM quality and the association of quality with ERM. Result show that ERM quality is positively associated with operating performance. Bertinetti et al. (2013) tested the determinants of ERM implementations with 200 financial and non-financial company examples. In the study was found to be the determinants of ERM for firm size, firm beta and firm profitability in the study which based on the data obtained from the annual financial statements. Farrell and

Gallagher (2015) analyzed determinants of ERM maturity in the 2006-2011 period. In the study, it was confirmed that size was an ERM determinant.

3. Data, Variables and Method

In this study, the effect of ERM on firm performance and ERM determinants for the real sector were examined. The financial sector was not included in the study. Risk management in Turkey has reached a certain level in the financial sector. In the study conducted by Koç (2012), the ratio of the banks in Turkey that have completed the process, in the advanced phase and in the middle of the process in relation to the ERM of the banks is stated as 81,8%. However, ERM applications in the non-finance sector have not yet reached sufficient levels. This situation has also been reflected in the academic studies conducted worldwide, and it is seen that a significant part of the studies on ERM belong to the financial sector. The impact of ERM has been addressed in the non-financial sector, which has not yet reached a sufficient level and has not been subject to sufficient academic research. Due to the disclosure of the data on the financial performance indicators to be used, the firms registered in the BIST were included in the scope of the study.

The ERM application is often used in large firms, and the literature on the subject has been identified in the literature. The study sample was prepared by the firms listed in BIST, taking place in the first 200 of the list of the Top 500 Industrial Enterprises of Turkey, prepared by the Istanbul Chamber of Industry for 2015. The information obtained from the firm's annual reports indicates that ERM implementations in Turkey started in 2009 in the non-financial sector. For this reason, the study period was identified as 2009-2015 and 231 observational values were generated from the annual data of 33 firms.

The variables used in the study are shown in Table 1. These variables have been determined by taking into account past studies such as risk management, firm value and firm performance.

Table 1

Variables Used and Explanations

Variables and Abbreviations	Explaining Variables	Variable Usage Studies
ERM Application **(ERM)**	**ERM if Applied "1", if not applied "0"**	Liebenberg and Hoyt (2003); Şekerci (2011); Li et. al (2014)
Tobin's Q **(TBNQ)**	**(Market Value +Short Term Liabilities+Long Term Liabilities) / Total Assets**	Allayannis and Weston (2001), Jin and Jorion (2006), Mackay ve Moeller (2007), Hoyt and Liebenberg (2011), Şekerci (2011), McShane et. al (2011), Panaretou (2014), Baxter et.al (2013) and Bertinetti et.al (2013)
Market Value-Book Value **(MB)**	**Market Value/Book Value**	Pagach and Warr (2010) Eckles et. al (2014)
Firm Size **(LOGSIZE)**	**Natural Logarithm of Total Assets**	Şekerci (2011), McShane et.al (2011), Hoyt and Liebenberg (2011), Bertinetti et. al (2013), Abdel-Azim and Abdelmoniem (2015)
Financial Leverage **(LEV)**	**Total Debt/Total Assets**	McShane et. al (2011) Abdel-Azim and Abdelmoniem (2015), Pagach and Warr (2010), Şekerci (2011), Önder and Ergin (2012) adn Li et.al (2014)
Return on Assets **(ROA)**	**Net Profit/Total Assets**	Hoyt and Liebenberg (2011), Şekerci (2011), Bertinetti et.al (2013), Baxter et.al (2013), Eckles et.al (2014), Abdel-Azim and Abdelmoniem (2015)
Geographical Diversity **(GD)**	**Foreign Sales / Total Sales**	Allayannis and Weston (2001), Şekerci (2011)
Growth in Sales **(GS)**	**$(Sales_t - Sales_{t-1})/ Sales_{t-1}$**	Hoyt and Liebenberg (2011) and Li et.al (2014)
Price Stability **(PS)**	**Standard Deviation of Daily Prices**	Beasley et. al (2008) and Pagach and Warr (2010)

Source: It was prepared by the authors considering the related literature.

