Current Applied Studies in the Field of Finance

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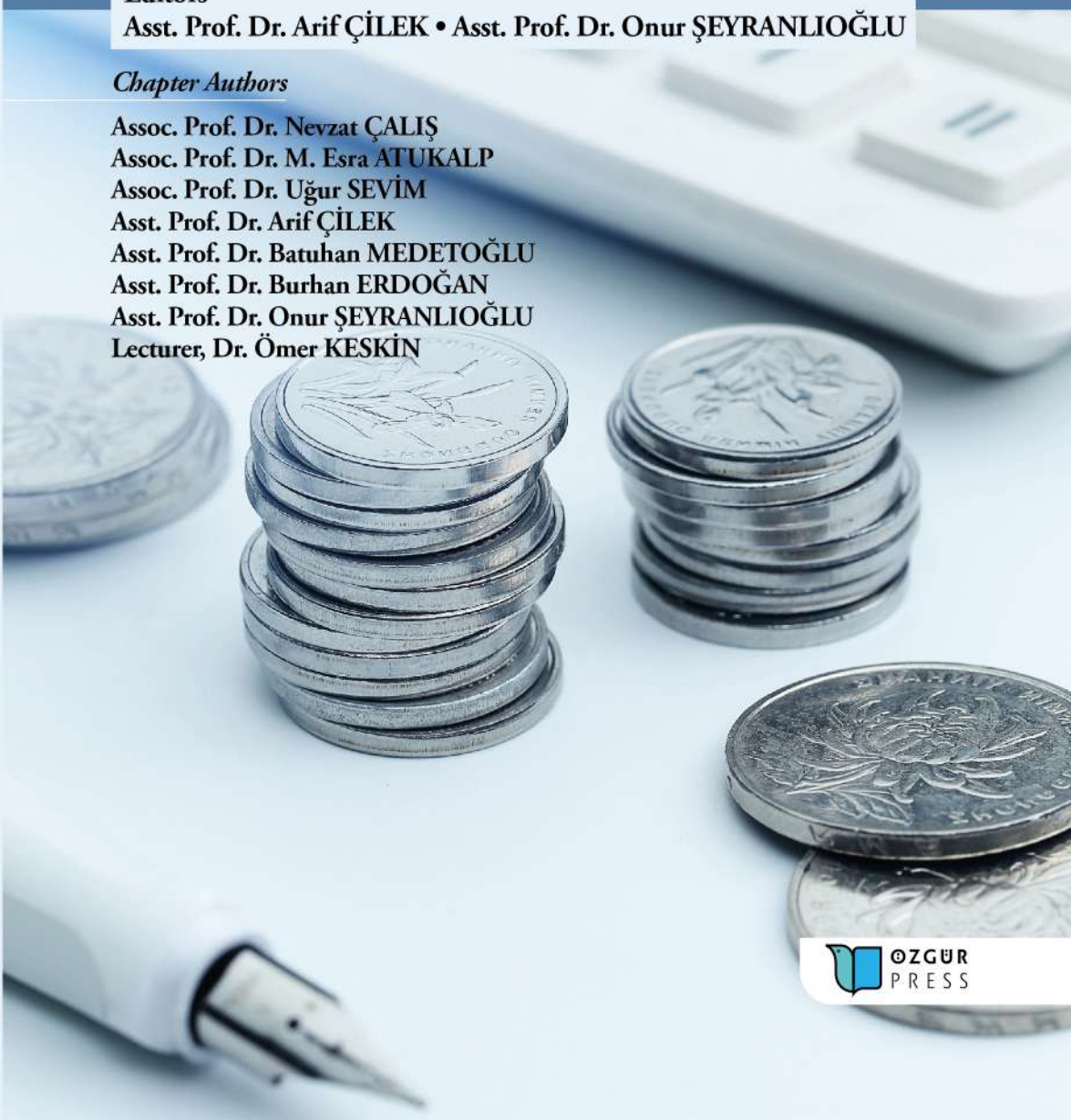

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Preface

In recent years, the world of finance has undergone a major transformation driven by both technological innovations and global developments. The acceleration of digitalization, the rise of financial technologies (FinTech), the increasing prominence of sustainability-focused approaches, and the impact of macroeconomic shocks have led to changes across a wide range of areas, from financial management to investment strategies. The global pandemic has also been one of the most significant factors accelerating this transformation. COVID-19 tested the resilience of the global financial system, forced businesses and individuals to redefine economic security, and once again highlighted the importance of risk management. In this context, financial analyses and performance evaluations have become more critical than ever.

The transformation in the world of finance has also been strongly interconnected with other sectors, particularly energy, banking, and insurance. Fluctuations in energy markets, evolving credit policies within banking systems, and risk assessments and profitability calculations in the insurance sector have added complexity to financial decision-making. Today, finance plays a crucial role not only in regulating capital flows but also in achieving sustainable development goals, minimizing societal risks, and maintaining economic growth.

This book brings together significant studies aimed at better understanding this complex and constantly evolving financial ecosystem. Topics such as the comparison of energy companies' financial performance before and after the COVID-19 pandemic, the analysis of factors affecting profitability in the insurance sector, and the impact of bank loans and innovation on economic growth aim to shed light on current economic challenges. Additionally, the intricate relationships between financial indicators, such as the causality between profitability ratios and the interaction between credit volumes and profitability, are examined in detail. With growing awareness of sustainability, the analysis of how ESG (Environmental, Social, and Governance) risk ratings impact financial performance also emerges as a key focus area. These studies not only illuminate some of the most pressing debates in today's financial world but also provide valuable contributions to the literature.

The studies in this book have been prepared by academics with different interests and specialisations in the field of finance, and each of them offers in-depth knowledge and experience in their own field. Our authors are esteemed academics who have academic studies in different fields of finance and work at reputable universities. Their devoted efforts enable this book to make a significant contribution to the finance literature.

On this occasion, we would like to extend our gratitude to all the authors who contributed to the creation of this important work. We are confident that their valuable contributions to the academic world will offer readers new perspectives and serve as a guide in the dynamic realm of finance. With the belief that you, our esteemed readers, will greatly benefit from these studies, we wish you a pleasant and insightful reading experience.

Asst. Prof. Dr. Arif ÇİLEK
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Chapter 1

An Analysis of Factors Affecting Profitability in the Insurance Sector: Evidence from Turkish Insurance Companies

Burhan Erdoğan[1]

Abstract

Achieving sustainable development in emerging economies is contingent upon the effective and efficient operation of all sectors. The financial sector plays a critical role in supporting individuals and institutions within an economy by ensuring resource allocation and promoting investments. Alongside banking activities, the insurance sector has taken on a significant role in Türkiye's financial landscape, contributing to the nation's economic development through its recent growth and profitability. This study analyzes the factors influencing the return on assets (ROA) of firms operating in the Turkish insurance sector. Quarterly data from 28 insurance firms for the period between the first quarter of 2014 and the second quarter of 2024 were analyzed using panel data analysis. The results indicate that premium size, leverage ratio, and BIST variables have a significant impact on the return on assets of insurance companies, while liquidity ratio and conservation ratio do not exhibit significant effects.

Introduction

The insurance sector, one of the key players in the financial industry, fulfills vital roles for global economies by managing and mitigating risks faced by both individuals and businesses. As a cornerstone of modern economies, this sector supports economic stability and contributes to the sustainability of the financial system by distributing risk across individuals and institutions (Haiss & Sümegi, 2008:406; Lee, 2014:681). Insurance companies not only manage the risks of individuals and institutions through

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their products and services but also engage in activities that safeguard the overall health of the economy.

The economic significance of the insurance sector emerges particularly through risk redistribution and management. By collecting premiums from policyholders, insurance companies allocate these funds to cover future damages and losses. Insurance facilitates the sharing and broad distribution of risks, preventing significant financial losses at the individual and institutional levels (Mehari & Aemiro, 2013:246). The critical activities performed by the insurance sector help to mitigate sudden and large financial fluctuations in economies.

The functions of the insurance sector extend beyond risk management alone (Oscar Akotey et al., 2013:286). Insurance companies also contribute significantly to investment and capital markets (Ahmed et al., 2010). By investing the collected premiums in various financial instruments, they support economic growth and employment. These funds also serve as a source of financing for governments, enabling long-term investments. Thus, insurance companies act not only as economic agents for individuals and firms but also for states, especially in countries facing resource constraints, where they help reintegrate idle funds into the economy and protect resources.

The insurance sector assumes a crucial role in ensuring sustainable development in modern economies. In recent years, unexpected events such as natural disasters, accidents, and pandemics have underscored the sector's importance in increasing societal resilience and accelerating recovery processes, thereby supporting stable economic growth (Lim & Rokhim, 2021:982). Additionally, by raising awareness of risk perception and management, the insurance sector fosters more informed decision-making processes (Camino-Mogro & Bermúdez-Barrezueta, 2019:831).

As the insurance sector continues to strengthen its position in economies, it demonstrates resilience and adaptability in response to major risks such as global financial crises, natural disasters, and pandemics. The performance of insurance companies during such challenging periods plays a decisive role in the overall health of the economy. Therefore, examining the factors affecting profitability in the insurance sector is not only crucial for the financial success of these companies but also for maintaining economic stability and growth.

This research aims to identify the factors influencing the profitability of insurance companies and analyze their broader economic implications. The study will explore the financial performance of insurance companies and

evaluate the impact of these factors on the sector's profitability. By doing so, the research seeks to contribute to the development of financial strategies for insurance companies and the shaping of economic policies.

To achieve this, quarterly data from 28 firms operating in the Turkish insurance sector, covering the period from Q1 2014 to Q2 2024, were compiled to analyze the factors affecting insurance companies' profitability. The data, obtained from the Turkish Insurance Association, were analyzed using panel data analysis techniques. The results of the study are particularly significant as they include the pandemic period, which had a direct impact on the insurance sector, and provide insights for future investments in the insurance industry.

1. Literature Review

Academic studies on the factors affecting the profitability of insurance companies provide valuable insights into both the key determinants of financial performance and the long-term impacts of these factors on the insurance sector. The literature has examined profitability factors from various perspectives, revealing how macroeconomic conditions, market structure, internal dynamics, and regulatory frameworks shape the financial performance of insurance companies. In this context, the studies have compared the profitability dynamics of insurance companies in both developed and developing countries, analyzing how the sector responds to different economic conditions and which strategies prove successful.

The literature review not only deepens the existing knowledge on the profitability of the insurance sector but also establishes a crucial foundation for future research in this field. This study aims to identify gaps in the literature and develop a more comprehensive and up-to-date understanding of the financial performance of the insurance sector. Some of the studies on this topic in the literature are summarized in Table 1.

Tablo 1. Literature Review

Author(s)	**Study Periods**	**Methods**	**Results**
Elitaş et al. (2012)	2010-2011	Grey relational analysis	The results demonstrate a significant relationship between the liquidity ratios of insurance companies and their financial performance.
Boadi et al. (2013)	2005-2010	Panel regression analysis	The study results show that leverage and liquidity are effective factors influencing profitability.
Doğan (2013)	2005-2011	Panel regression analysis	The results obtained from the study reveal that while the loss ratio, leverage ratio, and liquid asset variables negatively affect profitability, asset size positively influences profitability.
Alhassan et al. (2015)	2007-2011	Data envelopment analysis	The results obtained from the study indicate that leverage ratio and inflation are factors that affect profitability.
Kripa and Ajasllari (2016)	2008-2013	Panel regression analysis	The results indicate that the growth rate is positively related to profitability, whereas liabilities, liquidity, and fixed assets are negatively related.
Ullah et al. (2016)	2004-2014	Ordinary least squares	The study has revealed a significant relationship between insurance risk and profitability.
Berhe and Kaur (2017)	2005-2014	Panel regression analysis	The study results indicate that the capital adequacy ratio, liquidity ratio, and GDP growth rate have significant effects on the profitability of insurance companies.
Kramaric et al. (2017)	2010-2014	Panel regression analysis	The study results show that GDP and age variables have significant effects on the profitability of insurance companies.
Camino-Mogro and Bermúdez-Barrezueta (2019)	2001-2017	Panel regression analysis	The obtained results indicate that capital adequacy and liquidity ratios have significant impacts on profitability.
Eling and Jia (2019)	2003-2013	Stochastic Frontier Analysis and Data Envelopment Analysis	The results demonstrate that efficiency is a significant variable affecting profitability in the insurance sector.

