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## HOW ENTERPRISE RISK MANAGEMENT (ERM) CAN AFFECT ON SHORT-TERM AND LONG-TERM FIRM PERFORMANCE: EVIDENCE FROM THE IRANIAN BANKING SYSTEM

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**Abstract.** Enterprise risk management (ERM) has emerged as a more integrated risk management (IRM) framework in recent years. Many studies have been conducted in recent years to determine the effects of ERM implementation on other parts of an organization. The purpose of this research was to explore the relationship between ERM implementation and organizational performance. The research sample consisted of Iranian banks that either had a license from the central bank of Iran (CBI) or were active in the stock market. A novel measure of ERM implementation was employed in this study. Furthermore, the return on equity (ROE) and Tobin's Q ratio were used as two measures of organizational performance. The results showed that there was a positive and significant relationship between ERM implementation and Tobin's Q ratio, whereas such a significant relationship was not observed between ERM implementation and ROE. The study findings suggested that the adoption of an ERM strategy influences the long-term performance of a firm, not its short-term performance.

**Keywords:** Enterprise risk management; Organizational risk management; Integrated risk management system; Iranian banking system; Firm performance; Return on equity; Tobin's Q ratio

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### 1. Introduction

Risk management has gained more attention in recent years. Many firms have started to invest a large sum of money in the implementation of IRM programs. Despite the increasing rate of implementing such systems, there

is little information on whether ERM will add further value to firms. Risk management is an important issue for organizations in a dynamic business environment. In recent years, there has been a shift in attitudes toward risk management from addressing it in isolation to a more holistic and system-based view. Although this is a novel approach in Iran, many organizations have attempted to adopt it. Many researches argue that the adoption of ERM improves organizational performance (Barton, Shenkir, & Walker, 2002; Lam, 2014; Lang & Stulz, 1994; Nocco & Stulz, 2006; Gordon, Loeb, & Tseng, 2009; Hoyt & Liebenberg, 2011; Jing, Brockett, & Wang, 2017; Jing, Brockett, Cooper, & Golden, 2012). Many organizations have implemented ERM systems based on the assumption that such systems will enhance their organizational performance. Although empirical pieces of evidence confirm this relationship, the result of previous studies should be interpreted cautiously because of the lack of robust measures of ERM (Hoyt & Liebenberg, 2011).

This research aims to explore the relationship between organizational performance and ERM implementation. To recognize ERM implementation, the first year of implementation and the degree of implementation in each of the studied banks were investigated. The data were collected from pieces of evidence related to 20 active banks in Iran that had implemented an ERM system. These banks had reported the implementation of relevant activities in line with risk management, whereas other banks had not mentioned anything about risk management in their reports. However, there were arguable signs that these banks were implementing some dimensions of ERM .

A novel measure of ERM was employed in this study, in which the ERM-related words in the annual report are identified (Lundqvist & Vilhelmsson, 2018). Although most current accounting studies focus on rigorous data analysis, recent studies have started to realize the significance of unstructured data and eliciting hidden information from them, as a complement to the analysis and interpretation of structured data (Rong, Yang, Manlu, & Kean, 2018).

The degree of ERM implementation varies from time to time and from bank to bank. Therefore, the last two annual reports were used for ERM measurement in each bank. There are too many measures of organizational performance, two of which were employed in this study: ROE as a short-term measure of organizational performance and Tobin's Q ratio as a long-term measure of organizational performance.

## **2. Literature reviews and hypothesis development**

ERM information contained in annual reports helps investors with their investment decisions. ERM is part of a firm's risk management system that provides investors with decision signals. ERM and financial performance cause the transfer of signs and information from well-informed managers to poorly-informed stockholders in order to reduce information asymmetry between them. Positive signals of financial performance and ERM, in turn, may increase the value of a firm. As part of the existing corporate governance mechanism, ERM provides certainty upon the risk undertaken by the management that is referred to as operational certainty in the future, and the agents who deserve to be appreciated for their performance in providing certainty for the future (Agustina & Baroroh, 2016) .

### **Enterprise risk management (ERM)**

Derived from the corporate risk management theory, ERM is defined as a process in which corporate risks (e.g. financial risks, interest rate risks, legal risks, credit risks, etc.) are evaluated and managed in a coordinated and strategic framework. ERM is a fundamental and comprehensive model that has changed from a traditional risk management system into a holistic and more integrated one. Empirical studies on ERM are limited and can be classified into three groups; ERM description, analysis of factors that lead to ERM adoption, and evaluating the consequences of ERM (Eckles, Hoyt, & Miller, 2014).