Different methods are used in the literature to determine and measure firms' ERM applications (Şenol et al., 2015: 802). (1) Bertinetti et al (2013) and Pagach and Warr (2010) used the presence of Chief Risk Officer (CRO) in firm management. In addition to Florio and Leoni (2016) appointing a Chief Risk Officer (CRO), they also used ERM to represent board independence variables as well as internal control and risk committee.

(2) Hoyt and Liebenberg (2011) used the information obtained from financial reports representing ERM. (3) Şekerci (2011) measured ERM applications with the information obtained from the questionnaire. (4) McShane et al. (2011) used ERM ratings from S&P since 2007 to represent ERM. (5) Gordon et al. (2009) conducted ERM studies through the ERM index they created. The variables used in the study and their explanations are shown in Table 1. In the determination and calculation of the variables, ERM literature and studies related to financial performance are taken as basis in general. And also statistical summary appear in Table 2.

Table 2

Summary Statistics

	Obs.	Mean	Std. Dev.	Min.	Max.
TBNQ	231	1.901624	1.071159	1.107716	8.862194
MB	231	1.907176	1.486606	0.4281031	8.587649
ERM	231	0.4935065	0.5010435	0	1
SIZE	231	2.61e+09	3.30e+09	2.16e+07	2.24e+10
LOGSIZE	231	21.07508	1.198366	16.88936	23.83085
ROA	231	0.0543444	0.071098	-0.2162277	0.3448591
LEV	231	0.5121941	0.1903641	0.0530751	0.9128917
PS	231	2.217832	10.03457	0.0532091	148.8215
GS	231	0.128686	0.1854141	-0.4795295	0.7737703
GD	231	0.2960342	0.2421374	0	1

Tobin's Q (TBNQ) is used to represent the firm value. The fact that this value is greater than 1 (TBNQ>1) indicates that the expectations about the firms are positive. It is possible to understand Tobin's Q (1.90) that the market values and expectations of the firms

in the sample are positive. The SIZE variable indicates the size of the firm. The average asset size of the sample firms is 2.6 billion TL. Firms have an average return on assets (ROA) of 5%. The average leverage ratios (LEV) are 51%. In the finance literature, this ratio is not much more than 0.50. In this respect, it can be said that they are at the upper limit of the leverage ratio for sample firms. The average growth rate (GS) of annual sales of the firms is 12%.

Table 3

Pearson Correlation Coefficients

	TBNQ	ERM	SIZE	ROA	LEV	PS	GS	GD	MB
TBNQ	1	-0,047 (0,476)	-0,058 (0,377)	0,569** (0,000)	-0,447** (0,000)	0,057 (0,391)	0,014 (0,831)	0,119 (0,070)	0,790 (0,000)
ERM		1	0,308** (0,000)	0,113 (0,086)	0,029 (0,666)	0,073 (0,269)	0,049 (0,455)	-0,005 (0,936)	0,110 (0,083)
SIZE			1	-0,012 (0,859)	0,142* (0,031)	-0,031 (0,635)	0,082 (0,212)	0,302** (0,000)	0,096 (0,129)
ROA				1	-0,539** (0,000)	0,055 (0,404)	0,129 (0,051)	0,073 (0,268)	0,372 (0,000)
LEV					1	0,031 (0,636)	0,172** (0,009)	0,065 (0,326)	0,061 (0,333)
PS						1	-0,005 (0,938)	-0,062 (0,345)	0,124 (0,058)
GS							1	-0,041 (0,533)	-0,056 (0,379)
GD								1	0,102 (0,112
MB									1

*Note: The first values in the table cells indicate Pearson coefficients, ** and * indicate significance levels of 0.01 and 0.05 respectively*

Panel data analysis is performed to determine the effects of ERM on firm performance and panel logistic regression is used to investigating for determinants of ERM.

The panel data regression is generally expressed as follows;

$Yit = \alpha + Xit\ \beta + \mu it\ i = 1, ..., N, t = 1$

Where; *i* denoting household, individuals, firms, conuries, etc. and *t* denoting time. The *i* subscript, therefore, denote the cross-section dimension whereas *t* denote the times-series dimension. *α* scalar, *β*; *K x 1* and *Xit* is the i t th observation on *K* explanatory variables (Baltagi, 2005: 11).