Abdeljawad et al. (2020)	2006-2018	Panel regression analysis	The study results reveal that firm size, growth rate, and liquidity variables have significant effects on profitability.
Azmi et al. (2020)	2013-2017	Panel regression analysis	The results indicate that firm size, liquidity ratio, equity growth rate, economic growth, and interest rates have significant effects on profitability.
Bhattarai (2020)	2012-2018	Panel regression analysis	The study results show that financial leverage and firm size are factors that influence profitability.
Ben Dhiab (2021)	2009-2017	System GMM	The results indicate that the ratio of tangible fixed assets and the rate of premium increase have significant effects on profitability.
Ahmeti and Iseni (2022)	2015-2022	Panel regression analysis	The results have demonstrated that firm size and firm age significantly influence profitability.

2. Data and Methodology

In this study, quarterly data from 28 firms operating in the Turkish insurance sector, covering the period from the first quarter of 2014 to the second quarter of 2024 (a total of 42 quarters), were obtained from the official statistics of the Insurance Association of Türkiye. Information regarding the insurance companies included in the study is presented in Table 2.

Table 2. Insurance Companies Examined in the Study

Firm's Title			
Ak Sigorta AŞ	BNP Paribas Cardif Sigorta	Gulf Sigorta	Orient Sigorta
Allianz Sigorta AŞ	Coface Sigorta AŞ	Türkiye Sigorta	Quick Sigorta
AgeSA Hayat ve Emeklilik	Doğa Sigorta	HDI Sigorta	Ray Sigorta
Anadolu Anonim Türk Sigorta	Ethica Sigorta	Koru Sigorta	Sompo Sigorta
Anadolu Hayat Emeklilik	Eureko Sigorta	Magdeburger Sigorta	Şeker Sigorta
Axa Sigorta	Generali Sigorta	Mapfre Sigorta	Unico Sigorta
Bereket Sigorta	Groupama Sigorta	Neova Sigorta	Zurich Sigorta

The regression model used in the study is presented in Equation 1, and information regarding the variables is provided in Table 3.

$$ROA_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 LIQ_{it} + \beta_3 CON_{it} + \beta_4 LEV_{it} + \beta_5 BIST_i + \varepsilon_{it} \quad (1)$$

In the above Model 1, the dependent variable ROA represents the return on assets of the insurance companies, β_0 is the constant term, SIZE represents the premium production of the insurance companies, LIQ denotes the liquidity ratio of the companies, CON refers to the conservation ratio, LEV stands for the leverage ratio, BIST is a dummy variable indicating whether the firms are publicly traded, and ε represents the error term of the model. Additionally, *i* indicates the insurance companies, while *t* represents the time period of the study. The basic information regarding the variables used in Model 1 is provided in Table 3.

Table 3. Variables Used in the Study

Variable Type	Variable	Calculation	Symbol	Expected Impact	Source
Dependent Variable	Return on Asset	Net Profit / Total Assets	ROA		Insurance Association of Türkiye
Independent Variables	Premium Size	Natural Logarithm of Gross Premiums	SIZE	+	
	Liquidity Ratio	Current Assets / Short-Term Liabilities	LIQ	+/-	
	Conservation Ratio	Collected Premiums (Net) / Collected Premiums (Gross)	CON	+	
	Leverage Ratio	Total Liabilities / Total Assets	LEV	-	
	BIST	Dummy variable that takes the value "1" if the insurance company is traded on the stock exchange, otherwise "0".	BIST	+	

In the study, the quarterly data spanning 42 periods from 2014 to 2024 were analyzed using panel data analysis methods. The analyses were conducted using the Stata 15 software. The summary statistics of the data are presented in Table 4.

Tablo 4. Summary Statistics

Variables	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
ROA	1,096	0.015	0.055	-0.432	0.255
SIZE	1,096	8.634	1.031	4.847	10.774
LIQ	1,096	1.610	1.675	0.679	20.767
CON	1,096	0.729	0.691	-0.073	17.704
LEV	1,096	0.783	1.135	0.056	1.254
BIST	1,096	0.229	0.420	0	1

Upon examining the results in Table 4, the following observations can be made:

ROA (Return on Assets): With an average value of 1.58%, the return on assets of the companies is relatively low, and some firms even exhibit negative values (down to -43%), indicating that some companies are not utilizing their assets effectively.

SIZE (Premium Size): The average premium size for insurance companies is 8.63. Since the standard deviation is low, premium sizes are generally similar across companies, suggesting a homogeneous distribution.

LIQ (Liquidity Ratio): The average liquidity ratio is 1.61, with some companies displaying significantly higher liquidity ratios (up to 20.76). This indicates that there are notable differences in liquidity management among insurance companies.

CON (Conservation Ratio): The average conservation ratio is 0.73, meaning that approximately 73% of insurance companies retain their existing policies. With low variance, this ratio is consistent across companies in the sector.

LEV (Leverage Ratio): The average leverage ratio is 0.78, indicating that the companies generally maintain reasonable debt levels, although some companies may have higher leverage ratios.

These data suggest that there are significant differences in the financial structures of insurance companies, reflecting diverse strategic approaches for each ratio. The correlation relationships between the variables are presented in Table 5.

Table 5. Correlation Table

	ROA	SIZE	LIQ	CON	LEV	BIST
ROA	1.000					
SIZE	0.2303	1.000				
LIQ	0.0690	-0.4389	1.000			
CON	-0.0726	-0.1553	0.0844	1.000		
LEV	-0.3580	0.0825	-0.5722	-0.0323	1.000	
BIST	-0.0019	-0.1087	-0.0083	-0.0689	0.2407	1.000

According to the correlation results presented in Table 5, there is a positive relationship (0.2303) between ROA and SIZE, and a negative relationship (-0.3580) between ROA and LEV. A strong negative correlation is observed between SIZ and LIQ (-0.4389). The strong negative relationship between LIQ and LEV (-0.5722) is noteworthy. Additionally, a positive relationship (0.2407) exists between LEV and BIST. These relationships suggest that return on assets, leverage, liquidity, and premium size may have significant impacts on financial performance.

3. Analysis Results

According to the unit root test results, it was found that the ROA variable is not stationary at the level, but it becomes stationary when its first difference is taken. On the other hand, the other variables are stationary at their levels. These results indicate that the first difference of the ROA variable should be used in the model, while the other variables can be included directly at their levels. This approach ensures stationarity in the model, reducing the risk of bias or misleading results in the econometric analysis.

To select the appropriate panel data model for the analyses, several tests must be conducted. These include the F-test (Moulton & Randolph, 1989) for choosing between the Pooled Ordinary Least Squares and Fixed Effects models, the Breusch-Pagan LM test (1980) for selecting between the Pooled Ordinary Least Squares and Random Effects models, and finally, the Hausman test (1978) to choose between the Fixed Effects and Random Effects models. The results of these tests are presented in Table 6.

Table 6. Appropriate Model Selection Results

Test	Results	Effect/Result
Unit Effect (F Test)	27.63 (0.0000)	Exist
Time Effect (Breusch and Pagan LM Test)	5.44 (0.0000)	Exist
Hausman Test	20.94 (0.0003)	Fixed Effects

Based on the performed test results, the fixed effects model was identified as the most appropriate model. Following this determination, assumption deviation tests need to be conducted. The results of these assumption tests are presented in Table 7.

Table 7. Assumption Deviation Tests

Test Types	Probability	Problems
Modified Wald	0.0000	Exist
Bhargava etc. DW	0.4651	Exist
Baltagi-Whu LBI	0.9037	Exist
Pesaran	0.0000	Exist
Friedman's	0.0000	Exist

Upon reviewing the results presented in Table 7, it is evident that the model encounters issues related to heteroskedasticity, autocorrelation, and cross-sectional dependence. To address these issues, Panel-Corrected Standard Errors (PCSE) estimators (Beck & Katz, 1995), known for their robustness in such cases, were employed. The PCSE estimation results are presented in Table 8.

Table 8. PCSE Robust Estimator Analysis Results

ROA	Coef.	Panel-Corrected Std. Err.	z	P>|z|	[95% Conf. Interval]	
SIZE	0.0211	0.0036	5.82	0.0000	0.0140	0.0283
LIQ	-0.0038	0.0033	-1.13	0.2570	-0.0104	0.0028
CON	0.0004	0.0020	0.21	0.8300	-0.0035	0.0044
LEV	-0.0305	0.0277	-11.01	0.0000	-0.3599	-0.2511
BIST	0.0297	0.0044	6.62	0.0000	0.0209	0.0385
_cons	0.0706	0.0428	1.65	0.0990	-0.0133	0.1546

The analysis results of the variables affecting the return on assets (**ROA**) of insurance companies reveal several important findings. First, a strong and positive relationship was identified between premium size (**SIZE**) and ROA. This indicates that as insurance companies collect more premiums, their ROA increases. An increase in premium size emerges as a key factor that strengthens revenue streams and enhances return on assets for insurance firms.

On the other hand, the leverage ratio (**LEV**) has a negative effect on ROA. A higher leverage ratio indicates increased financial risk, which negatively impacts ROA. This finding suggests that excessive borrowing

leads to a decrease in ROA for insurance companies. Therefore, firms with lower leverage ratios may achieve more stable and sustainable ROA.

The variable representing whether a company is publicly traded (**BIST**) also has a positive effect on ROA. Insurance companies that are publicly listed tend to have higher ROA compared to those that are not. This suggests that being publicly traded may provide companies with better financial performance.

However, variables such as liquidity (**LIQ**) and conservation ratio (**CON**) do not have a significant impact on ROA. This indicates that changes in liquidity and conservation ratios do not directly affect the ROA of insurance companies.

4. Conclusion and Evaluation

Analyzing the asset structure of the insurance sector is critically important for understanding the financial health and sustainability of the industry. Effective management of the assets and liabilities of insurance companies is a fundamental factor in minimizing risks and enhancing company performance. In particular, a thorough understanding of liquidity, profitability, and risk management in the insurance sector contributes to greater resilience in times of economic uncertainty and crises.

According to the results of this study, significant relationships were found between the profitability of insurance companies and the variables of premium size, leverage ratio, and being publicly traded. In light of these results, various incentives could be introduced to increase premium size and improve profitability. Specifically, tax breaks or financial support could be provided for research and development (R&D) activities and product innovations aimed at expanding insurance coverage and developing new insurance products.

Public policies could be developed to increase the insurance penetration rate, thereby boosting premium volume in the insurance sector. In this context, expanding mandatory insurance types and launching awareness campaigns to enhance insurance literacy among individuals could increase the number of policyholders. More insured individuals would, in turn, increase premium income and support the profitability of insurance companies.

To prevent excessive risk-taking through over-leveraging, an upper limit on leverage ratios should be imposed. This would help preserve the financial soundness of companies and prevent borrowing costs from negatively affecting profitability.

Companies should be encouraged to increase their equity capital. Tax incentives for capital increases or financing opportunities provided through public funds could help insurance companies grow through equity rather than debt, thereby reducing leverage ratios.

The fact that being publicly traded offers insurance companies advantages in terms of transparency, corporate governance, and access to capital should be acknowledged. Therefore, initial public offerings (IPOs) within the insurance sector should be encouraged. Simplifications in regulatory processes and tax advantages could be provided to facilitate the IPO process.

The adoption of corporate governance standards by publicly traded companies can enhance investor confidence and financial transparency, thereby positively impacting profitability. In this regard, incentives should be provided to publicly traded insurance companies to adopt and implement corporate governance principles. Good corporate governance practices can enhance a company's long-term profitability.

Educational and awareness campaigns should be organized to help companies in the insurance sector better understand the positive impact that being publicly traded has on profitability. These campaigns could highlight how public trading facilitates access to capital markets, provides liquidity, and increases growth opportunities.

Future research could focus on more comprehensive studies examining the impact of various variables on the asset structure of insurance companies. Particularly, studies focusing on the effects of technology and digitalization would be beneficial for future research. Additionally, case studies exploring how insurance companies manage their asset structures during crisis periods could help develop practical strategies to enhance the sector's resilience against crises.

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Chapter 2

The Effect of Bank Credits and Innovation on Economic Growth in BRICS Countries

M. Esra Atukalp[1]

Abstract

In many economies, private sector credit plays a critical role by productively allocating resources for investment and is considered the engine of economic growth. Bank credit to the private sector promotes economic growth through capital accumulation and technological progress by mobilizing savings, increasing production and optimizing capital allocation. In this respect, it is expected that the determination of the relationship between bank credits and economic growth will shed light on policy makers. The aim of this study is to examine the effect of bank credit and innovation on economic growth in BRICS countries. In the study, which deals with the period of 2001-2020, the analysis was carried out with Westerlund panel cointegration analysis. As a result of the analysis, it has been determined that there is no cointegration relationship between GDP and domestic credits from banks to the private sector and innovation in BRICS countries and the supply-side hypothesis that bank credit causes economic growth in BRICS countries is not valid.

