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The Effects of Risk Management Practices on Financial Performance: An Empirical Analysis on Islamic Banks*

Suna AKTEN ÇÜRÜK** **Gülşah ŞEN KÜÇÜK***** **Mine IŞIK****** **Raif PARLAKKAYA*******

ABSTRACT

Risk is an inevitable reality for financial institutions, and once it is known, the main activity to be done is an effective risk management.The purpose of this study is to empirically analyze the effects of risk management practices on financial performance in Islamic banks. This study examines the effect of risk management practices on the financial performances of three Islamic banks operating in Türkiye through regression analysis. The data set of the study consists of a panel data containing 180 observations in total. Return on equity and return on assets, which are used as indicators of banks' financial performance, are dependent variables of the model. The financial ratios used to represent risk management are the independent variables of the model. The findings reveal that leverage ratio and asset utilization ratio have statistically significant effects on the performance of Islamic banks. The results of the study support the findings and arguments in the established body of previous literature. The findings obtained within the scope of this study could be used as guidance for the banks in their financial risk management practices and they will shed light on the future studies.

Keywords: Risk Management, Financial Performance, Islamic Banks, Panel Regression**.**

Risk Yönetimi Uygulamalarının Finansal Performans Üzerindeki Etkisi: İslami Bankalarda Uygulamalı Bir Araştırma

ÖZ

Risk, finansal kuruluşlar için kaçınılmaz bir gerçektir ve bir kez bilindiğinde yapılacak temel faaliyet, etkin bir risk yönetimidir. Bu çalışmanın amacı, İslami bankalarda risk yönetimi uygulamalarının finansal performans üzerindeki etkisini analiz etmektir. Bu çalışma, Türkiye'de faaliyet gösteren üç İslami bankanın risk yönetimi uygulamalarının finansal performansları üzerindeki etkisini regresyon analizi yoluyla incelemektedir. Çalışmanın veri seti, toplamda 180 gözlem içeren bir panel veriden oluşmaktadır. Bankaların finansal performansının göstergesi olarak kullanılan özkaynak karlılığı ve aktif karlılığı modelin bağımlı değişkenleridir. Risk yönetimini temsil etmek için kullanılan finansal oranlar, modelin bağımsız değişkenleridir. Bulgular, kaldıraç oranı ve aktif kullanım oranının İslami bankaların performansı üzerinde istatistiksel olarak anlamlı etkilere sahip olduğunu ortaya koymaktadır. Çalışmanın sonuçları, önceki literatürün yerleşik yapısındaki bulguları ve argümanları desteklemektedir. Elde edilen bulgular, bankaların finansal risk yönetimi uygulamalarında yol gösterici olarak kullanılabilir ve bundan sonraki çalışmalara ışık tutacaktır.

Anahtar Kelimeler: Risk Yönetimi, Finansal Performans, İslami Bankalar, Panel Regresyon.

1. Introduction

Risk refers to the probability of the occurrence of adverse events (Brigham and Houston, 2014, p.259). Unlike the uncertainty, the occurrence probabilities of possible outcomes in a risky event are known. Risk is an inevitable fact for financial institutions, and once it is known, the main activity to be done is an effective risk management. Atan defined the risk management as "a set of policies implemented to ensure

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** **Corresponding Author/Sorumlu Yazar,** Doç. Dr., Necmettin Erbakan Üniversitesi, sakten@erbakan.edu.tr
*** Dr., Bağımsız Araştırmacı, gulsah42_18@hotmail.com
**** Dr. Öğr. Üyesi, Bayburt Üniversitesi, mineisik@bayburt.edu.tr
***** Prof. Dr., Necmettin Erbakan Üniversitesi, rpkaya@erbakan.edu.tr

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and protect the profitability of the bank" (Atan, 2002, p. 5). Risk management has a special importance for banks due to their potential influence on both banking sector and the entire economy (Çolak & Yiğidim, 2001, p. 117). Islamic banks also need effective risk management practices that include risk identification, measurement, mitigation, monitoring, control and reporting (Ariffin & Kassim, 2014, p. 27).

For a successful risk management, first of all, it is necessary to determine the types of risks that are likely to be encountered. Similar to their traditional competitors, Islamic banks face credit risk, market risk, liquidity risk and operational risk. However, due to its unique structure, the level of exposure of Islamic banks to these risks varies (Parlakkaya, Çetin, & Demirci, 2022, p. 610).

Credit risk is generally defined as "the potential for a counterparty to fail to meet its obligations, as agreed in the terms and conditions". Such risks arise from loans given by banks. Islamic banks should have sufficient capital to protect themselves from the credit risk they undertake (Febianto, 2012, p. 75).

The purpose of credit risk management is to maximize a bank's risk-adjusted rate of return by taking measurable and reasonable credit risks. Banks should consider the relationships between credit risk and other risks. Effective management of credit risk is a critical component of a comprehensive risk management approach and is an important factor for a bank's long-term success (Shah, Ullah, & Khalıd, 2012, p. 617).

Market risk is generally defined as "risks that affect the value of many assets" or "systematic and non-systematic risks arising from instruments and assets traded in organized markets and causing price volatility" (Febianto, 2012, p. 76) Market risk can also be expressed as the loss risk of the bank due to negative developments in market prices. The components of market risk are stock risk, commodity price risk, return rate risk and currency risk (Van Greuning & Iqbal, 2008, s. 156).