Logistic regression is a technique for creating a model for a dependent variable in cut-off data that can be expressed in two or more classes. Logistic or probit regression methods are used if the dependent variable is intermittent (Arı and Önder, 2013: 169). The purpose of the logistic regression is to explain the relationship between one or more independent variables and dependent variables as in other regression methods (Ege and Bardakoğlu, 2009: 146).

Panel data analysis is also performed for models that show dependent variables qualitatively. In these models, the dependent variable is usually a dummy variable that takes "1" if there is a qualitative change and "0" if it is not (Çağlayan Akay, 2015: 175).

4. Analysis and findings

Table 3 shows the Pearson correlation coefficients for the variables used in the study. Correlation results indicate that there is no significant relationship between the ERM application and the variables used to represent firm performance and the regressions (TBNQ, MB, ROA and PS).

In order to measure the effect of ERM on firm performance and to determine the determinants of ERM application, the following five models were created based on the ERM studies and the benefits of ERM application stated in the literature.

The first performance measure we use to measure the impact of ERM on firm performance is firm value. Tobin's Q (TBNQ) is used to represent firm value. In the literature, the effect of ERM on firm value is investigated in many ERM related studies and Tobin's Q is used in most of these studies. The other variables used in the model are the control variables which are used in past studies and expressed that they affect the firm value in these studies.

$$ddTBNQ_{it} = \beta_0 + \beta_1 ERM_{it} + \beta_2\, ddLOGSIZE_{it} + \beta_3 ddROA_{it} + \beta_4 dGD_{it} + \beta_5 ddLEV_{it} + \beta_6 PS_{it} + \beta_7 GS_{it} + \mu_{it} \quad (1)$$

The second variable used to measure the effect of ERM on firm value in the study is the market value - book value (MB) ratio. Market value applies to publicly traded firms.

$$MB_{it} = \beta_0 + \beta_1 ERM_{it} + \beta_2 LOGSIZE_{it} + \beta_3 ROA_{it} + \beta_4 GD_{it} + \beta_5 LEV_{it} + \beta_6 PS_{it} + \beta_7 GS_{it} + \mu_{it} \quad (2)$$

In terms of profitability in finance, return on asset (ROA), return on equity (ROE) and return on investment are used. Pagach and Warr (2010), Li et al. (2014) used return on equity (ROE) while Baxter et al. (2013) used the return on asset (ROA). This study used return on asset (ROA).

$$ROA_{it} = \beta_0 + \beta_1 ERM_{it} + \beta_2 LOGSIZE_{it} + \beta_3 GD_{it} + \beta_4 PS_{it} + \beta_5 LEV_{it} + \beta_6 GS_{it} + \mu_{it} \quad (3)$$

One of the benefits of ERM, expressed in the literature, is the reduction of operational surprises and the reduction of volatility in the earnings and prices of firms, thereby ensuring firm continuity. While Beasley et al. (2008) used variance in earnings per share volatility as a variable in ERM related returns analysis, Pagach and Warr (2010) investigated the effects of the decrease in earnings and share price fluctuations in their work. The standard deviations of the variables are taken into consideration in the calculation of the fluctuation decrease in the mentioned studies.

$$PS_{it} = \beta_0 + \beta_1 ERM_{it} + \beta_2 LOGSIZE_{it} + \beta_3 GD_{it} + \beta_4 ROA + \beta_5 LEV_{it} + \beta_6 GS_{it} + \mu_{it} \quad (4)$$

Liebenberg and Hoyt (2003), Beasley et al. (2005), Önder and Ergin (2012), Baxter et al. (2013), Bertinetti et al. (2013) and Farrell and Gallagher (2015) analyzed the factors affecting/determinant of ERM implementation/application. Inspired by these studies, the following panel logistic regression model was created:

$$ERM_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 LOGSIZE_{it} + \beta_3 GD_{it} + \beta_4 LEV + \mu_{it} \quad (5)$$

The panel series displays asymptotic properties because the panel is both time and section size. Asymptotic properties can be affected if panel data is correlated between units. Thus, in the case of panel data, there is a correlation between the units, II. Generation unit root tests are used when there is no correlation between the units, and Generation I. unit root tests are used (Şak, 2015: 204).