1. Introduction

Economic growth is one of the main goals of macroeconomic policies. In addition to raising living standards, it is the most important way to ensure economic development. Within the scope of economic policies, money supply in the credit channel is expected to affect real variables through credit availability. In this context, it is thought that the development of the financial sector plays a major role in economic development.

Deposit banks provide economic development in every economy through their intermediary roles. Credit can be defined as the total amount of funds

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provided by deposit banks to individuals, businesses and the government for consumption and investment purposes. Bank lending to the private sector promotes economic growth through capital accumulation and technological progress by mobilizing savings, increasing production and optimizing capital allocation.

Since credit feeds the economy, it is considered the key to economic growth, especially in developing countries. In many economies, private sector credit plays a critical role by efficiently allocating resources for investment and is considered the engine of economic growth. In this respect, it is expected that the determination of the relationship between bank loans, innovation and economic growth will shed light on policy makers. Therefore, the role of bank credit in economic growth has been recognized by many researchers, as various economic units can invest in various investment opportunities.

Based on the fact that the development of the financial sector plays a major role in economic development and that loans affect real variables The effect of credit on economic growth should be considered for high-speed developing countries with different financial characteristics such as Brazil, Russia, India, China and South Africa. In this study, the effect of bank credit on economic growth in BRICS countries consisting of Brazil, Russia, India, China and South Africa was examined. In the study, which deals with the period of 2001-2020, the examination was carried out with panel cointegration analysis. The study consists of four parts. The study is organized as follows after the introduction. In the second part, literature studies examining the effects of banking sector loans and innovation on economic growth are examined. In the third chapter, the analysis method and data set discussed within the scope of the analysis are explained and the findings are been given. In the fourth and last section, the results are included.

2. Literature Review

There are national and international studies in the literature examining the effects of banking sector loans, financial development and innovation on economic growth. These studies differ in terms of both the country constituting the study area, the analysis period and the analysis method. Some of these studies, especially the cointegration analysis, have been examined here, these studies are included in Table 1.

Tablo 1. Literature Studies

Author (Year)	Country	Period	Subject of Analysis
Nazlıoğlu et al. (2009)	Turkey	1987-2007	causality between investment and financial development.
Hasan & Tucci (2010)	58 countries	1980–2003	the importance of innovation on economic growth.
Adamopoulos (2010)	Ireland	1965-2007	relationship between financial development and economic growth.
Esso (2010)	Ecowas countries	1960-2005	the cointegrating and causal relationship between financial development and economic growth.
Kar et al. (2011)	Middle East and North African countries	1980-2007	causality between financial development and economic growth.
Akujuobi & Chima (2012)	Nigeria	1960-2008	the effects of loans given by banks to the manufacturing sector on economic growth.
Bittencourt (2012)	four Latin American countries	1980-2007	the role of financial development, or more widespread access to finance, in generating economic growth.
Timsina (2014)	Nepal	1975-2013	the effect of commercial bank loans given to the private sector on economic growth.
Pradhan et al. (2014)	34 OECD countries	1960-2011	real relationship between banking sector development, economic growth and inflation.
Meierrieks (2014)	51 countries	1993-2008	the effect of financial development on innovation.
Tang (2015)	Malaysia, Singapore, Indonesia, Thailand and Philippines	1990-1996	causality between bank loans and economic growth.
Mushtaq (2016)	Pakistan	1961-2012	the effects of deposits and loans on economic growth.
Işık (2017)	G-20 countries	1995-2015	cointegration bank loans given to the private sector and innovation - economic growth and innovation.
Kılınç et al. (2020)	24 European Union member countries and Turkey	2001-2017	the effects of loans given to the private sector on innovation.
Zhou et al. (2020)	China	2007-2017	the impact of regional credit and technological innovation on regional economic growth.
Kesbiç & Şimşek (2020)	33 OECD countries	2000-2018	the effect of innovation on economic growth.

3. Dataset, Methods and Findings

When empirical analysis is considered in general it has been observed that, variables such as the ratio of loans given to the private sector to gross domestic product and commercial loans, representing bank funds; R&D expenditures and patent numbers are generally considered for innovation. It has been accepted that the economies of countries that can realize innovation are also strengthened, and within the framework of the Schumpeterian tradition, whether banking contributes to innovation-based economic growth has begun to be the subject of research.

The principal changes in a dynamic economy are due to technical innovations in the production process. Credit expansion affects the distribution of income and capital formation. Bank credit detaches productive resources to new productive combinations and innovations (Schumpeter, 1934). Schumpeter (1911) also stated that the banking sector is the capitalist of productive investments and causes an increase in the rate of economic growth. Schumpeter is also first researcher to place innovation at center of economic growth, as well as banking sector (Işık, 2017, p.54).

It is important for the banking sector to finance innovations that will provide an advantage in economic growth, as financing innovations through bank loans allows the financial sector to create a bridge to the production-oriented real sector.

In this study, which examines the effect of bank loans on economic growth, BRICS countries (Brazil, Russia, India, China and South Africa) are included in the scope of the study. The data on the banking systems and economies of these countries are discussed in terms of 20-year observation numbers for the 2001-2020 period. The aspect of the study that differs from the existing literature and its contribution to the literature is that it deals with the effects of both innovation and bank credits on economic growth and differentiates the country group discussed from the literature. The data for the analysis were obtained from the World Bank website. The dependent and independent variable information, which is handled within the scope of the analysis, is given in Table 2.

Tablo 2. Defining Variables

Type	Variable Name	Code
Dependent	Growth	GDP
Independent	Domestic credit from banks to private sector	CrBank
Independent	Patent	Innov

As can be seen in Table 2, in order to measure the effect of loans on growth, GDP was taken as the dependent variable, and private sector loan as the representative of bank loan and patent were taken as the independent variable due to the fact that the loans given to the private sector to support economic growth among the loans offered by banks were evaluated more effectively.

The analysis was made with the panel cointegration test, the processes related to the process are explained below.

In the study, the homogeneity / heterogeneity of the slope coefficients in the series were examined with the $\tilde{\Delta}$ and $\tilde{\Delta}adj$ tests developed by Pesaran & Yagamata (2008). $\tilde{\Delta}$ and $\tilde{\Delta}adj$ test statistics are calculated by equations (1) and (2) (Pesaran & Yamagata, 2008, p.8).

$$\tilde{\Delta} = \sqrt{N}\left(\frac{N^{-1}\tilde{S} - k}{\sqrt{2K}}\right) \tag{1}$$

$$\tilde{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\tilde{S} - E(\tilde{z}_{it})}{\sqrt{Var(\tilde{z}_{it})}}\right) \tag{2}$$

$$E(\tilde{z}_{iT}) = k,\ Var(\tilde{z}_{iT}) = \frac{2k(T-k-1)}{T+1}$$

The homogeneity test results are given in Table 3, and the hypotheses for the delta test are formed as follows.

H_0: The slope coefficient is homogeneous.

H_1: The slope coefficient is not homogeneous.

Tablo 3. Homogeneity Test Results

	Statistic	**Probability**
Delta	9,543	0,000
adj	10,670	0,000

According to the homogeneity test results, it is seen that the probability values are 0,000 and accordingly the H_0 hypothesis has been rejected. Accordingly, it can be said that the slope coefficients for the variables are heterogeneous.

Whether there is a cross-section dependency in the series, unit root tests to be applied in the analysis, and cointegration tests may vary. As a result, it is necessary to test the cross-section dependence first in panel data analysis. Pesaran (2004) CD test was used in the study to determine the cross-sectional dependence in the series of the variables. CD test turns out to be remarkably robust to major departures from normal errors, particularly for T ≥ 10 (Pesaran, 2004, p.2). Pesaran (2004) CD test is calculated with the help of equation (3) (Pesaran, 2004, p.5).

$$CD_{LM} = \sqrt{\frac{1}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T \hat{p}_{ij}^2 - 1) \right) \qquad N(0,1) \qquad (3)$$

Pesaran CD results are given in Table 4. The hypotheses are as follows.

H_0: There is no cross-section dependency.

H_1: There is cross-section dependency.

Tablo 4. Cross Section Dependency Test Results

Variables	**Pesaran CD**	
	Statistic	Probability
GDP	11,33	0,000
CrBank	11,24	0,000
Innov	7,59	0,000

According to the results given in Table 4, the probability values are less than 0.01 ($p<0.01$), and the H_0 hypothesis has been rejected. Accordingly, there is a cross-sectional dependence between domestic loans from banks to the private sector, innovation and GDP variables.

In the Levin-Lin-Chu (LLC) unit root test, it is assumed that all individuals in the panel have the same first-order partial autocorrelation, and all other parameters in the error process are allowed to vary freely among individuals (Levin et. al., 2002, p.4). For stationarity tests, first and the second generation LLC test was used (Yerdelen Tatoğlu, 2020, p.68; Şahin, 2022, p.80-81). One of the following models can be created (Levin et. al., 2002, p.4).

Model 1: $$\Delta y_{it} = \delta y_{it-1} + \zeta_{it} \qquad (4)$$

Model 2: $$\Delta y_{it} = \alpha_{0i} + \delta y_{it-1} + \zeta_{it} \qquad (5)$$

Model 3: $$\Delta y_{it} = \alpha_{0i} + \alpha_{1i} t + \delta y_{it-1} + \zeta_{it} \qquad (6)$$

Here, $-2 < \delta \leq 0$ i=1, …, N

In the test, the error process is independently distributed among the individuals and is modeled as in equation (7) (Levin et. al., 2002, p.4).

$$\zeta_{it} = \sum_{j=1}^{\infty} \theta_{ij} \zeta_{it-j} + \varepsilon_{it} \qquad (7)$$

Levin et. al., 2002 tests consist of three steps (Levin et. al., 2002, p.5).

1) A separate Augmented Dickey Fuller (ADF) regression is applied for all cross sections. The ADF regression model is created as in equation (8).

$$\Delta y_{it} = \delta_i y_{it-1} + \sum_{L=1}^{p_i} \theta_{iL} \Delta y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it} \qquad \text{m=1,2,3} \qquad (8)$$

The lag order p_i is permitted to vary across individuals

2) An estimation is made from the long-term standard deviations to the short-term standard deviations.

3) Calculations of panel test statistics are made.

The results of the LLC unit root test are given in Table 5, and the hypotheses regarding the unit root test are as follows.

H_0: Panels contain unit root.

H_1: Panels are stationary.

According to Table 5, the GDP variable was found to be significant at 10% significance levels in the fixed and trend model, and accordingly, the H_0 hypothesis, which states that the relevant series is not stationary, was rejected. On the other hand, the CrBank and Innov variables were not found to be significant at any significance level, and the H_0 hypothesis was accepted. In the first difference of the CrBank and Innov variable, the probability values were found to be significant, respectively at the 1% and 10% significance level ($p<0.01$) in the fixed and trend model, so the H_0 hypothesis, which states that the series is not stationary (contains a unit root) for all series, has been rejected.

Table 5. Levin-Lin-Chu Unit Root Test Results

Variables	No Fixed-Trendless		Fixed		Fixed-Trend	
	Statistic	Probability	Statistic	Probability	Statistic	Probability
GDP	-1,7768	0,2249	0,7197	0,9743	-4,5297	0,0658*
CrBank	-0,2376	0,8556	5,5586	1,0000	-2,2598	0,2141
Innov	-2,2584	0,1777	0,9108	0,9861	-4,7641	0,1029
Δ(GDP)	-1,1198	0,4548	0,7214	0,9809	-4,6363	0,0370**
Δ(CrBank)	-0,8573	0,6422	3,0846	1,0000	-4,4081	0,0040***
Δ(Innov)	-3,0579	0,0513*	-0,2272	0,9391	-4,6130	0,0867*

*%10 significance level, ** %5 significance level, *** %1 significance level, Δ: first difference of the series

According to the stationarity test results given in Table 5, it is understood that GDP variable is stationary at its level, the CrBank and Innov variables have a unit root at its level and they are stationary at first difference (Δ).

The existence of long-term relationships between series that are stationary at difference is determined. In determining the long-term relationship between growth and domestic loans from banks, innovation to the private sector in the BRICS countries, 2nd generation cointegration tests will be used since the correlation between units is determined.

Equation (9) can be used to generate test statistics (Westerlund, 2007, p.715).

$$\Delta y_{it} = \hat{\delta}_i^{'} d_t + \hat{\alpha}_i y_{it-1} + \hat{\lambda}_i^{'} x_{it-1} + \sum_{j=1}^{p_i} \hat{\alpha}_{ij} \Delta y_{it-j} + \sum_{j=0}^{p_i} \hat{\gamma}_{ij} \Delta x_{it-j} + \hat{e}_{it} \qquad (9)$$

Here $d_t = (1,t)^{'}$ is the deterministic components and $\delta_i = (\delta_{1i}, \delta_{2i})^{'}$ is the associated vector of the parameters.