Liquidity risk emerges due to insufficient liquidity that reduces the bank's ability to fulfil its obligations on maturity date (Febianto, 2012, p. 77). Having sufficient liquidity is of great importance for meeting funding demands and fulfilling obligations. Liquidity risk is very important due to (i) the limited Sharia compliant money market and interbank market, and (ii) the shallow subsidiary bazaar (Al Rahahleh, Bhatti, & Misman, 2019, p. 9)

Operational risk is stated as "the risk of direct or indirect loss arising from inadequate/failed internal processes, people, technology or external events" (Basel Committee on Banking Supervision, 2001, p. 2). Identifying operational risks in Islamic banks can be a difficult task as there are many elements that need to be analyzed comprehensively (Izhar & Hassan, 2013, pp. 15-16). In this context, Islamic banks should have a business continuity plan regarding operational processes or working systems to be implemented in order to avoid business interruptions which might result from technology and communication infrastructure or external events and disasters such as terrorism and flooding. In addition, Islamic banks can benefit from Islamic insurance services to reduce their operational risks; they can resort to outsourcing if there is a shortage of qualified personnel, develop audit policies, and increase staff productivity with training (Izhar & Hassan, 2013, pp. 34-36).

As Islamic banks performed better than conventional banking system during the global financial crisis, investigating the risk management practices of these banks is a worthy research path to follow. Accordingly, the purpose of this study is to empirically analyze the relationship between risk management practices and financial performance in Islamic banks, and the main research question can be expressed as: 'what are the types of risks that affect the financial performance of Islamic banks?'.

In order to achieve the aims of this study and to answer the research question, hypotheses that assumed that risk management practices has statistically significant effect on the performance of Islamic banks have formulated and a panel data regression model was developed to test the hypotheses.

2. Literature Review

A review of literature clearly indicates that there are several studies dealing with various aspects of risk management in the Islamic banks. While some theoretical discussions in the literature deal with the risks that Islamic banks are exposed to in the general framework (Makiyan, 2008) and in the context of specific risk types (Izhar & Hassan, 2013), some of them include comparative evaluations with traditional banks (Rhanoui & Belkhoutout, 2018). Many studies conducted to evaluate the effectiveness of risk management

practices of Islamic banks are based on survey. In addition to studies examining a single country such as Brunei Darussalam (Hassan, 2009), Pakistan (Khalid & Amjad, 2012) and Malaysia (Ariffin & Kassim, 2014), studies that make cross-country comparisons (Abdul Rahman, Balqis & Dean, 2013; Abdul Rahman , Alsmady, Ibrahim & Muhammad, 2014) are also noteworthy. It is seen that interviews (Ilias, 2012) and case studies (Halis & Abdssalm Eltawil, 2017) were conducted in other studies aiming to emphasize the need for risk management and to reveal the current situation in the sector. Studies evaluating the impact of risk management practices on banks are limited (Akhtar, Ali & Sadaqat, 2011; Yousfi, 2015), and this study aims to make an important contribution to the literature by focusing on Turkey by using the statistical analysis. Table 1 contains a summary of the literature.

Table 1. Literature Review

Author(s)	Extent	Methodology	Result
Makiyan (2008)	The general-specific risks that Islamic banks are exposed to are revealed and what can be done to reduce these risks is explained.	Theoretical discussion.	It is suggested that new financial instruments should be adopted in addition to the existent institutional arrangements in order to handle these risks and to operate in a more favorable environment.
Hassan (2009)	The study examines the degree to which Islamic banks in Brunei Darussalam use risk management practices and techniques in dealing with different types of risk.	Questionnaire Descriptive, Correlation and regression analysis.	It is found in this research that Islamic banks in Brunei Darussalaam face foreign exchange, credit and operational risk. Also the results show some evidence of efficiency in credit risk management within the industry.
Akhtar, Ali, & Sadaqat (2011)	The study examines liquidity risk through a comparative study between Conventional and Islamic banks of Pakistan.	Data from the financial reports. Descriptive, Correlation and regression analysis.	The study found that conventional banks had better profitability and liquidity risk management than Islamic banks.
Khalid & Amjad (2012)	This study examines the risk management of Islamic banks in Pakistan.	Questionnaire-Descriptive, Correlation and Regression analysis.	Credit risk analysis and risk monitoring are the most influential factors.
Ilias (2012)	It emphasises the need for risk management in Islamic banks.	Interviews-Descriptive Research	It was pointed out that risk management is important for Islamic banks and therefore recognizing and measuring all kinds of risks has cruical importance for Islamic banks.
Izhar & Hassan (2013)	It discusses various dimensions of operational risk and methods of reducing such risk.	Theoretical discussion	The study presents a framework to be applied in the analysis of operational risks. It is stated that the framework will be also useful in determining the losses that Islamic banks may make. In addition, the study draws attention to five dimensions of operational risk.
Abdul Rahman, Balqis, & Dean (2013)	It examines the efficacy of risk management practices of Islamic banks.	Questionnaire-Descriptive, Correlation and Regression analysis	The survey conducted on the risk management departments of Islamic banks in Pakistan and Malaysia indicates that they were reasonably effective in their risk management practices, in terms of understanding risk management, identifying risk, assessing and analyzing risk, and monitoring risk. Otherwise, it is stated that there are significant differences on describing risk and understanding risk management between the Islamic banks in these countries.
Abdul Rahman, Alsmady, Ibrahim, & Muhammad (2014)	The risk management practices of Islamic banks in Malaysia and Pakistan are comparatively examined.	Questionnaire-Independent t-test, Correlation and Regression analysis	It is argued in this study that the risk management practices of Malaysian Islamic banks are in a more preferable state, particularly in terms of the aspects, including risk management understanding, risk assessment and monitoring.