The Pesaran Test gives reliable results when the time dimension is smaller than the unit size in the panel regression analysis (Yamak et al, 2016: 63). The Pesaran CD Test statistical value is used to test the existence of correlation between the units in the models when the number of units used in the study (N) is 33 and the number of period (T) is 6, i.e N> T. Pesaran CD test statistical values are given in Table 4.

Table 4

Pesaran CD Test Statistics

Models	Pesaran's Test Statistics Value of CD	Prob
TBNQ	8.716	0.0000
MB	4.121	0.0000
ROA	-0.635	1.4745
PS	0.340	0.7340

According to the result in Table 4, While II. Generation unit root tests are used for TBNQ and MB models, I. Generation unit root tests are applied to ROA and PS models.

Table 5

Pesaran's CADF Panel Unit Root Test

Variables	Level	1st Diff	2nd Diff
TBNQ			18.573***
MB	-1.614*		
LOGSIZE			18.573***
ROA			18.573***
LEV			18.573***
PS	-3.083***		
GS	-3.319***		
GD		-1.902*	

*Note: ***, **, and * indicate significance at levels of 1%, 5% and 10%, respectively. The appropriate delay length is determined by the Akaike Info Criterion.*

In the TBNQ and MB models, the level or differences of the variables are used by considering the Pesaran's CADF panel unit root test results in Table 5.

Table 6

Panel Unit Root Tests (I. Generation – None Trend)

	Levin, Lin ve Chu		Breitung		Im, Pesaran ve Shin	
	Level	1st Diff	Level	1st Diff	Level	1st Diff
ROA	-8.7494***			-5.2827***	-2.2826**	
LOGSIZE	-4.7600***			-5.2017***	4.7556	-5.6613***
LEV	-7.8223***			-5.0927***	-1.1103	-7.3333***
GD	-18.1370***			-2.0680**		
PS	-13.6860***		-4.4007***		-5.3208***	
GS	-19.6424***			-3.9568***	-9.3309***	
	Fisher ADF		Harris-Tzavalis		Hadri	
	Level	1st Diff	Level	1st Diff	Level	1st Diff
ROA	84.8787*	225.1680***	-0.0237***		2.0665**	
LOGSIZE	66.1387	195.4745***	0.8920	-0.2303***	15.6451***	
LEV	88.8865**	284.9262***	0.5410*	-0.2173***	10.9796***	
GD	226.2240***		0.2082***		3.0529***	
PS	183.3096***		-0.1517***		-2.7127	
GS	345.4826***		-0.1005***		-0.8786	

*Note: ***, **, and * indicate significance at levels of 1%, 5% and 10%, respectively. The appropriate delay length is determined according to Akaike Info Criterion.*

In the ROA, PS and ERM models, the values at the level of the variables are used based on the results of the six different Generation I. unit root tests in Table 6. The classical model applies when the panel observations are homogeneous, meaning that there are no unit and/or time effects. Likelihood Ratio (LR) test and F Test are done to determine acceptance or rejection of the classical model. The unit and/or time effects were determined on the basis of the tests performed and the classical model was rejected (Table 7). In the panel data models of Hausman (1978) a specification test is used to

decide between a fixed effects estimator and a random effects estimator (Yerdelen Tatoğlu, 2013: 179). The Hausman Test statistic is chi-square distribution. If the Hausman statistic is high, the fixed effect model is preferred whereas if the Hausman statistic is low, the random effect model is preferred (Karaaslan and Yıldız, 2011: 10). In the generated models, the random effect is seen in the Hausman Test statistic (Chi Square) where the predictor models are valid (Table 7).