The hypotheses for cointegration tests are as follows.

H_0: No cointegration.

H_1: All panels are cointegrated.

Westerlund test results are given in Table 6.

Table 6: Westerlund Cointegration Test Results

Variables	Statistic	Probability
CrBank	-0,2790	0,3901
Innov	-0.8498	0,1977

In order to determine whether there is a cointegration relationship between GDP and domestic loans from banks to the private sector, innovation cointegration test statistics and their probability values are given.

According to the results in Table 6, probability values greater than 0,10. Accordingly, the H_0 hypothesis, which claims that there is no cointegrated course of action among the variables in the models, has been accepted, and there is no relationship between the variables with the panel and time dimension, and there is no cointegrated course of action. Accordingly, it has been determined that there is no cointegration relationship between GDP and domestic loans from banks to the private sector in BRICS countries, and the supply-side hypothesis (Timsina, 2014: 12) that bank loans cause economic growth in BRICS countries is not valid. Moreover there is no cointegration relationship between GDP and innovation in BRICS countries.

4. Conclusions

In the BRICS countries consisting of Brazil, Russia, India, China and South Africa, the effect of bank loans and innovation on economic growth was examined for the period 2001-2020. The analysis was carried out with panel cointegration analysis. In the analysis, economic growth is represented by the GDP dependent variable, bank loans are represented by the domestic loans from banks to the private sector (CrBank) and patent (Innov) independent variable. Cointegration analysis was carried out as a result of homogeneity test, cross-section dependency test, unit root test analysis.

Homogeneity was tested with the Delta test developed by Pesaran and Yamagata (2008), and as a result of the test, it was determined that the slope coefficients for the variables were heterogeneous. Pesaran (2004) CD test was used in the study to determine the cross-sectional dependence in the series of the variables. According to the results of cross-section dependency test, there is a cross-section dependency in domestic loans from banks to the private sector, innovation and GDP variables. According to the results of the unit root test, it is understood that the GDP variable is stationary at its level and first difference, the CrBank and the Innov variable has a unit root at its level and it is stationary at first difference.

The existence of long-term relationships between the series that are stationary at difference is determined. In the determination of the long-term relationship between growth in the BRICS countries and domestic loans from banks to the private sector and innovation 2nd generation cointegration tests should be used, since the correlation between units is determined. In this context, according to the results of the Westerlund test, there is no

relationship with panel and time dimension between the variables, and there is no cointegrating style of action.

As a result of the analysis, it has been determined that there is no cointegration relationship between GDP and domestic credits from banks to the private sector in BRICS countries, and the supply-side hypothesis that bank credit causes economic growth in BRICS countries is not valid. Moreover it has been determined that there is no cointegration relationship between GDP and innovation in BRICS countries.

As a result of the analysis, it can be said that the banking sector is not the determinant of economic growth in the BRICS countries and the relevant period, the banking sector may not be used as an effective tool in economic growth, and the banks do not contribute to the economic development of the BRICS countries in terms of lending. In other words, the result shows that the monetary policy implementation aimed to expanding the bank loan volume in the BRICS countries is not determinative within the framework of the growth target. Therefore, it should make policies considering the fact that lending has no effect on GDP growth for banks in these countries. At this point, it is important to determine the activities that affect the economic growth in the BRICS countries more than the domestic loans given by the banks to the private sector. On the other hand because of the bank lending to the private sector has not performed well in terms of contribution to BRICS economic development and therefore there should be a critical monitoring of the facilities.

Innovation, which is one of the dynamics of growth, has no effect on growth. For a sustainable economic growth, it is necessary to determine the areas with strong innovation capacity and which will bring superiority in international competition. For this reason, in terms of the effect of innovation on growth, innovation policies should be reviewed, and the right projects and R&D expenditures should be directed.

The study has similar features with Kar et al (2011), Akujuobi & Chima (2012) Mustaq (2016) in terms of analysis results. In this direction, in future studies, determining the factors that determine growth in BRICS countries and / or other economies can be considered at the point of determining the effective factors for growth within the framework of the economic growth target.

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Chapter 3

Determination of Causality Relationship Between Profitability Ratios: An Application on BIST Dividend 25 Index

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Abstract

Investment refers to generating returns by utilizing the remaining amount after expenses are deducted from income. It involves allocating resources today for future consumption. Savings can be invested in a range of assets. Investors' risk perception expected return levels, personality traits, and psychological and external factors play an active role in the investment process. Various forecasting techniques are available for investments in financial assets, including fundamental analysis, technical analysis, and computer-aided analysis methods. This study analyzes the relationships between the financial ratios of companies listed in the BIST Dividend 25 Index, which enables investors to earn dividends in addition to benefiting from price movements. The primary objective is to identify the causal relationships between the Net Profit Margin and Return on Equity ratios within this index. By examining the relationship between these two important financial ratios, the study provides valuable insights to investors and other stakeholders about the complexities of the investment process. A sample of 20 companies from the BIST Dividend 25 Index was selected, and quarterly data for the two financial ratios from 2018Q1 to 2024Q1 were collected. The study applies Correlation Analysis and the Dumitrescu & Hurlin (2012) Panel Causality Test. The analysis results indicate a bidirectional causal relationship between the two financial ratios, with a weak negative correlation between the variables. This suggests that the two financial ratios within the relevant index are interrelated. The study is original in its exploration of the relationship between these two financial ratios using current data from companies included in the dividend index. It aims to guide companies in the sector, market participants, and researchers.

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1.Introduction

Various indices calculated by Borsa Istanbul (BIST) are closely monitored by both domestic and international investors. For a company to be included in one of the indices published by BIST, it must meet all the qualifications required for that particular index. For instance, inclusion in the BIST Sustainability Index, which has been published since November 2022, requires companies to surpass a certain threshold in sustainability-related categories (BIST, 2024b). Similarly, the BIST Dividend 25 Index, launched in July 2011, comprises the stocks of 25 companies distinguished by their dividend yield and liquidity (BIST, 2024c). As such, the BIST Dividend 25 Index is particularly attractive to investors seeking to diversify their portfolios with a focus on both liquidity and dividend returns.

BIST Dividend 25 Index includes 25 companies with high dividend yields and high market value of their publicly held shares. Therefore, the stocks in this index form a more liquid portfolio compared to those in the BIST Dividend Index, which serves a similar purpose (Mazgit, 2013: 227). The sectoral distribution of companies in the BIST Dividend 25 Index is as follows: banks (30.9%), holdings and investment companies (20.3%), retail trade (17.6%), telecommunications (8.2%), metal goods, machinery, electrical appliances, and transportation vehicles (7.9%), food, beverages, and tobacco (6.3%), and other sectors (8.8%) (BIST, 2024a). Table 1 provides detailed information on the 25 companies included in this index.

Table 1. Stock Composition of the BIST Dividend 25 Index

Stock	Stock Name	Sector	Weight in Index (%)
BIMAS	Bim Birleşik Mağazalar A.Ş.	Trade	17.31
AKBNK	Akbank	Banking	11.4
KCHOL	Koç Holding	Holding and Investment	8.46
TCELL	Turkcell	Communication	7.95
ISCTR	İş Bankası	Banking	7.61
SAHOL	Sabancı Holding	Holding and Investment	7.47
YKBNK	Yapı Kredi Bankası	Banking	6.84
GARAN	Garanti Bankası	Banking	4.81
SISE	Şişecam	Holding and Investment	4.47
FROTO	Ford Otosan	Automotive	4.09
AEFES	Anadolu Efes	Food and Beverages	2.95
MAVI	Mavi Giyim Sanayi Tic. A.Ş.	Trade	1.93
TOASO	Tofaş Fabrika	Automotive	1.92
ENKAI	Enka İnşaat	Construction	1.79

EKGYO	Emlak Konut GYO	Real Estate Investment Trust	1.51
TTRAK	Türk Traktör	Automotive	1.34
DOAS	Doğuş Otomotiv	Automotive	1.22
ISMEN	İş Yatırım	Brokerage	1.16
ALARK	Alarko Holding	Holding and Investment	1.1
ARCLK	Arçelik	Metal Goods, Machinery	1
DOHOL	Doğan Holding	Holding and Investment	0.99
ENJSA	Enerjisa Enerji	Electricity	0.97
AKSA	Aksa	Chemicals, Petroleum, Plastics	0.84
VESBE	Vestel Beyaz Eşya	Metal Goods, Machinery	0.46
ECILC	Eczacıbaşı İlaç	Healthcare and Pharmaceuticals	0.44

Source: Stock Exchange and Investment (2024)

As shown in Table 1, the stock with the highest weight in the BIST Dividend 25 Index is BİM Birleşik Mağazalar A.Ş., while the stock with the lowest weight is Eczacıbaşı İlaç. Additional details and characteristics of the index are presented in Table 2.

Table 2. Features of the BIST Dividend 25 Index

Feature	**Detail**
Index code	XTM25
ISIN code	TRAXIST00061
Index type	Market value weighted, non-weighted, price
Index starting value (30.06.2011)	632.694
Current index value (16.09.2024)	13,368.720
Total market value (Turkish Lira)	4,136,122,640,285.87
Number of investors (31.08.2024)	2,562,458

Source: BIST (2024a)

As illustrated in Table 2, the initial value of the BIST Dividend 25 Index was calculated at 632.6, while its current value stands at 13,368.7. The positive difference between the revenue generated and the expenses incurred within a given period is referred to as profit. Generating profit is the primary objective that businesses seek to achieve through their operations. Consequently, profitability ratios are employed to analyze whether the profit margins generated by businesses are adequate. Profitability is fundamentally

linked to a firm's sales and capital, and thus, the ratios employed in profitability analyses are typically evaluated on these two factors (Karagül, 2013: 80-81). These ratios are closely monitored by current stakeholders as well as potential investors, as they serve as critical indicators for assessing a company's success and the sustainability of its operations (Erokyar, 2008: 4). Additionally, profitability ratios reflect the efficiency with which a business is managed and play a crucial role in evaluating managerial competence (Ercan & Ban, 2016: 44).

The main profitability ratios used as indicators in academic studies include Return on Equity (ROE), Net Profit Margin (NPM), Gross Profit Margin (GPM), and Return on Assets (ROE) (Acar & Mortaş, 2011; Karadeniz et al., 2016; Sarıaslan & Erol, 2008 ve Çalış & Sakarya, 2022). Equity is the difference between the business's total assets and liabilities. This concept refers to the sum of the capital put in by the partners or owners of a business and the values it produces. Therefore, the amount of equity represents the rights of those who put capital into the business on the assets of the business (Arıkboğa, 2011: 220).

ROE represents the profit generated for each unit of capital invested by the business owners or partners. It is calculated by dividing the business's annual net profit by the total equity (Sarıtaş et al., 2016: 95):

$$\text{ROE} = \frac{\text{Net Profit}}{\text{Equity}} \tag{1}$$

NPM reflects the profitability level of a company's sales. In other words, NPM measures how much profit the company generates from every 1 TL of sales (Yenisu, 2019: 33). A higher NPM, which indicates the profit after tax, is generally viewed positively for the company. Factors influencing this margin include the country's economic conditions, the use of debt in financing, and high fixed costs (Sayılır, 2019: 114). NPM is calculated by dividing the company's net profit by net sales (Bülüç et al., 2017: 69; Çalış & Sakarya, 2023: 778):

$$\text{NPM} = \frac{\text{Net Profit}}{\text{Net Sales}}. \tag{2}$$

GPM represents the ratio of a company's gross profit to its net sales (Kiracı, 2009: 165). This ratio offers insight into the company's gross

profitability. A high or increasing GPM is generally interpreted as a positive indicator for the company (Tenker & Akdoğan, 2010: 669):

$$GPM = \frac{\text{Gross Sales Profit}}{\text{Net Sales}} \quad (3)$$

ROA is the ratio of a company's net profit to its total assets. This metric indicates how effectively the company's assets are being utilized to generate profits. In other words, a high ROA suggests that the company's assets are being efficiently leveraged to produce profits (Güçver, 2018: 106; Çalış, 2022: 112):

$$ROA = \frac{\text{Net Profit}}{\text{Total Assets}} \quad (4)$$

This study aims to investigate the causal relationship between ROE and NPM for 20 companies listed in the BIST Dividend 25 Index. The study begins by reviewing relevant literature, followed by a presentation of the analysis and findings, and concludes with recommendations based on the results.

2.Literature Review

There are numerous studies in the Turkish literature that directly examine the BIST Dividend 25 Index. Table 3 summarizes a selection of these studies as a general overview of the relevant literature.