The present study was mainly focused on two groups of the three ones mentioned above. The dimensions used to measure the degree of ERM implementation were identified. Moreover, the consequences of ERM implementation and its relationship with organizational performance was investigated.

**Firm performance**

Evidence suggests that enhancing organizational performance will lead to more value creation in organizations (Daley, Mehrotra, & Sivakumar, 1997). Therefore, most studies employ the measures related to value creation to investigate organizational performance. Several studies have used different approaches to the selection of performance variables. Some of them selected the measures of value creation. ROE (Hoyt & Trieschmann, 1991), Tobin's Q ratio, various accounting tools such as return on assets (ROA) and ROE are examples of such measures (Jing, Bajtelsmit, & Wang, 2018) .

Separate management of different risk units can greatly reduce system efficiency due to problems with coordination. Nevertheless, many believe that the organizations where an ERM system is implemented can effectively prevent risk management costs in different departments, due to its holistic and general outlook. Hence, ERM implementation can be synonymous with value creation. In this study, two measures of organizational performance were employed. ROE comes from dividing net profit by book value of stocks. This measure is a short-term indicator of organizational performance and is not able to well represent the organization's long-term performance (Damodaran, 2007) On the other hand, Tobin's Q ratio, proposed by a Nobel prize winner in economics named James Tobin from Yale University, is an indicator of how well an organization's assets are valued at the market. If a firm's market value exceeds its asset value, it indicates that the firm's assets are effectively used. In this case, the stock value surpasses the current value. This occurs whenever Tobin's Q ratio is greater than 1. If a firm's market value is lower than its asset value- that is to say Tobin's Q ratio is smaller than 1- then the firm has fared badly in the matter of effective use of assets .

Unlike ROE, which is focused on a firm's annual performance, this measure deals with a firm's value creation in the long run (Hoyt & Liebenberg, 2011). ROE and ROA are often used as two accounting tools to measure the internal financial performance of a firm. However, Tobin's Q ratio is used to measure the external financial performance of a firm.

**ERM and firm performance**

When annual reports of a firm show good ERM implementation, it can be stated that the firm is able to manage multiple risks. As a non-financial information package, ERM provides investors with signals related to the security of invested capital. A more obvious presentation of ERM in annual reports of a firm makes investors feel more confident about the security of their capital. Therefore, investors will compete to obtain proper certificates and higher shares of the purchase price. This is consistent with the findings of Liebenberg and Hoyt (2003) who reported that ERM positively and significantly influences a firm's value. Based on their results, ERM accounts for 3.6% of a firm's total value .

On the other hand, investors are willing to both take a lower risk and gain higher return. Batubara et al. (2018) state that firm analysis is one of the crucial steps in making investment decisions. In the firm analysis, investors will evaluate a firm's conditions and performance as a decision criterion. Financial performance provides a firm's true profile information and evidence of management efficiency in managing the available capital as the third party. Financial performance is an important signal in making investment decisions. Profitability is a reflection of a firm's operational activities and its ability to generate profits. Based on the owned capital, asset is a measure of assessing a firm's performance in a certain period. Then the assumption is that profitability positively influences a firm's value .

So far, we have reasoned that ERM implementation will positively influence a firm's value, and a firm's value is increased by its profitability. Then our hypothesis is that there is a positive relationship between ERM implementation and a firm's financial performance. Although several studies have investigated this relationship, their contradictory results have not led a unanimous conclusion. This difference can be partially attributed to the fact that previous studies did not make a distinction between the short-term and long-term performance of a firm. Our study will add to previous studies by exploring this relationship in the Iranian banking system, considering the paucity of studies conducted on this subject and their contradictory results. In addition, our study will make a distinction between the short-term and long-term performance of a firm. The first step to test the hypothesis is to specify the best measures of firm performance. To this end, we make a distinction between a firm's short-term and long-term performance. ROE is equivalent to the annual net income of shareholders divided by shareholder value. This index will measure the short-term performance of a firm. Agustina and Baroroh (2016) investigated the relationship between ERM and firm performance in Indonesian 53 banks from 2011 to 2013. They employed ROE to measure firm performance. Their results indicated that there is no relationship between ERM and ROE. However, we will measure this relationship in the Iranian banking system in order to determine whether there is a positive relationship between a firm's short-term performance and ERM implementation.

H1: There is a positive relationship between ERM implementation and a firm's short-term financial performance measured by ROE.