Table 7

F, LR and Hausman Test Results

Models	F Test		LR Test		Hausman Test
	Test	**Statistic**	**Test**	**Statistic**	**Chi2**
ddTBNQ	Cross-section	0.195253	Cross-section	0.000	1.59 (0.9790)
	Period	5.363783***	Period	9.417***	
	Cross-section and Period	0.744398	Cross-section and Period	9.417***	
	Test	**Statistic**	**Test**	**Statistic**	**Chi2**
MB	Cross-section	19.756265***	Cross-section	156.379***	-3.37 *chi2<0*
	Period	2.358665*	Period	0.016	
	Cross-section and Period	18.520467***	Cross-section and Period	162.010***	
	Test	**Statistic**	**Test**	**Statistic**	**Chi2**
ROA	Cross-section	4.884175***	Cross-section	*42.294****	*-17.12 chi2<0*
	Period	0.720478	Period	*0.000*	
	Cross-section and Period	4.264256***	Cross-section and Period	*42.294****	
	Test	**Statistic**	**Test**	**Statistic**	**Chi2**
PS	Cross-section	1.681162**	Cross-section	3.876**	2.74 (0.8402)
	Period	0.923851	Period	0.000	
	Cross-section and Period	1.564005**	Cross-section and Period	3.876	
	Test	**Statistic**	**Test**	**Statistic**	**Chi2**
ERM	Cross-section	6.538090***	Cross-section	89.48***	1.57 (0.8149)
	Period	11.414489***	Period	127.455***	
	Cross-section and Period	10.127687***	Cross-section and Period	52.056***	

*Note: ***, ** and * indicate significance at the 1%, 5% and 10% significance level of the respective test statistic, respectively.*

Table 8

Test of Assumptions

Models	Assumption	Test	Statistic	Appropriate Estimator
TBNQ	Heteroscedasticity	Levene, Brown and Forsythe	5.3068204***	Arellano, Froot and Rogers
	Autocorrelation	Durbin-Watson	2.5128096	
	Cross Sectional Independence	Pesaran's CD	4.077***	
MB	Heteroscedasticity	Levene, Brown and Forsythe	4.4330236***	Arellano, Froot and Rogers
	Autocorrelation	Baltagi-Wu LBI	1.7814559	
	Cross Sectional Independence	Pesaran's CD	3.121***	
ROA	Heteroscedasticity	Levene, Brown and Forsythe	*2.6126741****	Huber, Eicker and White
	Autocorrelation	Joint Lagrange Multiplier	*76.41****	
	Cross Sectional Independence	Pesaran's CD	*-0.635*	
PS	Heteroscedasticity	Levene, Brown and Forsythe	5.1755631***	Huber, Eicker and White
	Autocorrelation	Durbin-Watson	2.2169166	
	Cross Sectional Independence	Pesaran's CD	7.129***	

*Note: *** indicates statistical significance at 1% significance level.*

In case of heteroscedasticity the estimates to be made will not yield effective results. In the presence of autocorrelation, standard errors are affected and inefficient regression coefficients are estimated (Baltagi, 2005: 79, 84). Following the appropriate modeling period, the panel variance has been tested for heteroscedasticity,

autocorrelation, and correlation between units assumptions. Levine (1960) and, Brown and Forsyhe (1974) tests are used to test the suitability of error terms for the assumption of constant variance in the random effect model (Ün, 2015: 72). In the random effect models, a lack of the assumption of autocorrelation in error terms is tested by Narendranathan's Durbin-Watson, Baltagi-Wu, Lagrange multiplier. Pesaran's CD test is used for cross sectional independence if the number of units (N) is larger than the time (T) dimension (Yerdelen Tatoğlu, 2013: 216, 224).