Table 3. Summary of Literature

Author(s)	Period Examined	Methodology Applied	Topic	Finding
Mazgit (2013)	-	Event study method	The impact of being listed in the BIST Dividend 25 Index on stock returns	Changes in the BIST Dividend 25 Index do not significantly affect the price performance of the included stocks.
Kaya (2014)	2005-2013	Panel data analysis	The relationship between firms' dividend payout ratios and stock values	There is a positive relationship between earnings per share and stock prices.

Altın (2017)	2013-2015	Kolmogorov-Smirnov and Levene tests	Determination of anomalies in the stock returns of companies	Anomalies exist in stock returns.
Zeren (2017)	2001-2017	Pedroni, Kao, Cusum, and Westerlund panel cointegration tests, DOLS/ FMOLS estimators	The relationship between dividend distribution and firm value	No statistically significant relationship exists between dividend distribution and firm value.
Ünal and Ersoy (2020)	2009-2018	Panel regression analysis	The impact of dividend distribution policies on financial performance	Dividend distribution positively and significantly affects both ROE and ROA.
Şit (2021)	2010Q1-2021Q1	Durbin-H panel cointegration test and CCE coefficient estimator	The effect of dividend distribution policies on firm value	Dividend decisions influence firm value.
Sarılı and Gündoğdu (2021)	May 2011-April 2019	Johansen cointegration test	Examination of the dividend anomaly	Dividend anomaly is present.
Özkan and Yavuzaslan (2022)	June 2019-December 2020	Cross-sectional absolute deviation	Determination of herd behavior in price movements in the BIST Dividend 25 Index during COVID-19	Investors exhibited herd behavior in the BIST Dividend 25 Index before and after COVID-19.
Yılmaz and Gül (2023)	2016-2021	SD and WASPAS methods	Interaction between internal firm-specific and market-specific financial dynamics and firm performance	Firms with high dividend yield, profitability ratio, and market value, and low leverage ratio, perform better.
Çilek and Şeyranlıoğlu (2024)	2020-2022	Grey relational analysis method	The relationship between dividend yield and profitability ranking of firms	No significant relationship exists between dividend yield and profitability ranking of firms.

As seen in the literature review, the BIST Dividend 25 Index has generally been examined in terms of aspects such as the relationship between dividend distribution policies and firm values, and the presence or absence of anomalies in stock returns. This study differentiates itself from existing studies by utilizing profitability indicators such as ROE and NPM and investigating the causal relationship between these indicators. Furthermore, it employs the panel data analysis method on recent data. The study is anticipated to offer valuable insights for index investors, researchers, and all stakeholders with an interest in this area.

3.Method and Findings

This study investigates the causality relationship between Net Profit Margin (NPM) and Return on Equity (ROE) ratios of companies included in the BIST Dividend 25 Index. The index comprises the 25 stocks with the highest market value, ranked within the top two-thirds based on dividend yields (Borsa Istanbul, 2024). Furthermore, investors are attracted to the companies included in this index primarily due to their dividend distribution policies. For this reason, the companies within the index were selected as the sample, and the causal relationship between the two key financial ratios—Net Profit Margin and Return on Equity—was analyzed. To ensure a homogeneous structure in the sample selection, banks and enterprise data with discontinuous data (AKBNK, GARAN, ISCTR, ENJSA, YKBNK) were excluded. As a result, the final analysis was conducted using data from 20 enterprises. Quarterly NPM and ROE ratios were collected for these enterprises over the period from the first quarter of 2018 (2018Q1) to the first quarter of 2024 (2024Q1). The sample size was set at 20 enterprises, with 25 periods of data. The Dumitrescu & Hurlin (2012) Panel Causality Test was employed as the methodological approach to analyze the causal relationships.

The data were collected from Fintables (Fintables, 2024). Table 4 provides detailed information on the periods and codes corresponding to the relevant data.

Table 4. Financial Ratios and Period

Financial Ratio	Code	Date Range
Net Profit Margin	NPM	2018Q1-2024Q1
Return on Equity	ROE	

Source: (Fintables, 2024)

As part of the study, the descriptive statistics of the data were first presented. These statistics are outlined in Table 5, providing an overview of the key characteristics of the dataset.

Table 5. Descriptive Statistics

Variable	Observation	Mean	Std. Dev.	Min.	Max.	Correlation
NPM	500	162.1364	1134.731	-1351.01	17474.5	-0.08
ROE	500	38.85344	41.96179	-3.69	324.06	

Table 5 presents the observation values, mean values, standard deviation, minimum and maximum values, as well as the correlation coefficient of the dataset. The results indicate a weak negative correlation between the variables. Before applying the Dumitrescu & Hurlin (2012) panel causality test, several assumption tests were conducted. As part of this process, the presence of multicollinearity was assessed. To this end, Variance Inflation Factor (VIF) analysis was performed, which detects multicollinearity issues in the data. According to various sources, the VIF coefficient should remain below 5 or, in some cases, 10 (Kutner et al., 2005). The equation for this analysis is provided below.

$$VIF_i = \frac{1}{1 - R_i^2} \tag{5}$$

The VIF analysis results are given in Table 6.

Table 6. VIF Analysis Result

Variable	VIF	1/VIF
ROE	1.00	1.000000
Mean VIF	1.00	

According to the results presented in Table 6, there is no evidence of a multicollinearity problem. Following this, the analysis proceeded to examine the existence of inter-unit correlation, also known as cross-sectional dependence, using the Pesaran (2004) test. The Pesaran test utilizes the residuals from the Augmented Dickey-Fuller (ADF) regression estimate to assess inter-unit correlation. It does so by calculating the correlation of each unit with all other units, excluding itself (Pesaran, 2004). The balanced panel equation for this test is provided below (Yerdelen Tatoğlu, 2020).

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right) \quad (6)$$

Pesaran (2004) CD test results are given in Table 7.

Table 7. Pesaran (2004) CD Test Result

Variable	CD-test	p-value	Corr.	Abs (corr.)
NPM	9.13	0.000	0.133	0.399
ROE	39.09	0.000	0.567	0.690

Upon examining the results in Table 7, it is evident that there is a correlation between the units based on the probability values. When such correlation exists between units, further assumption testing should proceed using second-generation panel unit root tests (Yerdelen Tatoğlu, 2020; Çalış vd., 2023). In line with this, the Im, Pesaran, and Shin (IPS) unit root test was employed to assess stationarity. The hypotheses for the test are formulated as follows: H_0 "All units contain unit roots" and H_1 "Some units are stationary" (Im et al., 2003). The results of this test are presented in Table 8.

Table 8. Im, Peseran, Shin (IPS) Unit Root Test Result

Variable	Statistic	p-value
NPM	-14.2819	0.0000
ROE	-2.7599	0.0029

Upon examining the results in Table 8 and reviewing the probability values, it is concluded that the H₀ hypothesis is rejected, indicating that the series is stationary. The final assumption test involves analyzing the homogeneity of the data. For this analysis, the Swamy S and Delta tests were applied. The Swamy S test indicates that the data is homogeneous if there is no significant difference between the matrices (Swamy, 1971). The hypothesis for the relevant test is as follows:

$$\hat{S} = \chi^2_{k(N-1)} = \sum_{i=1}^{N}(\hat{\beta}_i - \bar{\beta}^*)'.\hat{V}i^{-1}.(\hat{\beta}_i - \bar{\beta}^*) \quad (7)$$

To further test the homogeneity of the data, the Delta test was conducted in addition to the Swamy S test (Erataş, 2013). The Delta test is calculated with the equations below (Pesaran and Yamagata, 2008).

$$\tilde{\Delta} = \sqrt{N}\frac{N^{-1}\tilde{S}-k}{\sqrt{2k}} \quad (8)$$

$$\tilde{\Delta}_{adj} = \sqrt{N}\frac{N^{-1}\tilde{S} - E(\tilde{Z}_{it})}{\sqrt{Var(\tilde{Z}_{it})}} \quad (9)$$

Swamy S and Delta test results are given in Table 9.

Tablo 9. Swamy S and Delta Test Result

Swamy S Test	Delta Test
chi2 (38) = 159.31	$\tilde{\Delta}$. Test Statistic=5.806
	p-value=0.000
Prob > chi2=0.000	$\tilde{\Delta}_{adj}$ Test Statistic =6.189
	p-value=0.000

According to the results of the Swamy S and Delta tests, the data were determined to be heterogeneous. To examine the causality relationships within the study, the Dumitrescu & Hurlin (2012) panel causality test, which is suitable for heterogeneous panels, was applied. The fundamental hypothesis of this method for heterogeneous panels is that all β_i. are equal to zero (indicating no causality), while the alternative hypothesis posits that some β_i differ from zero (indicating the presence of causality). The corresponding equations are provided below (Dumitrescu & Hurlin, 2012; Yerdelen Tatoğlu, 2020). In these equations, *W* represents the Wald statistic, and *Z* refers to the standard projection matrix in the linear regression model.

$$Y_{it} = a_i + \sum_{k=1}^{K} \gamma_i^{(k)} Y_{it-k} + \sum_{k=1}^{K} \beta_i^{(k)} X_{it-k} + \varepsilon_{it}. \quad (10)$$

$$\bar{W}_{N,T} = \frac{1}{N}\sum_{i=1}^{N} W_{i,T} \quad (11)$$

$$\bar{Z}_{N,T} = \sqrt{\frac{N}{2K}}\left(\bar{W}_{N,T} - \mathrm{K}\right) = \overset{\mathrm{T,N}\to\infty}{\to} \mathrm{N}(0,1). \quad (12)$$

When N is large:

$$\bar{Z}_{N} = \sqrt{\frac{N}{2\times K}\times\frac{(T-4)}{(T+K-2)}}\times\left[\left(\frac{T-2}{T}\right)\bar{W}_{N,T} - K\right] \quad (13)$$

Normally Distributed:

$$\tilde{Z}_N^{Hnc} = \sqrt{\frac{N}{2\times K}\times\frac{(T-2K-5)}{(T-K-3)}}\times\left[\left(\frac{T-2K-3}{T-2K-1}\right)\bar{W}_{N,T}-K\right]\overset{N\to\infty}{\to} N(0,1). \quad (14)$$

In the application of the Dumitrescu & Hurlin (2012) panel causality test, two hypotheses were formulated to analyze the causality relationships. These hypotheses are as follows:

$$H_1 = The\ \textbf{NPM}\ variable\ is\ the\ cause\ of\ the\ \textbf{ROE}\ variable.$$

$$H_2 = The\ \textbf{ROE}\ variable\ is\ the\ cause\ of\ the\ \textbf{NPM}\ variable.$$

The results of the analysis are presented in Table 10.

Table 10. Dumitrescu & Hurlin (2012) Granger Panel Causality Test Result

Hypotheses	W-bar Statistic	Z-bar Statistic	p-value	Causality
The NPM variable is the cause of the ROE variable.	49.5424	56.2129	0.0000	NPM => ROE
The ROE variable is the cause of the NPM variable.	22.1029	20.7887	0.0000	ROE => NPM

In the application of the Dumitrescu & Hurlin (2012) panel causality test, the lag length was determined using the Akaike Information Criterion (AIC). When reviewing the results in Table 10, it is evident that there is a bidirectional causality between the Net Profit Margin (NPM) and Return on Equity (ROE) variables. Both variables have the capacity to influence each other, demonstrating mutual causality at the 1% significance level. As a result, the hypotheses H_1 and H_2 are accepted, while the null hypothesis of the method is rejected, confirming the existence of mutual causality between NPM and ROE.

CONCLUSION AND DISCUSSION

Finance is the function that ensures the optimal management of resources to meet funding needs. The process includes making decisions related to financing, investment, and dividend distribution and formulating associated policies, which are core aspects of financial management. After securing funds and covering expenses, additional funds are typically sourced to address potential future financing needs, a process known as investment. This concept can be applied to physical assets such as buildings, vehicles, machinery, equipment, and land, as well as through financial assets. The

primary financial assets include stocks, bonds, bills, and other instruments such as futures contracts, warrants, real estate certificates, income-sharing certificates, repos, reverse repos, and deposits. This study examines financial markets, with companies listed on the BIST Dividend 25 Index as the sample. The selection of this index is justified by its appeal to investors due to its focus on dividend distribution. Data of the companies operating in the relevant index were obtained, and the relationships between the relevant financial ratios were determined. The variables taken within the scope of the study are Net Profit Margin and Return on Equity. Twenty of the 25 companies operating in the index were taken as a sample. Banks and companies with missing data were excluded from the sample. Data between 2018Q1 and 2024Q1 were taken to analyze from a comprehensive data range. Relevant data were obtained quarterly. The Dumitrescu & Hurlin (2012) Panel Causality Test was applied to the dataset to identify potential causal relationships between variables. Prior to conducting this test, several assumption tests were performed, including Correlation Analysis, VIF Analysis, the Pesaran (2004) test, the Im, Pesaran, Shin (IPS) Unit Root Test, the Swamy S test, and the Delta test. These tests were employed to assess factors such as correlation, stationarity, and homogeneity across units. The Correlation Analysis revealed a weak and negative relationship between the variables. However, the Panel Causality Test indicated a bidirectional causal relationship between the Net Profit Margin and Return on Equity. The results, significant at the 1% level, demonstrate the interaction between these two financial ratios. This finding offers valuable insights, particularly for investors focused on fundamental analysis, as it provides guidance on assessing companies listed in the index. Moreover, it complements technical analysis and computer-aided analytical techniques, offering a broader perspective on firms' financial performance. The study underscores the importance of financial ratios in investment decision-making. Future research is recommended to analyze the same index and financial ratios using alternative methodologies to compare and expand upon the findings of this study.