In the next step, we represent Tobin's Q ratio as a measure of long-term performance. Tobin's Q ratio equals the sum of the market value of equity and book value of liabilities by the book value of total assets. Pagach and Warr (2010) studied the effect of ERM principles on a firm's long-term performance and found that the firms adopting an ERM system undergo a reduction in stock price volatility. In another study, Hoyt and Liebenberg (2011) measured the relationship between ERM implementation and firm performance in the US insurance market by using Tobin's Q ratio as a standard measure of firm performance. Their results indicated that there is a positive relationship between ERM and Tobin's Q ratio. Based on what discussed above, the next research hypothesis is as follows:

H2: There is a positive relationship between ERM implementation and a firm's long-term financial performance measured by Tobin's Q ratio.

In addition to making a contrast between a firm's short-term and long-term performance, a novel approach to the measurement of ERM implementation (Lundqvist and Vilhelmsson, 2018) was employed in the present study. To measure the degree of ERM implementation, the words related to ERM implementation were searched on annual reports of the studied banks.

### **3. Sample and measurement**

In the first step, all licensed banks in Iran were recognized. There were 37 licensed banks in Iran, 31 of which were Iranian banks. Of these 31 banks, 8 were public, 21 were private, and 2 were no-profit. In addition, annual reports of 24 for two fiscal years of 2014 and 2015 were available. Based on these reports, the degree of ERM implementation was measured .

To gain access to annual reports of banks, the websites of all studied banks as well as [www.codal.ir](http://www.codal.ir) were searched. In cases where there was no annual report of a bank on the website, the annual report was directly requested from them by email or telephone .

Tobin's Q ratio and ROE were used as two discrete and separate measures of firm performance. The value created by a firm is needed when measuring Tobin's Q ratio. Hence, this was calculated for the banks that were a public company and were priced in the exchange market. Of the 24 banks whose annual reports were available, 4 banks were not a public company and therefore could not be included in the sample. Therefore, the final sample size was

equal to 20. The average market value of a firm in a year was used in the numerator of Tobin's Q ratio formula to analyze firm performance .

### **Measuring the degree of ERM implementation**

The results showed that public disclosure of financial, strategic, and operational risks has a positive and significant relationship with financial statements (Rong et al., 2018). Hoyt and Liebenberg (2011) argue that firms generally do not disclose if they are managing risks in an integrated manner and the majority of risk management disclosure is related to specific risks. Therefore, it is difficult to maintain if a firm is implementing ERM. Therefore, to measure the degree of ERM implementation, we ought to employ an approach that makes use of information that organizations had disclosed. The tool used to measure the degree of ERM implementation in this study takes into account different dimensions of ERM: from the most basic risks to the organization to the control of the risk management system.

A comprehensive list of the dimensions of ERM implementation was extracted from the findings of Lundqvist and Vilhelmsson (2018), Desender (2011), and Lundqvist (2014). Such a list is assumed to be necessary for the correct assessment of the degree of ERM implementation. The dimensions used in this study reflect COSO's eight components of ERM implementation. This framework states that when all of the eight components are present and functioning properly, an entity of any size can run an effective ERM system. Lundqvist and Vilhelmsson (2018) employed identical dimensions in a survey to develop the pillars of ERM. They also state that all four pillars should be represented when attempting to measure the ERM implementation level. All dimensions proposed by Lundqvist and Vilhelmsson (2018) are given equal weight .

In this study, we searched the bank's annual reports for each of the 83 dimensions of ERM implementation. As a single word hardly represents an ERM dimension, we searched for word combinations. Additionally, some dimensions may be represented by more than one set of word combinations. For example, some dimensions in this study were represented by more than one set of word combinations. In these cases, the existence of any of those combinations indicates the presence of those dimensions. Therefore, it could be said that there exists "OR" between the set of word combinations in one dimension (Lundqvist & Vilhelmsson, 2018) .

Because of the difference between English and Persian languages and as sometimes there may exist many translations for a single word in Persian, the number of word combinations in some dimensions differs from those of English. However, these words were chosen meticulously by reviewing the risk-related annual reports of the studied organizations. There exist many examples of such translations and different sets of word combinations. Another point considered in using this approach is that the words searched for in annual reports were regarded as a dimension of ERM only when they were part of the bank's main programs and activities .

The total number of dimensions existing in annual reports indicates the degree of ERM implementation in a bank in a fiscal year. When the number of the set of word combinations considered, then one dimension is given more weight than others. That is not because the word or the word combination is more important, but it is just more prevalent. As previously mentioned, all dimensions were given equal weight, therefore the presence of any of the word combinations in an annual report gives that dimension a score of 1 and, reasonably, 0 if there are not any of such word combinations. Consequently, the degree of ERM implementation varies from 0 to 83 (Lundqvist and Vilhelmsson, 2018) .