Table 9

Driscoll-Kraay Random Effect Estimator

	ddTBNQ				MB			
	Coef.	Robust Std. Err.	Z	P	Coef.	Robust Std. Err.	Z	P
ERM	0.0568	0.045	1.26	0.208	0.3315	0.262	1.26	0.207
ddLOGSIZE	-0.7491	0.160	**-4.67**	0.000	0.1863	0.340	0.55	0.584
ddROA	-0.2463	0.337	-0.73	0.466	-0.6565	0.543	-1.21	0.227
dGD	0.2738	0.195	1.40	0.161	-0.1779	0.256	-0.69	0.488
ddLEV	-0.8647	0.412	**-2.10**	0.036	0.0506	0.811	0.06	0.950
PS	0.0013	0.000	**2.81**	0.005	-0.0010	0.003	-0.34	0.732
GS	-0.0628	0.124	-0.51	0.613	-0.7094	0.424	**-1.67**	0.095
Constant	-0.0996	0.034	-2.89	0.004	1.9636	0.311	6.30	0.000
	Number of Observation: 165 Number of Groups: 33 P = 0.0000 R^2(within) = 0.19 Wald x^2=37.15				Number of Observation: 165 Number of Groups: 33 P = 0.0000 R^2(within) = 0.10 Wald x^2= 11.25			

Note: The term "d" indicates the difference between the relevant variable.

The validity of *t* and *F* statistics, R^2 and confidence intervals are affected if there is heteroscedasticity, autocorrelation and correlation between units. Therefore, if the model has at least one of variance, autocorrelation and correlation between units, resistant predictors should be used (Yerdelen Tatoğlu, 2013: 242). Since the critical values were exceeded in the tests for the heteroscedasticity, autocorrelation and correlation between units assumptions regarding the models used in the study, standard error-resisting prediction models were used which gave more consistent results considering these assumptions.

It is common to rely on durable standard errors to provide valid statistical inferences when the assumptions of the basic regression model are violated. The most common of the alternative

covariance matrix estimators was developed by Huber (1967), Eicker (1967) and White (1980) (Hoechle, 2007: 283). Driscoll and Kraay (1998) developed a standard non-parametric time series covariance matrix estimator to be able to withstand the general forms of temporal and cross-sectional dependence (Hoechle, 2007: 284).

Table 9 shows the regression results used to estimate the effects of ERM on firm value. For this purpose, Tobin's Q (TBNQ) and Market Value - Book Value (MB) variables are used to represent firm value. The effects of firm size (ddLOGSIZE), financial leverage (ddLEV) and price stability (PS) variables on Tobin's Q (ddTBNQ) variable are statistically significant. The firm size (ddLOGSIZE) adversely affected the firm value (ddTBNQ) as opposed to the expected effect of the variable. It is seen that the financial leverage (ddLEV) variable negatively affects the firm value (ddLOGSIZE). It is normal for the financial leverage to be positive or negative because of the financial risk arising from the borrowing. Risk has threats and opportunities, resulting in negative or positive results.

The price stability (PS) variable is positive as expected for the impact on Firm Value (ddLOGSIZE). The second variable used to represent firm value is market value to book value. The effect of Growth in Sales variable on Market Value - Book Value (MB) is found statistically significant. Growth in sales (GS) is negative on the contrary to the expectation of impact on Market Value - Book Value (MB). The effect of the ERM application, which is the primary variable in the creation of ddTBNQ and MB models, is not found statistically significant. In other words, the effect of ERM on firm value has not been determined.

This result is similar to the results of Şekerci (2011) study, which does not find a meaningful relationship between ERM and firm value. In Pagach and Warr´s study (2010), their ERM findings do not support the situation regarding value creation. Our study shows similarities with these results. In addition, McShane et al. (2011) found similar results when ERM applications were developed, firm value did not increase. The studies that show positive effects of ERM on firm value are Hoyt and Liebenberg (2011), Baxter et al. (2013) and Bertinetti et al. (2013).

Table 10

Huber, Eicker and White Random Effect Estimator

	ROA				PS			
	Coef.	Robust Std. Err.	Z	P	Coef.	Robust Std. Err.	Z	P
ERM	0.0110	0.008	1.24	0.214	1.0032	1.305	0.77	0.442
LOGSIZE	0.0023	0.008	0.28	0.783	-0.3499	0.468	-0.75	0.455
GD	0.0182	0.024	0.75	0.452	-2.6359	3.454	-0.76	0.445
LEV	-0.2124	0.036	**-5.81**	0.000	5.3551	4.103	1.31	0.192
PS	0.0002	0.000	1.20	0.229				
ROA					12.1938	5.117	**2.38**	0.017
GS	0.0693	0.021	**3.26**	0.001	-1.9275	1.775	-1.09	0.278
Constant	0.0939	0.175	0.54	0.592	6.7204	8.956	0.75	0.453
	Number of Observation: 231 Number of Groups: 33 P = 0.0000 R^2(overall)=0.36 Wald x^2=*47.04*				Number of Observation: 231 Number of Groups: 33 P = 0.0568 R^2(overall)=0.02 Wald x^2= 12.24			