Ariffin & Kassim (2014)	It examines the risk management practices of selected Islamic banks in Malaysia and their financial performance.	Questionnaire-Descriptive, analysis	It is stated that the selected Islamic banks have acceptable risk management practices on average, but there are some aspects that need to be improved. Further, the adoption of technically more advanced techniques of risk measurement and risk reduction, which are in line with the Islamic law, is suggested so that Islamic banks could develop new products and maintain their competitiveness in the market.
Yousfi (2015)	The study aims to determine the impact of risk management practices on Jordanian Islamic banks' performance.	Data from the financial reports. Descriptive, Correlation and regression analysis.	Contrary to market risk; liquidity, credit and operational risk management practices have a negative and significant statistical impact on performance.
Halis & Abdssalm Eltawil (2017)	In this study, due diligence has been made regarding the risk management practices of Islamic banks operating in Libya.	Case study	As a result of the study, various recommendations are presented to strengthen the risk management of Islamic banks in Libya.
Rhanoui & Belkhoutout (2018)	It investigates the similarities and differences of operational risks in traditional and Islamic banking systems.	Theoretical discussion	It is proposed that the definition of operational risk differ across these banking systems.

3. Data Set and Research Model

Three Islamic banks operating in Turkey and having consistent data for the period from 2006 and 2020 were included in the analysis within the scope of the study. Thus, the data set consists of a panel data containing 180 observations in total. (Number of cross-section units N=3 (Number of banks) and the number of time units obtained for each cross-section unit is t=60 (15 years 4 quarters 15*4=60)) Panel data offers researchers several advantages, particularly as compared to cross-section and time series data sets, as it reduces linearity and therefore increases the efficiency of empirical findings. Thus, panel data enables the researcher to examine various economic problems that cannot be addressed otherwise (Hsiao, 2003). Table 2 presents information about the banks in focus and panel data set used in the analysis.

Table 2. Contents of The Panel Data Set

Islamic Banks (Participation Banks)		
1- Albaraka Türk Participation Bank		
2- Kuveyt Türk Participation Bank		
3- Türkiye Finans Participation Bank		
Number of Horizontal Section Units N= 3	**Number of Time Units t= 60 (15 years 4 quarters)**	**Total Number of Observations = 180**

In the research, two panel data regression models were built in order to analyze the effect of risk management practices of Islamic banks on their financial performance. Return on equity and return on assets, which are used as indicators of banks' financial performance, are dependent variables in the model. The financial ratios, that are categorized into 4 groups and used to represent risk management, are the independent variables of the model. The details of the variables included in the model and studies in the literature using these variables are shown in the table below.

Table 3. Variables and Their Bases

Category	Variable Name Used	Symbol	Calculation of Variables	Existing Literature
Performance	"Return on Assets"	ROA	"Net Profit/Total Assets"	(Kamau & Ayuo, 2014), (Yousfi, 2015), (Şamiloğlu, Öztop, & Kahraman, 2017), (Prieto & Lee, 2018), (Noor, 2019), (Ekinci & Poyraz, 2019), (Rohmawati & Shenurti, 2019), (Sathyamoorthi, Mogotsinyana, Mphoeng, & Mashoko, 2020), (Fadun & Oye, 2020), (Mandipa & Sibindi, 2022)
	"Return on Equity"	ROE	"Net Profit/Total Equity"	(Kamau & Ayuo, 2014), (Yousfi, 2015), (Şamiloğlu, Öztop, & Kahraman, 2017), (Olalekan, Mustapha, Irom, & Emily, 2018), (Ekinci & Poyraz, 2019), (Rohmawati & Shenurti, 2019), (Sathyamoorthi, Mogotsinyana, Mphoeng, & Mashoko, 2020), (Mandipa & Sibindi, 2022)
Liquidity Risk	Capital	LR1	"Total Equity/Total Assets"	(Said, 2013), (Yousfi, 2015), (Sathyamoorthi, Mogotsinyana, Mphoeng, & Mashoko, 2020)
	Liquidity	LR2	"Loan/Deposit"	(Yousfi, 2015), (Olalekan, Mustapha, Irom, & Emily, 2018), (Sathyamoorthi, Mogotsinyana, Mphoeng, & Mashoko, 2020), (Fadun & Oye, 2020)
Credit Risk	Risk	KR1	"Total Debt to Total Assets"	(Yousfi, 2015) (Sathyamoorthi, Mogotsinyana, Mphoeng, & Mashoko, 2020)
	Debt	KR2	"Total Bank Debt to Equity"	(Yousfi, 2015) (Sathyamoorthi, Mogotsinyana, Mphoeng, & Mashoko, 2020)
Operational Risk	Efficiency	OR1	"Total Overheads / Net Interest Income"	(Yousfi, 2015) (Fadun & Oye, 2020)
	Income	OR2	"Asset Utilization Ratio= Operating Income/ Total Assets"	(Yousfi, 2015)
Market Risk	Inflation	PR1		(Yousfi, 2015), (Ekinci & Poyraz, 2019), (Sathyamoorthi, Mogotsinyana, Mphoeng, & Mashoko, 2020)
	Interest Rates	PR2		(Yousfi, 2015), (Mudanya & Muturi, 2018), (Noor, 2019), (Sathyamoorthi, Mogotsinyana, Mphoeng, & Mashoko, 2020)

Data for the Islamic banks were obtained from the financial statements in their quarterly -4 period-independent audit reports, which are available on the official website of the Participation Banks Association of Turkey.

A general hypothesis is formulated for the liquidity risk category:

- $H1_0$: Liquidity risk management practices have not any statistically significant effect on the performance of Islamic banks.
- $H1_1$: Have statistically significant.

Then, two sub-hypotheses, H1.1 and H1.2, is formulated based on equity weight and loan/deposit ratios representing the liquidity risk.

- $H1.1_0$: Equity weight has not any statistically significant effect on the performance of Islamic banks.
- $H1.1_1$: Equity weight has statistically significant effect on the performance of Islamic banks.
- $H1.2_0$: The loan/deposit ratio has not any statistically significant effect on the performance of Islamic banks.
- $H1.2_1$: The loan/deposit ratio has statistically significant effect on the performance of Islamic banks.

A general hypothesis is formulated for the liquidity credit risk category:

- $H2_0$: Credit risk management practices have not any statistically significant effect on the performance of Islamic banks.
- $H2_1$: Credit risk management practices have statistically significant effect on the performance of Islamic banks.