It is arguably reasonable and expected that banks will be gradually more and more familiar with ERM and, as a result, the degree of ERM implementation increases over time. In this research, the mean degree of ERM implementation was 22.6 for 2014 and 24.7 for 2015. The mean degree of ERM implementation for Iranian banks is much lower than that of the major banks around the world, which has been estimated at 47.5 for the period 2005-2011 (Lundqvist and Vilhelmsson, 2018) .

Some of the ERM implementation dimensions were found in annual reports of none of the studied banks. These dimensions included chief risk operator (CRO), access to capital market, criteria accepted for results evaluation, compensation policies for aligning share of managers and stockholders, physical control, foreign transfer rate, response to risk program, internal auditing budget, acquisition threat, centralized technology for risk information, compliance with voluntary protocols, alternative response to risk, customer information privacy, and centralization of production location. Some dimensions were present in all banks in both years. These dimensions were protection and health issues, training, leadership and training programs, and liquidity .

The lowest and the highest degrees of ERM implementation in this study were 11 and 34, respectively.

### **Measuring the depth of ERM implementation**

Because firms do not disclose the exact level of their risk management activities, according to Hoyt and Liebenberg (2011) and Pagach and Warr (2011), we searched for a specific set of words or synonyms of enterprise risk management, strategic risk management, and IRM system. Any encounter with these words was reported with one extra variable (depth) and then it was coded. For example, when Firm A begins to implement an ERM system in the first year, the depth of ERM will be 1 for that year. On the other hand, for the firms that have not yet begun to implement ERM, the depth will be zero. Reasonably, this figure for firms that have begun to implement ERM for the first year will be 2 in the second year (Lechner and Gatzert, 2018) .

### **Firm performance**

We sought the answer to two questions in this approach: first, whether ERM is a function of ROE for Iranian banks? And second, whether ERM is a function of Tobin's Q ratio for Iranian banks? If we just explore these two questions without considering other variables that could affect ERM, we might answer these questions erroneously. Then, we ought to control other factors that could affect ERM and has a relationship with ROE or Tobin's Q ratio. For this reason, we controlled 5 factors that will be later discussed in detail.

### **Return on equity**

To calculate the ROE of firms in each fiscal year, financial statements of the studied banks were reviewed and analyzed using the online Bourse View application. ROE is equivalent to the net income of shareholders in a year divided by shareholder value. In other words, this index measures a firm's efficiency in gaining profit from shareholder's money.

### **Tobin's Q ratio**

Financial statements of banks and [www.codal.ir](http://www.codal.ir) were reached to find Tobin's Q ratio of studied banks in each fiscal year. Tobin's Q ratio is achieved by dividing the sum of the market value of equity and book value of liabilities by book value of total assets.

### **ERM determinants**

#### **Size**

Since larger firms are more complex, they may face a wider range of risks. In addition, those have the institutional size to support the administrative cost of an ERM program are more likely to engage in the ERM program. This is corroborated by research evidence. The natural log of the book value of assets was employed in this study as an index of firm size. On the other hand, Lang and Stulz (1994) and Allayannis and Weston (2001) have found the negative relationship between firm value and firm size. Based on the evidence, it is promising to include firm size as a control variable in our relationship .

### Leverage

Leverage is defined as the ratio of the book value of assets to the book value of liabilities. High leverage greatly increases firm value and decreases the free flow of liquidity, unless it is invested in promising projects. On the other hand, extreme degrees of leverage might lead to bankruptcy or greatly increase its probability. The firms implementing ERM may have lower financial leverage if they decide to lower the probability of financial distress by decreasing financial risk. However, those firms that make such a decision may assume greater financial risk. These arguments justify the use of firm leverage as a control variable in the relationship (Jensen, 1986).

Return on assets (ROA)

Profitable firms are rewarding more than others (Allayannis and Weston, 2001). ROA is used as a measure of firm profit and is defined as a ratio of net profit to total assets. It is expected that there is a positive relationship between ROA and Tobin's Q ratio.

### Opacity

According to Pagach and Warr (2011), opacity refers to the ratio of intangible assets to the book value of total assets. Hoyt and Liebenberg (2011) argue that the relatively opaque firms should gain greater benefit from ERM programs that communicate the objectives of risk management and strategies with outsiders. Pottier and Sommer (2006) state that more opaque firms are those that are more default for outsiders to evaluate them. Pagach and Warr (2011) hypothesized that ERM implementation is related to the opacity of the firm's assets because relatively opaque assets are more difficult to liquidate to avert financial distress .

### Value Change

Value Change is measured as the one-year percentage change in a firm's market value. In addition, market value is calculated by multiplying the year-end shares of outstanding and closing stock price. Pagach and Warr (2011) showed that ERM implementation may be related to a sharp decline in shareholder value in firms that feel pressure to convey to shareholders that they are taking corrective steps to prevent continued value reduction .