Note: The term "d" indicates the difference between the related variable.

While firm profitability (ROA), which is shown as a firm performance indicator, is negatively affect by the Financial Leverage (LEV), is positively affect by the Growth in Sales (GS) (Table 10). The effect of ERM on return on assets (ROA) is not statistically significant. The effect of Return On Asset (ROA) on Price Stability (PS) variable is statistically significant. In similar studies, Baxter et al. (2013) showed a positive effect on the return on assets (ROA) of ERM application whereas Li and others (2014) failed to determine the effect of ERM on the return on equity used as asset profitability. ERM has not affected on price stability (PS). Pagach and Warr (2010) find that ERM has a limited impact on price and earnings volatility. Beasley et al. (2008) find not positive relationship between ERM and firm's variance in earning per share (EPS).

Table 11

The Determinants of ERM (Panel Logistic Regression)

	Coef.	Std. Err.	Z	P
ROA	-3.533012	10.8325	-0.33	0.744
LOGSIZE	18.80115	2.222174	**8.46**	0.000
GD	3.00198	4.338259	0.69	0.489
LEV	-11.28258	6.898455	-1.64	0.102
Constant	-394.337	45.68267	-8.63	0.000

Number of observation: 231 Number of Groups: 33;
Wald x^2=73.80(P=0.0000); Likelihood-ratio test:89.48(P=0.000)

The panel logistic regression show that the firm size variable (LOGSIZE) is the determinant of ERM applications (Table 11). According to this, it is possible to say that as the firm size increases, ERM applications become more widespread. In similar studies that firm size (LOGSIZE) is the determinant of ERM, or that ERM and firm size are positively related; Liebenberg and Hoyt (2003), Beasley et al. (2005), Önder and Ergin (2012), Baxter and others (2013), Farrell and Gallagher (2015). Other factors related to the determining the use of ERM in the literature; Liebenberg and Hoyt (2003), financial leverage (LEV); Önder and Ergin (2012), systematic risk (BETA) and Bertinetti et al. (2013) return on asset (ROA) find ERM determinants.

5. Conclusion

The study attemted to determine the effects of the ERM applications on the financial performance indicators of the real sector firms listed on the BIST as well as the factors determining ERM applications. Panel data analysis and panel logistic regression analysis were performed when hypotheses were tested.

ERM has no effect on Firm Value (ddTBNQ), Market Value-Book Value (MB), Return on Asset (ROA) and Price Stability (PS) variables used for firm performance. That is, the effect of ERM on firm performance can not be determined. The effects of Firm Size (ddLOGSIZE), Financial Leverage (ddLEV), Price Stability (PS), Growth in Sales (GS) and Return on Asset (ROA) on firm performance indicators were observed variables used as control variables. This conclusion proves Modigliani-Millery approach. It has been determined that Firm Size (LOGSIZE) is a factor affecting ERM implementations.

It may take time to establish ERM in enterprises and to reach ERM level of maturity. Initial levels of ERM are aimed at preventing the loss and maintaining the current state. However, as the maturity level of the ERM increases and best ERM practices are achieved, the quality of ERM's value creation can emerge. In Turkey´s non-financial sector, since ERM applications have not yet reached a sufficient maturity level, it may be a natural consequence that ERM has no effect on firm performance. The data used in this study was formed from financial and operating reports. These reports provide limited information on risk management practices. By using survey methodology in subsequent studies, the levels of ERM implementation will be quantitatively and qualitatively more realistic, thus the effects of ERM can be seen more clearly.

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