Then, two sub-hypotheses, H2.1 and H2.2, is formulated based on debt weight and leverage ratio representing the credit risk.

- $H2.1_0$: Leverage ratio has not any statistically significant effect on the performance of Islamic banks.
- $H2.1_1$: Leverage ratio has statistically significant effect on the performance of Islamic banks.
- $H2.2_0$: Debt weight has not any statistically significant effect on the performance of Islamic banks.
- $H2.2_1$: Debt weight has statistically significant effect on the performance of Islamic banks.

A general hypothesis is formulated for the operational risk category:

- $H3_0$: Operational risk management practices have not any statistically significant effect on the performance of Islamic banks.
- $H3_1$: Operational risk management practices have statistically significant effect on the performance of Islamic banks.

Then, two sub-hypotheses, H3.1 and H3.2, is formulated based on efficiency and utilization rates representing the operational risk.

- $H3.1_0$: The efficiency ratio has not statistically significant effect on the performance of Islamic banks.
- $H3.1_1$: The efficiency ratio has statistically significant effect on the performance of Islamic banks.
- $H3.2_0$: The asset utilization rate has not statistically significant effect on the performance of Islamic banks.
- $H3.2_1$: The asset utilization rate has statistically significant effect on the performance of Islamic banks.

A general hypothesis is formulated for the market risk category:

- $H4_0$: Market risk management practices have not any statistically significant effect on the performance of Islamic banks.
- $H4_1$: Market risk management practices have statistically significant effect on the performance of Islamic banks.

Then, two sub-hypotheses, H4.1 and H4.2, is formulated based on inflation and interest rates representing the operational risk.

- $H4.1_0$: Inflation has not any statistically significant effect on the performance of Islamic banks.
- $H4.1_1$: Inflation has statistically significant effect on the performance of Islamic banks.
- $H4.2_0$: Interest rates have not statistically significant effect on the performance of Islamic banks.
- $H4.2_1$: Interest rates have statistically significant effect on the performance of Islamic banks.

The equation for the panel data regression model, which was created to test the hypotheses and where ROA is the dependent variable, is presented in equation 1 below.

$$ROA_{it}=\beta_{0it} + \beta_{1it}.LR1_{it} + \beta_{2it}.LR2_{it} + \beta_{3it}.KR1_{it} + \beta_{4it}.KR2_{it} + \beta_{5it}.OR1_{it} + \beta_{6it}.OR2_{it} + \beta_{7it}.PR1_{it} + \beta_{8it}.PR2 + \varepsilon_{it}$$

$$i = 1,2, \dots N \qquad t = 1,2, \dots, T \qquad (1)$$

The equation for the panel data regression model, which was created to test the hypotheses and where ROE is the dependent variable, is presented in equation 2 below.

$$ROE_{it}=\beta_{0it} + \beta_{1it}.LR1_{it} + \beta_{2it}.LR2_{it} + \beta_{3it}.KR1_{it} + \beta_{4it}.KR2_{it} + \beta_{5it}.OR1_{it} + \beta_{6it}.OR2_{it} + \beta_{7it}.PR1_{it} + \beta_{8it}.PR2 + \varepsilon_{it}$$

$$i = 1,2, \dots, N \qquad t = 1,2, \dots, T \qquad (2)$$

4. Methodology and Empirical Findings

Regression models are models that examine the relationship between dependent variable and independent variables. In other words, regression models are models used to explain a dependent variable by one or more independent variables (Gujarati, 2004). Regression models that are built on data sets with two different dimensions of time and cross section, represent panel data regression models.

The panel data regression model, which is widely used in empirical analysis, is generally expressed as in equation 3, presented below (Baltagi, 2008):

$$Y_{it} = \alpha + x_{it}\beta + \varepsilon_{it} \qquad i = 1,2, \ldots, N \;\; t = 1,2, \ldots, T \qquad (3)$$

In the regression model; the letter i represents the cross-section unit, while the letter t represents the time series dimension. Also, α is the constant term, x_{it} is the explanatory variable, Y_{it} is the dependent variable, and εit is the error term (Baltagi, 2008).

In regression models that are built on variables affecting each other, the relationship between variables is explained based on some core assumptions. These core assumptions can be summarized as follows; normality assumption, no autocorrelation problem, no multicollinearity problem, covariance assumption, and no strong correlation between independent variables. In the analysis, the tests required for the core assumptions of the regression analysis were carried out sequentially.

There are very important estimation methods used in panel data regression models such as pooled or mixed least squares (Pooled OLS model), fixed effect, and random effect in estimating panel data regression models (Lopez, 2015). In the panel data regression model with unit and time dimensions, necessary tests were carried out in this study to make an appropriate choice between pooled EQC, fixed effect and random effect estimators. Table 4 presents descriptive statistics for all variables used in the study. ROA average was 0.0902, ROE average was 0.2905, LR1 average was 0.0963, LR2 average was 0.9931, KR2 average was 9.9288, KR1 average was 0.9036, OR1 average was 1.1949, OR2 average was 0.0369, PR1 average was 9.7268, PR2 average was 9.9142. Information on the minimum, maximum, standard deviation and skewness, and kurtosis values of the variables are also presented in Table 4. For panel data regression analysis, first of all, the assumption that the dependent variables fit the normal distribution should be tested. For this reason, the (Jarque & Bera, 1987) test was conducted in the study and the results are presented in Table 4. Before any transformation, the significance values of (Jarque & Bera, 1987) normality test for ROA and ROE series were respectively obtained as <0.001 and <0.001. In order to ensure normality, the p value of the (Jarque & Bera, 1987) test should be >0.050. When the square root transformation of the dependent variables was made, it was observed that the dependent variables ROA and ROE fit the normal distribution, and the results are presented in Table 4.