As previously mentioned in this paper, firms should gradually implement an ERM system over time. Finally, the dummy variable of the year is included in the regression to control time variation to adopt ERM (Hoyt & Liebenberg, 2011).

## 4. Models and results

When we specify ROE as a dependent variable, the degree of ERM implementation, size, leverage, opacity, ROA, and value change, and depth are considered the control variables. Additionally, year dummy controlled variations in time. In other words, our model is as follows:

$$ROE = f (ERM, Size, Leverage, Opacity, ROA, Valuechange, Depth) \quad (1)$$

On the other hand, when regressing Tobin's Q ratio on ERM, size, leverage, Opacity, ROA, and value change are controlled for. Besides, the year dummy controlled for variations in time .

$$Q = f (ERM, Size, Leverage, Opacity, ROA, Valuechange, Depth) \quad (2)$$

Summary statistics for year 2014 and year 2015 is provided in Table 1 and Table 2 respectively.

**Table 1.** Summary Statistics for year 2014

	Banks Implemented ERM (6 banks)			Banks not implemented ERM (14 banks)		
	<i>Mean</i>	Median	<i>Standard error</i>	Mean	Median	Standard error
ERM	23.6667	24	3.141	21.7143	21.5	6.402
ROE	0.167	0.217	0.170	0.023	0.146	0.351
Q	1.008	1.007	0.048	1.024	1.011	0.027
Size	33.278	32.971	0.817	32.545	32.377	1.211
Leverage	12.669	13.314	5.458	21.248	13.624	24.910
Opacity	0.947	1.056	0.671	1.137	0.566	1.258
ROA	1.052	0.989	1.248	0.724	0.750	1.645
ValueChange	0.263	0.222	0.450	-0.047	0.000	0.354

**Table 2.** Summary Statistics for year 2015

	<i>Banks Implemented ERM (9banks)</i>			<i>Banks not implemented ERM (11 banks)</i>		
	<i>Mean</i>	<i>Median</i>	<i>Standard error</i>	<i>Mean</i>	<i>Median</i>	<i>Standard error</i>
ERM	25.4444	26	4.733	24	23	6.542
ROE	0.105	0.133	0.113	0.031	0.077	0.284
Q	1.008	1.003	0.021	1.024	1.006	0.036
Size	33.502	33.046	0.924	32.685	32.455	1.088
Leverage	21.331	13.934	15.249	34.635	16.336	48.002
Opacity	0.800	0.957	0.555	1.277	1.486	1.129
ROA	0.688	0.400	0.993	0.825	0.407	1.156
ValueChange	-0.363	0.078	0.646	-0.721	-0.789	0.236

**Correlation between variables and checking assumptions**

As shown in Table 3, the correlation between variables was calculated. The results indicated that ROE and ROA had a positive and significant relationship with the degree of ERM implementation and firm size. In addition, the degree of ERM implementation strongly and positively correlated with Tobin’s Q ratio, opacity, and ROA. Tobin’s Q ratio also had a positive correlation with ERM and highly correlated with opacity. Table 3 shows the correlation between all research variables.

Table 3. Variable Correlations

Correlation	ROE	ERM	Depth	Q	Size	Leverage	Opacity	ROA	ValueChange
ROE	1								
ERM	0.285	1							
Depth	0.229	0.122	1						
Q	0.086	0.428	-0.166	1					
Size	0.277	-0.038	0.272	-0.456	1				
Leverage	-0.270	-0.307	-0.183	-0.355	-0.010	1			
Opacity	0.0998	0.392	-0.074	0.533	-0.220	-0.431	1		
ROA	0.631	0.435	0.182	0.271	0.138	-0.335	0.350	1	
ValueChange	0.190	-0.090	0.213	0.017	0.370	-0.260	0.061	0.257	1

Also, we check for assumption of normality of reseduals and it is supported by Kolmogorov-Smirnov (Pvalue=0.123>0.05) and Shapiro-Wilk (Pvalue=0.462>0.05).

**ROE and the degree of ERM implementation**

Table 4 is an OLS regression to estimate the relationship between ROE, as a short-term measure of firm performance, and the degree of ERM implementation. In this study, we estimated the bootstrapped standard errors with 1000 repetitions to compensate partially for the lack of sufficient data, resulting from the low number of Iranian banks that are licensed by CBI or are active in the stock market. All data related to 2014 and 2015, shown in columns 1, 2, and 3, were used to estimate the regression. Columns 4, 5, and 6 present the data of 2014 and the last three columns show the data of 2015. Specifications 1, 4, and 7 show the estimates of ROE as the sole function of the degree of ERM implementation. In columns 2, 5, and 8, we added all control variables except ROA and the depth of ERM implementation. Finally, in 3, 6, and 9, all control variables were added to the regression. When we regarded ERM as a sole determinant of ROE and employed the whole dataset (Column 1), the relationship was statically significant. In other columns, there was no significant relationship between the degree of ERM implementation and ROE. Therefore, the first hypothesis is not confirmed and it cannot be stated that there is a positive and significant relationship between the degree of ERM implementation and ROE.