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Chapter 4

The Relationship Between Credit Volumes and Profitability: Findings from the BIST Banking Index

Nevzat Çalış[1]

Abstract

In this study, the effect of the loan amount given by the banks operating in the BIST banking index on the profitability of the banks was examined. The data for the periods 2009-2023 were analysed with the help of regression analysis. Two different models were created and ROA and ROE were determined as dependent variables. Total loans were determined as independent variables, while Non-Performing Loans / Total Loans, Shareholders' Equity / Total Assets, Deposits / Total Assets and Liquid Assets / Total Assets ratios were used as control variables. As a result of the study, a negative and significant relationship was found between ROA and NPL at a significance level of 5%, and between ROE and NPL at a significance level of 1%. In addition, a positive relationship was found between ROA and equity-fixed assets/ total assets ratio. In addition, significant relationships were found between ROA and equity/total assets and liquid assets/total assets ratios at the 10% significance level. On the other hand, a positive correlation was found between the equity/total assets ratio and ROE, indicating that a stronger equity structure of banks could increase their return on equity.

1. Introduction

Financial systems are examined in two groups as market-based and bank-based. In countries where the financial system is based on a market basis, retirement and investment funds form the basis of the system. In financial systems based on banking, banks are at the center of the system (Acikalin and Yildirim, 2021; Medetoglu and Saldanli, 2022). In countries with a bank-based financial system, achieving financial stability depends on having

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strong and durable banks. When the share and function of the banking sector in the country's economy are taken into account, it can be said that Turkey's financial system has a bank-based structure (Yıldırım and Sakarya, 2019).

The banking sector is at the heart of the financial system, playing a critical role in economic growth and development (Acikalin and Yildirim, 2021). The main function of banks is to provide funds for economic activities by converting savings into loans, and at the same time achieve profitability in the process. Banks' lending activities account for a large part of their earnings (Yildirim et.al, 2018; Kavas and Medetoglu, 2024). Therefore, the relationship between loan volume and the profitability of banks is of great importance for the sustainability of the sector and the health of the economic system. Understanding this relationship helps both banks make strategic decisions and regulators manage risks.

While the loan volume refers to the amount of credit provided by banks to the economy through the financial products offered; Profitability is usually measured by indicators such as net profit margin, return on equity (ROE) and return on assets (ROA) (Keskin and Kurt, 2022). Although the increase in loan volume has the potential to increase banks' revenues, the increased loan volume also comes with credit risk. This situation reveals the importance of banks' risk management strategies. In the literature, it has been stated that an increase in loan volume can have both positive and negative effects on the profitability of banks (Kashyap, Stein, & Wilcox, 1993; Berger and Bouwman, 2013).

Although an increase in loan volume means an increase in potential revenues for creditors, an increased loan volume also increases banks' exposure to credit risk. This can increase the risk of insolvency faced by banks, which can put pressure on profitability (Berger and Udell, 2004). On the other hand, with an efficient credit distribution mechanism and effective risk management, the increase in loan volume can significantly increase the profitability of banks (Dietrich and Wanzenried, 2011).

Banks perform important intermediary activities for financial markets. Banks are economic establishments that accept deposits and use deposits in various credit transactions in the most productive way or obtain or provide credit in a regular way, which is the main focus of their activities (Yıldırım, 2020). The impact of banks' loans on profitability examines the decisive role of credit transactions, which are an important part of the financial system, on bank performance. Through loans, banks meet the financial needs of their customers on the one hand and generate income from this process on the other. Interest income from loans is one of the main income items of banks

and directly affects their profitability. However, this profitability is not only limited to interest income but is also affected by many factors such as credit risks, economic conditions, and the quality of the loan portfolio. Banks try to manage these risks by carefully monitoring the repayment performance of the loans they provide (Keskin and Calisir, 2024). The increase in credit risk will adversely affect the profits of banks in case of problems in repayments. Therefore, banks' credit strategies and lending policies are a determining factor on profitability. In this study, the relationship between the financial performance of banks and credit management is investigated by examining the effect of loans given by banks operating in the BIST banking index on profitability.

The study was planned in four parts. In the first part, the introductory part, the relationship between profitability and credit is discussed, while in the second part, the summaries of the studies on the research subject are included. In the third part, information about the data and method is presented, and then in the fourth part, the findings of the research are included. In the fifth and last section, the results and recommendations of the study are included and the study is concluded.

2. Literature Review

In this section, summaries of national and international studies dealing with the effects of loans given by banks on profitability are included.

Molyneux and Thornton (1992) examined the factors affecting the profitability of European banks in their study. In the study, a positive relationship was found between the expansion of loan volume and profitability. It has been stated that banks with high loan volumes, in particular, can increase their revenues with the increase in credit demand, but this effect is associated with the capital structure of banks and the general economic situation. In addition, it was emphasized that the growth in loan volume is decisive on the performance of banks in the long run.

Kashyap, Stein and Wilcox (1992) examined the relationship between loan volume and profitability of banks from a macroeconomic perspective. The authors argued that the volume of credit reflects economic cycles and that changes in the supply of credit have a direct impact on the profitability of banks. Expansions in loan volume have made a positive contribution to the profitability of banks, especially during growth periods; In periods of contraction, it has been observed that it has negative effects on profitability due to the increase in credit risk.

Dietrich and Wanzenried (2011) analysed the factors affecting the profitability of banks in the Swiss banking sector. In the study, it was observed that the increase in loan volume had a positive effect on the profitability of banks. However, the authors state that this relationship may vary depending on the credit quality and risk management processes of banks. It has been concluded that banks' tendency to provide risky loans, especially in times of crisis, puts pressure on profitability.

Berger and Bouwman (2013) examined the effects of banks' capital structure on banks' performance during crisis periods. In the study, it was concluded that the increase in loan volume has a significant positive effect on the profitability of banks in times of crisis. However, it was emphasized that factors such as capital adequacy and risk management are important for this relationship to remain strong. The study shows that keeping the capital structure in balance while increasing the loan volume of banks can increase profitability.

Fidanoski et al. (2018) investigated the effect of bank-specific, sector-specific and macro-variable-specific determinants on return on assets (ROA) and net interest margin ratio (RNIM). In this study, the data of Croatian banks for the period 2007-2014 were analysed using dynamic estimation technique (DOLS). As a result of the study, it was determined that asset size (economies of scale), loan portfolio and GDP growth had a significant positive effect on the profitability of banks. In addition, it was concluded that capital adequacy ratio (CAR) and leverage had a positive effect on ROA and RNIM.

Aydemir et al. (2018) analysed the relationship between the profitability of the Turkish commercial banking sector and the loan deposit ratio using quarterly data between 2002-2015 with the help of the GMM model. In the study, three different variables as profitability indicators; net interest margin, return on assets and equity. As a result of the study, a statistically significant and positive relationship was found between loan deposit ratio and banking profitability.

Türkdönmez and Babuşçu (2019) examined the factors affecting the return on assets (ROA) and return on equity (ROE) of 11 banks, which constitute 83.8% of the total assets of the Turkish banking sector between 2010 and 2017, using the panel data analysis method. As a result of the study, a positive and significant relationship was found between inflation, average deposit interest and GDP selected as external factors and ROA and ROE selected as dependent variables, while a positive and significant relationship was found between equity/total assets and ROE selected as internal factors.

In addition, a positive and significant relationship was found between sector share and asset quality and ROA/ROE.

Brastama and Yadnya (2020) aimed to determine the role of profitability in mediating Capital Adequacy Ratio (CAR) and Non-Performing Loans (NPL) in banking stock prices. In the study, the data for the periods of 2011-2018 were examined with the help of regression analysis. As a result of the study, it was determined that the CAR variable had a positive effect on the ROA variable and the NPL variable had a negative effect on the ROA variable. In addition, it has been determined that the CAR variable has a positive effect on stock prices, while the NPL variable has a negative effect on stock prices.

Al-Homaidi et al. (2020) aimed to examine the impact of internal and external determinants on the profitability of 37 commercial banks listed on the Bombay Stock Exchange (BSE) in India over the period 2008-2017. The research employed both static models (pooled, fixed, and random effects) as well as the Generalized Method of Moments (GMM). The findings revealed that bank size, asset quality, liquidity, asset management, and net interest margin are significant internal determinants influencing return on assets (ROA). Additionally, it was concluded that capital adequacy, bank size, operational efficiency, gross domestic product (GDP), and inflation rate have a significant negative impact on return on equity (ROE). However, asset quality and asset management were found to have a positive effect on ROE, while liquidity, deposits, net interest margin, and non-interest income were determined to have an insignificant impact on ROE.

Yildirim and Ildokuz (2020) analyzed annual data from 11 banks listed in the BIST Bank Index, covering the period from 2004 to 2018. Their study focused on internal factors affecting banks, including capital adequacy, asset quality, management efficiency, liquidity status, and market risk sensitivity, and how these factors influence return on assets (ROA) and return on equity (ROE). The findings revealed that capital adequacy, management efficiency, and liquidity significantly impact both ROA and ROE. In contrast, asset quality and market risk sensitivity were found to have no significant effect on these financial ratios.

Sarı and Konukman (2021) examined the relationship between sectoral credit concentration and credit risk-profitability in the Turkish banking sector with the autoregressive distributed lag (ARDL) model by using 3-month sector data and macroeconomic data for the period 2007-2018. As a result of the study, a negative relationship was found between sectoral

credit concentration and credit risk, and a positive relationship was found with return on equity (ROE).

Singh et al. (2021) investigated the impact of non-performing loans (NPLs) on the profitability of traditional commercial banks in Nepal. In the study, the data cover the period of 2015-2019 and NPL dependent variable and Return on Assets (ROA), Capital Adequacy Ratio (CAR), Bank Size, GDP growth and Inflation were analyzed using multiple regression analysis method using the independent variable. As a result of the study, it was determined that ROA, Bank Size, GDP growth and Inflation significantly affect NPLs. In addition, it was determined that CAR did not have a significant effect on NPL, whereas GDP growth had a positive and significant effect on NPL.

Chollaku and Aliu (2021) investigated the effect of non-performing loans on the profitability of Kosovo banks. In the study, the data for the periods of 2010-2019 were examined with the help of regression analysis. As a result of the study, it was determined that the effect of non-performing loans on profitability was statistically significant and the return on assets decreased by 0.19% for every 1% increase in the non-performing loan ratio.

Isayas (2022) investigated the firm-specific and macroeconomic determinants of the profitability of commercial banks in Ethiopia. In the study, the data of 14 banks for the periods of 2008-2019 were analyzed using the GMM model. As a result of the analysis, it was revealed that firm size, liquidity ratio, fixed assets, capital adequacy, leverage and real GDP growth rate have a positive and statistically significant effect on the profitability of banks, while firm age and inflation rate have a negative but statistically significant effect on the profitability of banks in Ethiopia.

Jigeer and Koroleva (2023) investigated the effect of internal and external factors on the profitability of urban commercial banks in China. In the study, the data of 16 commercial banks for the periods of 2008-2020 were examined with the help of panel regression analysis. As a result of the study, it was determined that internal factors such as bank size, capital adequacy, credit quality and operating efficiency and external factors such as GDP and inflation have a significant impact on the profitability of commercial banks, while liquidity does not have a significant effect on the profitability of the bank.

Anshar (2023) examined the relationship between loan volume and profitability level and the relationship between non-performing loans and profitability. The research was carried out using the data obtained from

banks operating in Indonesia for the period 2010-2014. Descriptive analysis and correlation analysis were applied as analysis methods. According to the results of the research, it was observed that the increase in loan volume increased the profitability of the bank, but non-performing loans negatively affected the profitability. In particular, it has been determined that the level of profitability decreases as the non-performing loans increase, and profitability increases as these ratios decrease

When the literature review is evaluated in general, it is seen that the researches are examined in the context of various factors affecting the profitability of banks. There are differences in the results obtained. It has been determined that the most used micro variables in the researches are the non-performing loans ratio, capital adequacy ratio, bank size, liquidity ratio, and the most used macro variables are ratios such as GDP and inflation rate. Within the framework of the resources reached, there is no study examining the effect of the loan volumes given by the banks operating in the BIST banking index on the profitability of the banks. From this point of view, this research is expected to contribute to the literature.