Table 4. Descriptive Statistics for Variables

	ROA*	ROE*	LR1	LR2	KR2	KR1	OR1	OR2	PR1	PR2
Average	0.0902	0.2905	0.0963	0.9931	9.9288	0.9036	1.1949	0.0369	9.7268	9.9142
Median	0.0872	0.2856	0.0938	0.9712	9.6616	0.9062	1.0289	0.0349	9.2083	7.2500
Maximum	0.1842	0.5675	0.1550	2.6070	19.3291	0.9508	6.7031	0.0829	22.3867	22.5000
Minimum	0.0147	0.0565	0.0492	0.6471	5.4520	0.8450	0.5023	0.0102	4.3500	1.5000
Standard deviation	0.0314	0.0906	0.0218	0.1805	2.5505	0.0218	0.7538	0.0177	3.4105	5.6802
Skewness	0.2921	0.0791	0.4030	4.0422	0.7453	-0.4029	3.9211	0.5484	1.7334	0.7384
Kurtosis	3.0291	3.0463	2.6471	36.8704	3.7159	2.6476	22.3505	2.6401	6.6146	2.4797
Jarque-Bera	2.5655	0.2038	5.8062	9094.2010	20.5099	5.8008	3269.5530	9.9928	188.1244	18.3878
p	0.2773	0.9031	0.0549	0.0000	0.0000	0.0550	0.0000	0.0068	0.0000	0.0001
Number of observation	180	180	180	180	180	180	180	180	180	180

* The square root transformation was performed because the dependent variables (ROA and ROE) were not normally distributed.

In order to determine the tests to be used and to produce reliable findings, it is important to test the cross-section dependence at first in the empirical studies. The test to be used in determining whether there is a cross-section dependency for the series is decided by examining the data set. If the time dimension (T) is larger than the cross-section dimension (N) in the data set, the (Breusch & Pagan, 1980) test is used, and in the opposite case, the (Pesaran, 2004) test is used. Since the time dimension of the data set subject to the analysis in the study is larger than the cross-section dimension, the cross-section dependence was examined using the (Breusch & Pagan, 1980) test and the results are shown in Table 5.

Table 5. Cross-Section Dependence and Unit Root Test Results

	Cross-section dependence		**Unit root test results**			
	Breusch-Pagan LM test		**Fixed**		**Fixed and trend**	
			Pesaran-CIPS	**PANIC (Bai and Ng)**	**Pesaran-CIPS**	**PANIC (Bai and Ng)**
	Test statistic (p)		**Test statistic (p)**	**Test statistic (p)**	**Test statistic (p)**	**Test statistic (p)**
ROA	116.5065 (<0.001) *	ROA	-3.59463 (<0.01) *	2.92668 (0.005) *	-3.64730 (<0.01) *	0.24476 (0.807)
ROE	84.73122 (<0.001) *	ROE	-2.37071 (<0.05) **	0.15700 (0.875)	-2.41341(>=0.10)	-0.79630 (0.426)
LR1	99.41925 (<0.001) *	LR1	-3.00710 (<0.01) *	1.21513 (0.243)	-3.25102 (<0.01) *	-1.16138 (0.246)
LR2	16.90298 (0.001) *	LR2	-2.76998 (<0.01) *	-0.32379 (0.746)	-3.53645 (<0.01) *	0.49897 (0.618)
KR1	99.40885 (<0.001) *	KR1	-3.00661 (<0.01) *	1.18127 (0.238)	-3.25109 (<0.01) *	-1.17433 (0.240)
KR2	121.3706 (<0.001) *	KR2	-2.22320(<0.10) ***	2,06295 (0.039) **	-2.47307 (>=0.10)	-6.65352 (0.513)
OR1	111.4112 (<0.001) *	OR1	-4.60341 (<0.01) *	6.56707 (<0.001) *	-5.27004 (<0.01) *	6.15983 (<0.001) *
OR2	161.5488 (<0.001) *	OR2	-2.79481 (<0.01) *	-0.01370 (0.989)	-3.71559 (<0.01) *	-0.23279 (0.816)
PR1	180 (<0.001) *	PR1	0.19461 (>=0.10)	4.09134 (<0.001) *	>=0.10	0.98118 (0.327)
PR2	180 (<0.001) *	PR2	0.0 (>=0.10)	4.30839 (<0.001) *	>=0.10	1.09586 (0.273)

*1% significance level, **5% significance level, ***10% significance level, Bai and Ng method was used in the PANIC test.

It was found that the level of cross-sectional dependence for banks in all series is 1%, according to the results of the Breusch-Pagan LM (1980) test conducted in the analysis of cross-sectional dependence. Since the hypothesis of 'H_0: There is no cross-section dependency' is rejected, the stationarity of the series should be examined using second-generation unit root tests (Baltagi, 2008).

Second generation unit root tests are a highly developed method used to detect the presence of unit roots more accurately, as they have the ability to detect the existence of unit roots more precisely. Second generation unit root tests such as Maddala-Wu, CIPS, PANIC were first proposed by Maddala and Wu in 1999. These tests are widely used, correcting for varying variance and producing accurate results even for small samples, withstanding various other data problems. In this context, the analyzes in this study were continued by using second generation unit root tests. In this study, CIPS and PANIC tests were used as unit root tests. CIPS and PANIC tests, which are second generation unit root tests, offer advantages such as reorganizing the data in a non-parametric way and being resistant to deviations from the normal distribution. The CIPS test is a Phillips-Perron (PP) unit root test designed to eliminate excessive skewness and varying variance problems. The CIPS test provides an alternative method by rearranging the data to be non-parametric, but also increases the power of the test.(Hakkio, C. S., & Rush, M., 1991); (Breitung, J., 2000); (Choi, I., 2001); (Chang, Y., & Park, J. Y., 2002).