The heteroscedasticity of the regression model was also tested in this study. Three conventional tests, namely the Breusch-Pagan test (Pvalue=000<0.05), the White test(Pvalue=0.381>0.05) and modified Breusch-Pagan test(Pvalue=0.191>0.05), produced contradictory and mix results about the existence of heteroscedasticity. The results of the Breusch-Pagan test suggested significant heteroscedasticity in our model, whereas the White test showed the opposite. In cases that the heteroscedasticity is established, standard errors are estimated higher than the reality, and this causes downward bias in estimating t-values. We needed to find robust standard errors to address the problem. Since there were signs of strong heteroscedasticity- which violates one of OLS assumptions- based on the results of the White test, we included OLS regression with robust standard errors in Table 5. The results did not vary significantly from our results in Table 4, except for the fact that standard errors in Table 5 were lower than that of Table 4.

**Table 4.** ROE Sample- OLS Regression Results

Explanatory Variable	All data			Year 2014			Year 2015		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ERM	*.01309	.01265	.00156	.01665	-.00272	-.01400	.01090	.01380	.00860
	(.0067)	(.0102)	(.06302)	(.011)	(.0174)	(.0656)	(.0881)	(.0147)	(.0122)
Size		.06744	.04676		.11386	.06341		-.00482	.06602
		(.0678)	(.0630)		(.0869)	(.3329)		(.1023)	(.111)
Leverage		-.00162	-.00106		-.01012	-.010275		.00067	.00072
		(.00352)	(.0034)		(.00795)	(.01674)		(.0059)	(.0068)
Opacity		-.00789	-.03567		-.00015	-.02341		-.03506	-.09602
		(.05811)	(.1314)		(.0883)	(.1715)		(.111)	(.1123)
ValueChange		.03818	-.03059		.23010	.13870		.03468	-.19839
		(.13084)	(.1314)		(.1723)	(1.847)		(.333)	(.3879)
ROA			***.1314			.10217			.17464
			(.0328)			(.2428)			(.1429)
Depth			.00756			-.01090			.01612
			(0.170)			(.1608)			(.0599)
R <sup>2</sup>	0.0787	0.2033	0.4578	0.0900	0.7803	0.8870	0.0792	0.1211	0.5533
Adjusted R <sup>2</sup>	0.0545	0.0748	0.3269	0.0395	0.6805	0.7991	0.0280	-0.1928	0.2928
Number of observations	40	37	37	20	17	17	20	20	20

Note: Numbers in the parentheses are standard errors of coefficients. The dependent variable is return on equity. ERM is the degree of enterprise risk management implementation. Control variables are explained in detail in previous parts of the paper. \*Denotes significance at the 10% levels, \*\*5% level and \*\*\* 1% level based on bootstrapped standard errors.

**Table 5.** ROE Sample- OLS Regression Results (Robust standard errors)

Explanatory Variable	All data			Year 2014			Year 2015		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ERM	*.01309	.01265	.00156	.01665	-.00272	-.01400	.01090	.01380	.00860
	(.0066)	(.0097)	(.0069)	(.010)	(.0129)	(.0136)	(.0852)	(.0145)	(.0085)
Size		.06744	.04676		.11386	.06341		-.00482	.06602
		(.0666)	(.0602)		(.0611)	(.0436)		(.0457)	(.062)
Leverage		-.00162	-.00106		***-.01012	***-.01027		.00067	.00072
		(.00265)	(.0024)		(.002693)	(.00252)		(.00069)	(.00069)
Opacity		-.00789	-.03567		-.00015	-.02341		-.03506	-.09602
		(.05702)	(.0456)		(.0726)	(.0349)		(.095)	(.0905)
ValueChange		.03818	-.03059		***.23010	***.1387		.03468	-.19839
		(.1326)	(.1275)		(.0787)	(.0506)		(.119)	(.1106)
ROA			***.1314			.10217			.17464
			(.0275)			(.2354)			(.0879)
Depth			.00756			-.01090			.01612
			(0.144)			(.021)			(.02197)
R <sup>2</sup>	0.0787	0.2033	0.4578	0.0900	0.7803	0.8870	0.0792	0.1211	0.5533
Number of observations	40	37	37	20	17	17	20	20	20

Note: Numbers in the parentheses are standard errors of coefficients. The dependent variable is return on equity. ERM is the degree of enterprise risk management implementation. Control variables are explained in detail in previous parts of the paper. Standard errors are calculated using robust inference. \*Denotes significance at the 10% levels, \*\*5% level and \*\*\* 1% level based on bootstrapped standard errors.