3. Data and Methodology

In this study, the effect of the loans given by the banks on the profitability of the banks was investigated by using the annual data of 10 banks operating in the BIST Bank index between 2009-2023. For this purpose, 2 different models were created. In Model 1, return on assets (R1) is considered as the dependent variable, while in Model 2, return on equity (R2) is taken as the dependent variable. The main independent variable in both models is the loan amounts given by banks. In addition, Non-Performing Loans / Total Loans, (Equity – Fixed Assets) / Total Assets, Equity / Total Assets, Deposits / Total Assets and Liquid Assets / Total Assets ratios were used as the control variable of the study. The data used in the study were obtained from the Finnet database. Table 1 shows the codes and names of the banks used in the research.

Table 1. Banks Used in Research

No	Code	Banks
1	AKBNK	Akbank
2	ALBRK	Albaraka Türk
3	GARAN	Garanti Bank
4	HALKB	Halkbank of Turkiye
5	ICBCT	ICBC Turkey Bank
6	ISBTR	İş Bank (B)
7	SKBNK	Şekerbank
8	TSKB	Industrial Development Bank of Turkiye
9	VAKBN	Vakıfbank
10	YKBNK	Yapı ve Kredi Bank

The regression equations created for Model 1 and Model 2 in the study are given below. Panel data models were used in the application part of the study, and the abbreviations of the dependent and independent variables are shown in Table 2.

(Model 1) $$R1_{it} = \beta_0 + \beta_1 B1_{it} + \beta_2 B2_{it} + \beta_3 B3_{it} + \beta_4 B4_{it} + \beta_5 B5_{it} + \beta_6 B6_{it}.$$

(Model 2) $$R2_{it} = \beta_0 + \beta_1 B1_{it} + \beta_2 B2_{it} + \beta_3 B3_{it} + \beta_4 B4_{it} + \beta_5 B5_{it} + \beta_6 B6_{it}.$$

Table 2. Research Variables Details

Abbreviations	Variables Name and Details	Variable Types
B1	Loans	Independent
B2	Non-Performing Loans / Total Loans	
B3	(Equity – Fixed Assets) / Total Assets	
B4	Equity / Total Assets	
B5	Deposits / Total Assets	
B6	Liquid Assets / Total Assets	
R1	Return on Asset (Net İncome/ Total Assets)	Dependent
R2	Return on Equity (Net İncome/ Total Equity)	

In Table 3, descriptive statistics of 140 observations consisting of 14-year data of 10 banks in the BIST Banking Index are included. It is seen that the average return on assets and return on equity, which are determined as dependent variables in the two models, are 1.84 and 17.59, respectively.

Table 3. Descriptive Statistics

	R1	R2	B1	B2	B3	B4	B5	B6
Mean	1.848291	17.59137	1.71E+11	3.897265	16.99812	10.30274	63.75650	3.581111
Median	1.490000	13.60000	7.26E+10	3.680000	16.03000	10.54000	63.28000	2.380000
Maximum	17.59000	150.5000	1.46E+12	13.05000	30.81000	21.94000	85.31000	54.97000
Minimum	-2.210000	-31.42000	1146684.	0.150000	13.03000	3.700000	26.06000	-62.06000

In Table 3, It is seen that the maximum value of the asset profitability variable is 17.59 and the minimum value is -2.21. Looking at the return on equity, it is seen that the maximum value is 150.50, while the minimum value is -31.42.

Table 4. Correlation Analysis Results of Variables

	R1	**R2**	**B1**	**B2**	**B3**	**B4**	**B5**
R2	0,96	1,00					
B1	0,10	0,12	1,00				
B2	-0,24	-0,32	-0,21	1,00			
B3	0,40	0,43	0,04	-0,20	1,00		
B4	0,25	0,11	-0,17	0,14	0,18	1,00	
B5	0,01	0,00	0,11	0,35	-0,31	-0,07	1,00
B6	-0,05	0,01	-0,04	-0,11	0,34	-0,27	-0,13

In Table 4, the correlation matrix of the variables used in the research is given. In the study, it is seen that there is a strong positive correlation of 0.96 between return on assets and return on equity, which are determined as the dependent variable. In other words, it is seen that these two variables tend to increase and decrease together. It is seen that there is a positive correlation between return on assets and loans, and a negative correlation between non-performing loan ratio. Additionally, it is seen that asset profitability (Equity - Fixed Assets) / Total Assets, Equity / Total Assets, Deposits / Total Assets ratios have a positive correlation and a negative correlation with the Liquid Asset / Total Assets ratio. The relationship between return on equity and other variables is parallel to the return on assets, excluding the Liquid Assets/ Total Assets ratio. When the relationship between the independent variables is examined, it is seen that the relationship is generally low.

In the study, before starting the analysis, it was tested whether the variables had cross-sectional dependency (Yıldırım, 2021). According to the results of cross-sectional analysis, the stationarity of the variables according to the first generation or second generation unit root analyzes was examined (Börekci Dilsizler ve Yüksel Yıldırım, 2022). Series should not contain stationary i.e.

unit roots. Analyses with series containing unit roots lead to the problem of spurious regression (Sarıkovanlık et al., 2019). After the non-stationary series were made stationary, the appropriate panel data analysis model was selected for the study. Here, after deciding whether the regression model has a pooled, fixed-effect or random-effect model, the test of assumptions is examined. In order to eliminate the negative situations in the assumptions, the regression model was reconstructed with the appropriate resistant estimator and more reliable results were obtained.

3.1. Findings

Table 5 shows the cross-sectional dependency test results of the variables. The Breusch-Pagan LM test (1980) and the Pesaran CD (2004) test were performed to determine whether the variables contained horizontal sections. As a result of the tests, it was determined that there was cross-sectional dependence in all 2 dependents and 6 independent variables. In this case, second-generation unit root tests will be more appropriate to perform unit root analysis of variables. For the second generation unit root test, the Bai and NP-Panic test (2004) unit root test was performed.

Table 5. Test Results of Cross Section Dependency

Variable Name	Breusch-Pagan LM		Pesaran CD Test	
	Statistics	Probability	Statistics	Probability
R1	293.4636	0.0000	15.00714	0.0000
R2	383.0820	0.0000	18.22366	0.0000
B1	624.2322	0.0000	24.95507	0.0000
B2	302.8237	0.0000	12.98201	0.0000
B3	140.7222	0.0000	9.287932	0.0000
B4	297.5893	0.0000	15.73851	0.0000
B5	100.7020	0.0000	7.212812	0.0000
B6	91.57833	0.0001	4.482860	0.0000

Table 6 shows the unit root test results of the variables. Series containing unit roots exhibit non-stationary behaviour (Yüksel Yıldırım, 2023). It was determined that all variables were stationary at the level of "0.10" in level values and did not contain unit roots. Therefore, in the analyses to be made, analyses will be made with the level values of the variables.

Table 6. Unit Root Test Results of Variables

Variables	Types of Tests		Result
	Bai ve Ng- PANIC		
R1	None	-1.9566 (0.0503)	Stationary
	Constant	-1.9829 (0.0473)	
	Constant and Trend	-3.1619 (0.0015)	
R2	None	-1.9783 (0.0478)	Stationary
	Constant	-1.9146 (0.0555)	
	Constant and Trend	-3.1619 (0.0015)	
B1	None	-1.9631 (0.0496)	Stationary
	Constant	-1.9952 (0.0460)	
	Constant and Trend	-3.1619 (0.0015)	
B2	None	-1.9501 (0.0511)	Stationary
	Constant	-1.9948 (0.0460)	
	Constant and Trend	-3.1619 (0.0015)	
B3	None	-1.8588 (0.0630)	Stationary
	Constant	-1.8783 (0.0603)	
	Constant and Trend	-3.1619 (0.0015)	
B4	None	-1.9380 (0.0526)	Stationary
	Constant	-1.9607 (0.0499)	
	Constant and Trend	-3.1619 (0.0015)	
B5	None	-1.8386 (0.0659)	Stationary
	Constant	-1.8741 (0.0609)	
	Constant and Trend	-2.9997 (0.0027)	
B6	None	-1.9907 (0.0465)	Stationary
	Constant	-1.9801 (0.0476)	
	Constant and Trend	-3.1619 (0.0015)	

It is essential to assess whether a fixed effects or random effects model is more appropriate for the analysis. To make this determination, the Hausman (1978) test statistic is employed. A key distinction between the two models lies in the correlation between unit effects and independent variables. If no correlation exists, the random effects model is deemed the more suitable choice (Yıldırım, 2021). In Table 7, Hausman test (1978) and Breusch Pagan LM test (1980) were used to select the regression model for Model 1 and Model 2. According to the results of the Model 1 Hausman test and Breush Pagan LM test, it was determined that the random effect was more appropriate. According to the results of the Hausman test and the Breush Pagan LM test for Model 2, it was determined that fixed effects would be more appropriate.

Table 7. Model Selection Tests

Model 1	**Hausman Test**			**Breusch and Pagan Lagrangian Multiplier Test**	
	Chi-Square Value	Probability		Chi-Square Value	Probability
	7.30	0.1991		14.23	0.0001
Model 2	**Hausman Test**			**Breusch and Pagan Lagrangian Multiplier Test**	
	Chi-Square Value	Probability		Chi-Square Value	Probability
	12.55	0,000		5.29	0.0000

Table 8 shows the results of different variance, autocorrelation and inter-unit correlation assumptions for Model 1 compared to the random effect model. When the test results of Levene (1960), Brown and Forsythe (1974) were examined, it was determined that there was different variance. Durbin-Watson test was performed for autocorrelation and it was determined that autocorrelation existed. Pesaran, Friedman and Frees' tests (Tatoğlu, 2012:228) were performed for correlation between units and it was determined that there was no correlation between units. When the results of the assumptions for Model 1 were examined, it was determined that while there was different variance and autocorrelation, there was no correlation between the units.

Table 8. Test Results of Random Effects Assumptions for Model 1

Type of Assumption	**Test Value**
Heteroscedasticity	***Levene's Test, Brown-Forsythe Test***
	W0 = 15.0868386 df (8, 108) Pr> F = 0.00000000 W50= 2.8223331 df (8, 108) Pr> F =0.00699112 W10= 14.9577399 df (8, 108) Pr> F =0.00000000
Autocorrelation	Modified Bhargava et al. Durbin-Watson = 0.676528
Multicollinearity	Pesaran's test of cross sectional independence =-0.211, Pr= 0.8330 Friedman's test of cross sectional independence =15.111, Pr= 0.0570 Frees' test of cross sectional independence = 0.683 |----------| Critical values from Frees' Q distribution Alpha = 0.10: 0.3583 Alpha = 0.05: 0.4923 Alpha = 0.01: 0.7678

Table 9 shows the results of different variance, autocorrelation, and multicollinearity assumptions for Model 2 compared to the fixed-effect model. When the result of the Wald test for different variance was examined, it was determined that there was different variance. Durbin-Watson test was performed for autocorrelation and it was determined that there was an autocorrelation. Tests of Pesaran, Friedman and Frees were carried out for multicollinearity and it was determined that there was a correlation between units. Looking at the result of the assumptions for model 2, it was determined that there was a correlation, autocorrelation and different variance between the units.

Table 9. Test Results of Random Effects Assumptions for Model 2

Type of Assumption	**Test Value**
Heteroscedasticity	Wald Test
	1296.78, Pr= 0.0000
Autocorrelation	Modified Bhargava et al. Durbin-Watson = 1.255269
Multicollinearity	Pesaran's test of cross sectional independence =3.621, Pr = 0.0003 Friedman's test of cross sectional independenc = 30.159, Pr = 0.0002 Frees' test of cross sectional independence = 1.213 |----------| Critical values from Frees' Q distribution Alpha = 0.10: 0.3583 Alpha = 0.05: 0.4923 Alpha = 0.01: 0.7678

Table 10 shows the results of regression analysis with the Beck-Katz resistive estimator to eliminate problems in the unprovided assumptions of Model 1. Table 11 presents the results of regression analysis with the Driscoll-Kraay resistive estimator to eliminate the problems in the unmet assumptions of Model 2.

Table 10. Regression Results of BECK-KATZ Robust Estimator for Model 1

Model	**Model 1 Dependent Variable R1**		
Independent Variables	**Coefficient**	**Standard Error**	**Probability**
B1	-1.30	1.39	0.993
B2	-0.37	0.15	**0.013****
B3	0.15	0.05	**0.002****
B4	0.31	0.18	**0.097*****
B5	0.06	0.04	0.172
B6	-0.01	0.01	**0.090*****
Constant Term	-7.82	5.39	0.147
R-sq	0.3037		
Sigma_u	0.5080		
Sigma_e	1.7744		
Rho	0.0757		
Note: Statistical significance of the variables was used for 1% (*), 5% (**) and 10% (***).			