The test statistic is calculated as presented below:

$$t = [(\beta - 1)/SE(\beta)] - 0.5 * [(ln(T)/ln(n))] * \delta$$

β is the unit root coefficient. SE(β) represents the standard error, while T represents the number of data. n represents the size of the sampling window and δ is a correction factor.

The PANIC test, on the other hand, is a unit root test formulated using resampling and halving methods. Although resistant to deviation of data from normal distribution, this test has the ability to produce powerful results against common data problems such as heteroscedasticity and autocorrelation.

The test statistic is calculated as presented below:

$$t = [(\beta - 1)/SE(\beta)] * [(1 + \gamma n)/n]$$

β is the unit root coefficient. SE(β) represents the standard error, while n represents the number of data. γ is a correction factor (Hakkio, C. S., & Rush, M., 1991); (Choi, I., 2001); (Chang, Y., & Park, J. Y., 2002); (Breitung, J., 2000). When the unit root test results are examined with the (Pesaran, 2007) CIPS and (Bai & Ng, 2004) PANIC tests, the hypothesis of "H_0: There is a unit root" in the PR1 and PR2 series in the CIPS test results was accepted. The result was "no unit root" at the 5% significance level in the ROE series, at the 10% significance level in the KR2 series, and at the 1% significance level in the other series. In addition, when the PANIC test results were examined, PR1 and PR2 series were found to be stationary at 1% significance level, and KR2 variable at 5% significance level. In general, it can be said that the series are stationary at the level. According to the results of the CIPS test in the fixed and trend model, ROA,

LR1, LR2, KR1, OR1 and OR2 series were not observed as stationary, while other variables were observed as stationary. At the end of the PANIC test, OR1 series was observed as stationary at only 1% significance level, while other variables were not observed as stationary.

In order to decide the appropriate model within the scope of the study, the models were examined with the F test and Pegan LM test, depending on the cross-section effect, and the results are presented in Table 6.

Table 6. F Test and Breusch Pagan LM test results

	ROA			ROE		
Tests	**Test statistics**	**Probability value**	**Impact**	**Test statistics**	**Probability value**	**Impact**
F Test	1.275235	0.282	Pooled	1.082911	0.3409	Pooled
Breusch Pagan LM Test	0.130196	0.7182	Pooled	0.200791	0.6541	Pooled
Hausman Test*	---	---	---	---	---	---

*The value was not calculated because the number of cross-sections is lower than the number of dependent variables.

Following the results obtained, both models were examined with the pooled effect model. Therefore, in the study, the effect of independent variables on ROA and ROE was estimated by the pooled least squares method and the significance level was taken as $p<0.050$. In addition, according to the Pesaran CD (2004) test, cross-sectional dependence was observed in the ROA (4.072526; <0.001) and ROE (4.339319; <0.001) models.

The correlation matrix for the variables was examined and the results obtained are shown in Table 7. A statistically significant positive correlation was observed between ROA and ROE ($r=0.941$; $p<0.001$).

Table 7. Correlation Matrix for The Variables

		ROA	ROE	LR1	LR2	KR1	KR2	OR1	OR2	PR1	PR2
ROA	**r**	1.000									
	p	-----									
ROE	**r**	0.941*	1.000								
	p	<0.001	-----								
LR1	**r**	0.497*	0.190**	1.000							
	p	<0.001	0.011	-----							
LR2	**r**	0.008	-0.083	0.229*	1.000						
	p	0.911	0.271	0.002	-----						
KR1	**r**	-0.497*	-0.190**	-1.000*	-0.229*	1.000					
	p	<0.001	0.011	<0.001	0.002	-----					
KR2	**r**	-0.474*	-0.173**	-0.958*	-0.315*	0.958*	1.000				
	p	<0.001	0.021	<0.001	<0.001	<0.001	-----				
OR1	**r**	-0.086	-0.072	-0.137	-0.212*	0.137	0.099	1.000			
	p	0.249	0.335	0.067	0.004	0.067	0.188	-----			
OR2	**r**	0.872*	0.849*	0.323*	-0.052	-0.323*	-0.277*	0.002	1.000		
	p	<0.001	<0.001	<0.001	0.489	<0.001	<0.001	0.983	-----		
PR1	**r**	-0.230*	-0.118	-0.398*	-0.209*	0.398*	0.422*	0.229*	-0.090	1.000	
	p	0.002	0.115	<0.001	0.005	<0.001	<0.001	0.002	0.229	-----	
PR2	**r**	0.084	0.124	-0.111	-0.217*	0.111	0.137	0.446*	0.147**	0.701*	1.000
	p	0.261	0.098	0.138	0.004	0.138	0.066	<0.001	0.049	<0.001	-----

r: Correlation factor, *1% significance level, **5% significance level.

Looking at Table 7, it was observed that there was a statistically significant negative correlation between ROA and KR1 ($r=-0.497$; $p<0.001$). It was found that among the independent variables, OR2 has the strongest correlation with the dependent variable ROA, and this correlation was statistically significant and positive ($r=0.872$; $p<0.001$). It was observed that there is a statistically significant negative correlation between ROE and KR1 ($r=-0.19$; $p=0.011$). Also, among the dependent variables, OR2 is the variable that has the strongest correlation with ROE, and this correlation was statistically significant and positive ($r=0.849$; $p<0.001$). A statistically significant positive correlation was found between PR1 and PR2; LR1 and LR2; LR1 and OR2; KR1 and KR2; PR1 and KR1; PR1 and KR2; PR1 and OR1; OR1 and

PR2; PR2 and OR2. Moreover, a statistically significant negative correlation was observed between KR2 and OR2; LR1 and KR1; LR1 and KR2; PR1 and LR1; KR1 and LR2; LR2 and KR2; OR1 and LR2; PR1 and LR2; PR2 and LR2. There was not any statistically significant correlation observed between OR2 and PR1; OR1 and LR1; PR2 and LR1; OR2 and LR2; OR1 and KR1; PR2 and KR1; OR1 and KR2; PR2 and KR2; OR1 and OR2.