**Tobin’s Q ratio and the degree of ERM implementation**

Table-5 is an OLS regression to estimate the relationship between Tobin’s Q as long term performance metrics and the degree of ERM implementation. In this table, we estimated the bootstrapped standard errors with 1000 repetitions to compensate partially for the lack of sufficient data, resulting from the low number of Iranian banks that are licensed by CBI or are active in the stock market. All data related to 2014 and 2015, shown in columns 1, 2, and 3, were used to estimate the regression. Columns 4, 5, and 6 present the data of 2014 and the last three columns show the data of 2015. Specifications 1, 4, and 7 show the estimates of ROE as the sole function of the degree of ERM implementation. In columns 2, 5, and 8, we added all control variables except ROA and the depth of ERM implementation. Finally, in 3, 6, and 9, all control variables were added to the regression. All three datasets indicated that there was a positive and significant relationship between the degree of ERM implementation and Tobin’s Q ratio without control variables. When we added control variables, shown in columns 2 and 3, the results were still statistically significant. Although the results were not as strong as claimed, the regression results approved the positive relationship between the degree of ERM implementation and Tobin’s Q ratio. Furthermore, we examined the possibility of heteroscedasticity. We tested the null hypothesis, indicating that there is no heteroscedasticity, using the Breusch-Pagan test (Pvalue=0.798>0.05) , the White test(Pvalue=0.522>0.05) and the Modified the Breusch-Pagan test (Pvalue=0.472>0.05) . The results of both tests do not rejected the null hypothesis. Therefore, there was no need to calculate robust standard errors for this regression.

**Table 6.** Tobin's Q ratio Sample- OLS Regression Results

Explanatory Variable	All data			Year 2014			Year 2015		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ERM	***.00242 (.00077)	*.00141 (.0008)	*.00141 (.00085)	***.0027 (.0008)	.00095 (.0016)	.00158 (.00088)	**0.00257 (.0013)	.00132 (.001)	.00134 (.0017)
Size		***-.01207 (.0041)	***-.01154 (.0043)		-.00717 (.0094)	-.00587 (.0437)		-.01867 (.115)	-.01827 (.0175)
Leverage		-.00010 (.00019)	-.00012 (.00023)		-.000030 (.00117)	-.00036 (.0028)		.00003 (.0006)	9.14e-06 (.00078)
Opacity		*.00718 (.0037)	.00618 (.0045)		.00396 (.00896)	.00287 (.0241)		*.01246 (.0067)	-.01201 (.0128)
ValueChange		.0082 (.00065)	.00836 (.0074)		.2254 (.0262)	.0303 (.2413)		.01289 (.0255)	.01385 (.0436)
ROA			.00139 (.0040)			-.00277 (.0321)			-.00044 (.014)
Depth			-.0022 (0.0022)			-.00351 (.0212)			-.00136 (.0045)
Year dummy is added	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
R <sup>2</sup>	0.2364	0.5109	0.5293	0.3239	0.5069	0.5671	0.2305	0.6656	0.6719
Adjusted R <sup>2</sup>	0.2158	0.4320	0.4156	0.2842	0.2828	0.2304	0.1878	0.5462	0.4806
Prob > chi2	0.0017	0.0001	0.0007	0.0012	0.4803	0.9873	0.0444	0.0104	0.5567
Number of observations	39	37	37	19	17	17	20	20	20

*Note:* Numbers in the parentheses standard errors of coefficients. The dependent variable Tobin's Q ratio. ERM is the degree of enterprise risk management implementation. Control variables are explained in detail in previous parts of the paper. \*Denotes significance at the 10% levels, \*\*5% level and \*\*\* 1% level based on bootstrapped standard errors.

## Conclusion

The study findings provide some evidence of the effect of ERM implementation on firm performance in the Iranian banking system. The degree of ERM implementation was measured by a novel method, in which 83 dimensions of ERM implementation were searched for in annual reports of banks. In addition to the degree of ERM implementation, the depth of ERM implementation, which is the number of years elapsed from the beginning of ERM implementation in a bank, was calculated in this study. However, there was a significant relationship between this measure and none of the important variables .

The firm performance was measured by using two measure. ROE is an internal measure of a firm's financial performance and an indicator of short-term performance. On the other hand, Tobin's Q ratio is an indicator of long-term performance and an external measure of a firm's financial performance .

To measure the effect of ERM implementation on Iranian banks, we employed OLS regression from the data related to two consecutive years. The data were analyzed in STATA. The results indicated there was no significant relationship between the degree of ERM implementation and ROE. In addition, there was a significant relationship between the degree of ERM implementation and Tobin's Q ratio when we measured Tobin's Q ratio separately as a function of ERM. This significant relationship was also true when we added the control variables. The results regarding the effects of the degree of ERM implementation on two measures of firm performance were contradictory. When the banks were assigned to two groups based on ERM implementation, there was a significant relationship between the degree of ERM implementation and Tobin's Q ratio in none of the groups. Furthermore, when we defined a dummy variable indicating ERM implementation in firms, there was no significant difference between the two groups in terms of in Tobin's Q ratio and ROE, regardless of other variables such as firm size, leverage, etc. Based on the results, it was concluded that the degree of ERM implementation determines Tobin's Q ratio, not merely ERM adoption. The other fact is that the depth of ERM implementation in none of the banks in that sample was not more than 5 years. This can justify our results indicating that ERM implementation and the depth of ERM implementation had no relationship with Tobin's Q ratio .

Previous studies did not make a distinction between the short-term and long-term performance of a firm in exploring the relationship between ERM and firm performance. Although some studies have reported a positive relationship between the degree of ERM implementation and long-term performance of a firm-which is limitedly corroborated by our findings- no significant relationship has been observed between the degree of ERM implementation and short-term performance of a firm. The study findings do not prove such a relationship. The results of this study are consistent with previous findings about the effect of the degree of ERM implementation on long-term performance of a firm, while the relationship between short-term performance of a firm and the degree of ERM implementation has not been fully proved yet .

In addition to the main results, the means and the median of banks in both groups were measured for each fiscal year. The results are consistent with the findings of previous studies. ROE, the degree of ERM implementation, firm size, and value change all are greater for banks that had begun to implement an ERM system.

### Limitations and recommendations

Since ERM implementation in Iranian banks does not follow a random process, there are confounding variables that differentiate between treatment and control groups (banks that implemented ERM and those did not). It is hence necessary to control these confounding variables. If the banks were randomly selected to implement ERM, it would be much easier to determine causal inference of the effect of ERM implementation on firm performance and there would be no need to control other variables in the model. However, conducting such a study is impossible, given the fact that adopting ERM is part of a firm's strategic decisions. Although some control variables were employed in this study to correctly measure the relationship between ERM and firm performance, we could add some other variables to the regression model. For example, Lundqvist and Vilhelmsson (2018) controlled total assets, tier 1 ratio, nonperforming loans, provision for loan losses, audit committee independence, corporate governance score, and single best owner in their study to measure the relationship between the degree of ERM implementation and credit default swap (CDS). Hoyt and Liebenberg (2011) employed firm size, leverage, ROA, percentage of outstanding shares owned by insiders, percentage of shares owned by institutions, sales growth, slack, opacity, value change, CV (EBIT), and beta as control variables. Although we did not add some of these variables to our regression model, the low correlation between these variables and the degree of ERM implementation, ROE, and Tobin's Q ratio, respectively, suggest that omission of these variables from our model would not be a remarkable source of bias .

Another source of bias in our results was related to the measurement error. Measurement error results in attenuation bias that will lead to the calculation of undervalued coefficients. The best possible way to address the problem is to use another measure of the degree of ERM implementation as an instrument variable. Therefore, future studies are recommended to use another measure of the degree of ERM implementation and compare the results with this study to obtain a clearer picture of the situation .Some other measures of ERM is ERMI (Gordon, Loeb&Tseng, 2009) and ERM rating (McShane, Nair&Rostambekov, 2011).

The other possible and important source of bias in our results was the reverse causality. We argued that both ROE and Tobin's Q ratio are the function of the degree of ERM implementation. In other words, implementing an ERM system will lead to higher levels of both ROE and Tobin's Q ratio. However, a reverse argument in this regard could be that the degree of ERM implementation is a function of both ROE and Tobin's Q ratio. Speaking loosely, this might be the case when firms with better performance -evidenced by higher degrees of ROE and Tobin's Q ratio as two measures of firm performance- implement an ERM system more readily and likely than those with poorer financial performance. The existence of simultaneity would bias the coefficient upward and against finding the correct relationship. Finding a suitable instrument variable in order to correct such endogeneity problem helps to alleviate the problem in the future, although is difficult and might have some disadvantages .

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