One of the most important assumptions in regression models is multicollinearity. Multicollinearity is an undesirable but frequently encountered problem in regression model analysis. If there is a multicollinearity problem between the independent variables, this may render the explanatory power of the associated variables for the parameter estimates meaningless and can cause the regression to give erroneous results. Therefore, correlation values between independent variables should be low in regression models. One of the main methods used to analyze this relationship between independent variables is the analysis of Variance Inflation Factor (VIF) values. VIF measures the extent of a variable's effect in the standard error of the regression. When there is a multicollinearity problem, the VIF value is high. Values such as VIF ≥ 5 or VIF ≥ 10 are considered as generally accepted threshold values for VIF. In a regression model, it is generally accepted that the multicollinearity problem arises when the VIF values are higher than 10 (Craney & Surles, 2002). The multicollinearity problem can also be examined through the tolerance values. A small Tolerance value (TV) indicates a larger VIF value. It is generally accepted in the literature that a TV above 0.20 suggests there is no multicollinearity problem (Mertler & Vannatta, 2005). If the VIF and tolerance values do not meet the mentioned conditions, it is accepted that there is a multicollinearity problem between the independent variables in the regression model. In this study, the multicollinearity regarding the variables was examined, and the findings are shown in Table 8. As it can be seen in Table 8 that the VIF value of the KR1 variable is very high, and its tolerance value is very low. In addition, it was found that the tolerance and VIF values of the KR2 and LR1 variables are not within the accepted limits.

Table 8. Multicollinearity Test Results

	The dependent variable; ROE and ROA	
	Tolerance Value	**VIF**
LR1	0.070	14.369
LR2	0.778	1.285
KR1	0.002	407708016.000
KR2	0.068	14.804
OR1	0.714	1.401
OR2	0.826	1.210
PR1	0.377	2.654
PR2	0.360	2.782

Within the scope of the analysis, at first the KR1 variable and then the LR1 variable were removed from the model, and the results of the new values obtained are presented in Table 9.

Table 9. Multicollinearity Test Results Obtained After Removing KR1, LR1 variables

	The dependent variable; ROE and ROA	
	Tolerance Value	**VIF**
LR2	0.842	1.188
KR2	0.668	1.497
OR1	0.757	1.321
OR2	0.845	1.183
PR1	0.378	2.648
PR2	0.363	2.754

As it can be seen in Table 9, the tolerance and VIF values were within the accepted limits, after the KR1 and LR1 variables were removed from the models.

Table 10. Prediction Results of The Regression Model for ROA

Independent variables	Beta coefficient	Least squares Standard errors			Cluster-Robust Standard errors		
		S. dev.	t	p	S. dev.	t	p
LR2	-0.007	0.006	-1.272	0.205	0.009	-0.810	0.503
KR2	-0.003	0.000	-5.738	0.000	0.000	-7.671	0.017
OR2	1.377	0.060	23.018	0.000	0.066	20.724	0.002
OR1	-0.004	0.001	-2.970	0.003	0.002	-2.404	0.138
PR1	-0.001	0.000	-3.124	0.002	0.001	-2.524	0.128
PR2	0.001	0.000	2.893	0.004	0.000	2.268	0.151
C	0.085	0.009	8.936	0.000	0.004	18.987	0.003

F= 145.659, p<0.001, R^2=0. 0.835, Adj. R^2= 0.829, Durbin-Watson stat= 0.764

The Pooled Least Square method was used as the estimation method for the regression model built for the ROA dependent variable. The created model was found to be statistically significant (F=145.659, p<0.001). The t test statistic value used in the least squares method is the t value of the 'student - t'. The t value in the cluster robust method is the test statistic value of the robust-t value. (Huber, P.J., 1981); (Yohai, V. J., 1987); (Maronna, R. A., Martin, R. D., & Yohai, V. J., 2006). With this created model, 82.9% of the dependent variable of ROA can be explained. When the presence of autocorrelation for the model is examined, in the Durbin-Watson d test table for 180 observations, the dL (lower) limit value of the d statistic was determined as 1.707 and the dU (upper) limit value was determined as 1.831. Through the model built with the ROA dependent variable as presented in Table 10, it is seen that the Durbin-Watson test statistical value is 0.764 (0 < d < dL). Durbin-Watson values of the model estimated according to these values suggest the existence of autocorrelation. In the regression models built, another method used in the cases of violation of assumptions, such as varying variance or autocorrelation, is the Robust error method (Chen, Wei, & Parzen, 2003); (Metin, 2013); (Parente & Santos Silva, 2016); (Hagemann, 2017). Since there is an autocorrelation problem in the model, the estimation results obtained by correcting the least squares standard errors with the Cluster-Robust method were interpreted in the study. According to the findings presented in Table 10, a statistically significant negative effect of the KR2 variable on ROA was observed (p=0.017), and 1% change in KR2 value causes 0.3% decrease in ROA value. Additionally, a statistically significant positive effect of the OR2 variable on ROA was found (p=0.002), and 1% change in OR2 value causes 137.7% increase in ROA value. For the other variables, there was not any statistically significant effect observed (p>0.050).

Table 11. Prediction Results of The Regression Model for ROE

Independent variables	Beta coefficient	Least squares Standard errors			Cluster-Robust Standard errors		
		S. dev.	t	p	S. dev.	t	p
LR2	-0.016	0.021	-0.748	0.455	0.028	-0.561	0.631
KR2	0.004	0.002	2.497	0.013	0.002	2.455	0.134
OR2	4.312	0.214	20.153	0.000	0.177	24.336	0.002
OR1	-0.015	0.005	-2.748	0.007	0.006	-2.276	0.151
PR1	-0.005	0.002	-2.905	0.004	0.002	-2.619	0.120
PR2	0.003	0.001	2.491	0.014	0.001	2.312	0.147
C	0.145	0.034	4.279	0.000	0.017	8.489	0.014

F= 84.519, p<0.001, R^2= 0.746, Adj. R^2= 0.737, Durbin-Watson stat= 0.680

In the regression model, which is the second model in this study and built for the dependent variable ROE, the Pooled Least Square method was used as the estimation method. The model created was found to be statistically significant (F=84.519, p<0.001). With this model created, 73.7% of the ROE dependent variable can be explained. When the presence of autocorrelation for the model was investigated, the dL (lower) limit value of the d statistic was 1.707 and the dU (upper) limit value was 1.831 in the Durbin-Watson d test table for 180 observations. With the model, the statistical value of Durbin-Watson test was found to be 0.680, and it is presented in Table 11 (0 < d < dL). Durbin-Watson values for the estimated model indicate the existence of autocorrelation. Since there is an autocorrelation problem in the model, the estimation results were interpreted by using the Cluster-Robust method. As in the results presented in Table 11, a statistically significant and positive effect of the OR2 variable on ROE was observed

(p=0.002). 1% change in OR2 value causes an increase of 431.2% in ROE value. There was not any statistically significant effect observed for the other variables (p>0.050).

Table 12 summarizes the acceptance status of the hypotheses created in the study according to the test results.

Table 12. Summary of Acceptance Status of Hypotheses According to Test Results

Hypotheses / Sub-Hypotheses	ROA	ROE
H1 / H1.2 (LR2)	$H1.2_0$: Accepted ; $H1.2_1$: Rejected	$H1.2_0$: Accepted ; $H1.2_1$: Rejected
H2 / H2.2 (KR2)	$H2.2_0$: Rejected ; $H2.2_1$: Accepted	$H2.2_0$: Accepted ; $H2.2_1$: Rejected
H3 / H3.1 (OR1)	$H3.1_0$: Accepted ; $H3.1_1$: Rejected	$H3.1_0$: Accepted ; $H3.1_1$: Rejected
H3 / H3.2 (OR2)	$H3.2_0$: Rejected ; $H3.2_1$: Accepted	$H3.2_0$: Rejected ; $H3.2_1$: Accepted
H4 / H4.1 (PR1)	$H4.1_0$: Accepted ; $H4.1_1$: Rejected	$H4.1_0$: Accepted ; $H4.1_1$: Rejected
H4 / H4.2 (PR2)	$H4.2_0$: Accepted ; $H4.2_1$: Rejected	$H4.2_0$: Accepted ; $H4.2_1$: Rejected

5. Conclusions

Islamic banks, whose popularity is consistently increasing each passing day all around the globe, have become an important field of study in the economics and finance literature. The foundations of the Islamic banking system in the Turkish financial system could be traced back to 1980s. Currently, six Islamic banks actively operate in Turkey. Three of them were founded and started their activities after the year, 2015. Even though the number of Islamic banks in Turkey and their asset size is quite low as compared to the conventional banks, Islamic banks, with their high growth rates and financial performances, appear as an important area that is worthy of examination.

This study, through regression analysis, examines the effect of risk management practices on the financial performances of three Islamic banks, which have fifteen years of consistent data from the period between 2006 and 2020, operating in Turkey. In the analyses, risk management was evaluated in four categories as liquidity risk, credit risk, operational risk and market risk. The findings reveal that leverage ratio and asset utilization ratio are effective on the performance of Islamic banks. The results of the study are in line with the finding of a similar research by (Yousfi, 2015), suggesting that credit risk and operational risk management practices affect financial performance. In addition, the results, obtained in this study are along the same line with the finding, indicating the effect of credit risk practices on financial performance, by (Sathyamoorthi, Mogotsinyana, Mphoeng, & Mashoko, 2020), who conducted a similar study focusing on traditional banks.

Credit risk is considered the most severe and common type of risk, especially for commercial banks in developed markets. Although it is impossible to operate as a bank without taking any credit risk, banks can and do manage their credit risks more effectively by utilizing the technological advancements and innovative applications. Additionally, the operational risks are of great importance for the banks, as they are becoming more integrated with the global markets, and the extent of their engagement with new technologies and qualified personnel increases day by day. In order to increase their financial performance, Islamic banks, with respect to their unique nature, should well-define the risks that they are exposed to, and make those risks measurable. Precautions should be taken for increased credit risk, especially in murabahah and mudarabah financing. Also, contracts with customers should be freed from gharar. Risks reduced by various tools and methods will no longer be a serious threat. Finally, it can be stated that the findings obtained within the scope of the current study could be used as guidance for the banks in their financial risk management policies and practices, and they will shed light on future research. The results can be used as valuable feedback for those interested in the Islamic banking system. Future studies that analyze different risk types in comparison with conventional banks would fill the gap in the literature.

Araştırmacıların Katkı Oran Beyanı/ Contribution of Authors

Yazarların çalışmadaki katkı oranları Suna AKTEN ÇÜRÜK %25/ Gülşah ŞEN KÜÇÜK %25/ Mine IŞIK %25/ Raif PARLAKKAYA %25 şeklindedir.

The authors' contribution rates in the study are AKTEN ÇÜRÜK %25/ Gülşah ŞEN KÜÇÜK %25/ Mine IŞIK %25/ Raif PARLAKKAYA %25 form.

Çıkar Çatışması Beyanı / Conflict of Interest

Çalışmada herhangi bir kurum veya kişi ile çıkar çatışması bulunmamaktadır.

There is no conflict of interest with any institution or person in the study.

İntihal Politikası Beyanı / Plagiarism Policy

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Bu çalışmada Yükseköğretim Kurumları Bilimsel Araştırma ve Yayın Etiği Yönergesi kapsamında belirtilen kurallara uyulmuştur.

In this study, the rules specified within the scope of the Higher Education Institutions Scientific Research and Publication Ethics Directive were followed.

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