Table 10 presents the results of random effects GLS regression. In the study, ROA (return on assets) was used as the dependent variable in the planned model 1. As a result of the regression analysis, a statistically negative and significant relationship was found between return on assets and non-performing loans at the level of 5% significance. In this context, it can be stated that the increase in non-performing loans of banks decreases the return on assets of banks. A statistically positive and significant relationship has been identified between Return on Assets and the Equity – Fixed Assets/ Total Assets ratio at a 5% significance level. In addition, a statistically significant relationship was found between return on assets and Equity / Total Assets and Liquid Assets / Total Assets at the level of 10% significance. While there is a positive relationship between the Equity / Total Assets ratio and ROA, a negative relationship was found between the Liquid Assets / Total Assets ratio.

Table 11. Regression Results of Driscoll-Kraay Standard Errors for Model 2

Model	Model 2 Dependent Variable R2		
Independent Variables	**Coefficient**	**Standard Error**	**Probability**
B1	-2.24	7.42	0.770
B2	-4.44	0.92	**0.001***
B3	1.13	0.67	0.133
B4	3.45	1.07	**0.013****
B5	0.55	0.34	0.146
B6	0.04	0.11	0.692
Constant Term	-70.61	31.90	0.058
R-sq	0.4248		
Prob> F	0.0012		
Note: Statistical significance of the variables was used for 1% (*), 5% (**) and 10% (***).			

Table 11 shows the results of regression analysis according to the fixed effects model. Driscoll-Kraay standard errors were used and ROE (return on equity) was considered as the dependent variable among the variables. As a result of the analysis, a negative and significant relationship was found between return on equity and non-performing loans at the level of 1% significance. In this case, it can be said that the increase in non-performing loans reduces the return on equity of banks. On the other hand, a statistically positive and significant relationship was found between return on equity and equity/total assets ratio at the level of 5% significance. In other words, when the equity/total assets ratio of banks increases, the return on equity of banks will also increase. There was no statistically significant relationship between the dependent variable and the other independent variables.

4. Conclusions and Recommendations

In this study, the effect of the loan amount given by the banks operating in the BIST banking index on the profitability of the banks was examined. The data for the periods 2009-2023 were analysed with the help of regression analysis. Two different models were created and ROA and ROE were determined as dependent variables. Total loans were determined as independent variables, while Non-Performing Loans / Total Loans, Shareholders' Equity / Total Assets, Deposits / Total Assets and Liquid Assets / Total Assets ratios were used as control variables

As a result of the regression analysis, some factors affecting the return on assets and return on equity of banks were identified. These findings show how the underlying financial ratios that determine performance in the banking sector interact.

First, a negative and significant relationship was found between return on assets and non-performing loans at the 5% significance level. This situation shows that the increase in non-performing loans of banks negatively affects asset profitability, that is, problematic loans weaken the profitability performance of banks. The results obtained are Anshar (2023); Chollaku and Aliu (2021) and Brastama and Yadnya (2020) support the results obtained in their studies. In addition, a positive relationship was found between return on assets and equity-fixed assets/total assets ratio. This means that banks can increase their return on assets when they have a stronger equity structure. In addition, significant relationships were found between return on assets and equity/total assets and liquid assets/total assets ratios at the 10% significance level. A positive correlation was observed between the equity/total assets ratio and return on assets, and a negative relationship was observed with the liquid assets/total assets ratio. These findings suggest that banks' use of more equity increases profitability, but the increase in liquid assets may have a negative impact on return on assets.

In terms of return on equity, a negative and significant relationship was found between non-performing loans and return on equity at the level of 1% significance. This result shows that the increase in non-performing loans reduces the return on equity of banks. On the other hand, a positive correlation was found between the equity/total assets ratio and return on equity, indicating that a stronger equity structure of banks could increase their return on equity. In conclusion, these findings reveal that banks need to reduce non-performing loans and strengthen their equity structures in order to increase their return on assets and equity. Liquidity management is also a factor that needs to be carefully considered in this process.

This study reveals the various factors that affect the profitability performance of banks and provides new areas of examination and in-depth analysis opportunities for future research. Future studies can be expanded to the following recommendations:

1. **Review of Other Financial Ratios:** In this study, only certain financial ratios were analysed. In future studies, more comprehensive models can be developed by including different ratios (e.g., loan-to-deposit ratio, leverage ratio) that may have an impact on banks' profitability.

2. **Contribution of Macroeconomic Variables:** It should be considered that not only financial ratios but also macroeconomic variables such as inflation, interest rates, and economic growth can be effective on the profitability performance of banks. Studies assessing the impact of these factors on banks' profitability can provide a broader perspective.
3. **Segregation by Banks' Scale and Fields of Activity:** The size of banks, their field of activity (operating at regional, national, international level) and the market conditions in which they operate can affect profitability performance. Future studies could examine the impact of these factors by comparing the performance of banks of different sizes and operating in different markets.
4. **International Comparisons:** The banking sector has different regulations, market conditions, and economic structures from country to country. Future studies could examine the impact of these variables by comparing the profitability performance of banks in different countries.
5. **Evaluation of Risk Management Strategies:** Considering the negative impact of non-performing loans on profitability, the impact of banks' risk management strategies on profitability can be investigated in more detail. Understanding the impact of different risk management approaches on banks' performance can help banks develop sustainable profitability strategies.

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Chapter 5

Do ESG Risk Ratings Affect Financial Performance? Evidence from Selected BIST Banking Sector Companies with LODECI and CRADIS Methods

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Abstract

The purpose of this study is to evaluate the impact of Environmental, Social and Governance (ESG) risk ratings on the financial performance of selected banks in the Borsa Istanbul (BIST) Banking Sector Index based on 2023 by using LODECI and CRADIS hybrid Multi-Criteria Decision Making (MCDM) model. The LODECI method, used for criterion weighting in the study, is a technique that objectively determines the importance levels of criteria while integrating the perspectives of two fundamental approaches; Entropy and MEREC methods. It also creates acceptable and robust weight vectors. The performance rankings of the companies are determined using the CRADIS method, which constructs utility functions based on ideal and anti-ideal values. In determining the financial performance rankings of the banks included in the analysis, a scoring is first conducted based on financial ratios and ESG risk ratings, and then the scores are recalculated excluding ESG risk ratings from the analysis. The scores calculated for both cases are compared, and it has been determined that including ESG risk ratings in the analysis causes differences in performance scores and rankings. In the performance ranking conducted with ESG risk ratings included, GARAN, AKBNK, and YKBNK are in the top three, while HALKB, VAKBN, and

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QNBFB are in the bottom three. In the performance ranking conducted with ESG risk ratings excluded, GARAN, SKBNK, and AKBNK are in the top three, while HALKB, VAKBN, and ISCTR are in the bottom three. Considering the scores and rankings of the CRADIS method, it has been observed that, in general, banks with lower ESG risk ratings have higher financial performance rankings, while those with higher ESG risk ratings have lower rankings. These results provide significant evidence regarding the impact of ESG risks on the Turkish banking system. The motivation behind this research stems from the very limited studies on the effect of ESG risk on the performance of banks listed on BIST, and it is believed that this research makes a valuable contribution to the literature in this field.

1. Introduction

As in most developing countries, the banking sector dominates the financial system in Türkiye (Özcan, 2021). In this context, the success or failure of the banking sector quickly reflects on the real sector, thus creating a significant impact on the country's economy (Kandemir & Demirel Arıcı, 2013). Measuring the performance of banks, which are key players in the financial system, and thus determining their position within the sector, is of strategic importance for both stakeholders in the sector and the country's economy in managing processes (Tezergil, 2016). A bank's stakeholders consist of its customers, managers, employees, partners, investors, competitors, and government institutions. Therefore, a wide audience is affected by the performance exhibited by banks (Onocak, 2024).

Robust and widely accepted financial indicators are needed to measure financial performance. For this purpose, financial ratios derived from financial statements are crucial resources. In financial analysis, comparing companies with one another reveals their level of competitiveness. Therefore, conducting the analysis on a sectoral basis is of great importance (Atukalp, 2019).

In recent years, financial crises and accounting scandals have caused stakeholders to question the quality of financial reporting, and the use of solely financial ratios for performance evaluation has begun to be seen as insufficient (Çalışkan & Eren, 2016; Şeker & Şengür, 2022). At this point, companies have started to provide environmental, social, and corporate governance disclosures to eliminate distrust (Şeker & Şengür, 2022). Banks, which play significant roles in the national economy, have not remained unaffected by these developments due to their responsibilities and influenced by past experiences, have increasingly focused on ESG activities (Onocak, 2024).

According to stakeholder theory, based on Freeman's (1984) work, ESG suggests that companies have an ethical responsibility to maximize the value of all their stakeholders (customers, debtors, employees, and regulatory authorities). The resource-based view also asserts that ESG activities can be seen as strategic investments, helping companies gain a competitive advantage by acquiring additional skills that are difficult to replicate. Thus, improvements in ESG within companies can lead to superior financial performance (Azmi et al., 2021). Furthermore, companies' social performance efforts contribute significantly to protecting stocks, providing a buffer against negative market reactions, and enhancing marketable brand image and reputation. On the other hand, companies with strong ESG performance tend to exhibit more stability in stock prices and achieve consistent profitability (Godfrey, 2005; Nagy et al., 2016). In recent years, due to increased demand from investors for sustainable products and regulatory pressures, banks have been required to consider ESG risks within their risk management frameworks (Nizamuddin et al., 2024). ESG risk encompasses potential threats arising from environmental, social and governance factors that can affect a company's sustainability and financial performance. As companies increasingly integrate ESG considerations into their decision-making processes, understanding these risks has become crucial for long-term sustainability (Gorzeń-Mitka, 2023). The impact of ESG risks on financial performance is increasingly recognised as companies face both challenges and opportunities. Effective management of these risks can lead to improved financial results and resilience. ESG factors can significantly impact companies' debt and liquidity risks by influencing the critical roles of corporate governance (Peliu, 2024). Particularly under stable economic conditions, improved ESG practices have been associated with higher stock valuations, emphasizing the importance of governance (Zhou, 2024). Additionally, companies that prioritize ESG factors tend to be more resilient to market fluctuations and exhibit more stable financial performance in the long term. In terms of ESG risk management strategies, integrating ESG criteria into decision-making processes can help reduce risks and uncover new opportunities (Pavani, 2024). Moreover, strong ESG performance, especially in privately-owned companies, has the potential to alleviate financing constraints by improving financial outcomes (Shang, 2024).

In this context, the main objective of this study is to examine the impact of ESG risk ratings on the financial performance of selected banks listed in the BIST Banking Sector Index using MCDM methods. Although many studies have explored the relationship between ESG investments and

financial outcomes in companies, there is a notable gap in the literature regarding the impact of ESG risk on the performance of banks listed on Borsa Istanbul.

In this regard, evaluating companies with similar objectives based on specific criteria is most effectively conducted using MCDM. The MCDM methodology is a widely used and continuously evolving framework in decision-making (Pala et al., 2024). In this study, two new and robust MCDM techniques have been employed. While financial ratios used as criteria were weighted using LODECI (Logarithmic Decomposition of Criteria Importance), the financial performances of the firms were ranked using CRADIS (Compromise Ranking of Alternatives from Distance to Ideal Solution). Within this framework, a CRADIS analysis was first conducted using financial ratios and ESG risk ratings, and then repeated with ESG risk ratings excluded, focusing solely on financial ratios. The performance rankings of the banks were determined for both scenarios and compared.

The second section of the study provides a review of the relevant literature, while the third section explains the methodology used in the study. In the fourth section, the empirical findings obtained from the study are presented. Following the fourth section, the results and policy recommendations are discussed.

2. Literature Review

In the national and international literature, a summary of the few studies focused on ESG scores and ESG risk ratings in the banking sector is provided.

In the study by Ahmed and Rahman (2014), a revised credit risk rating model was proposed for the banking lending process in Bangladesh by incorporating environmental, social, and governance (ESG) risk factors. It was found that banks are still in the developmental stage of integrating ESG factors into credit risk management, but regulatory bodies overseeing the banking sector exhibit a positive attitude toward such integration.

In Ng's (2016) study, the impact of countries' ESG performance and macroeconomic factors on banks' ESG scores was examined. The study assessed the relationship between the size, liquidity, founding year, market power of 251 banks from 45 different countries during the period 2005-2014 and their ESG performance using panel data analysis. The findings revealed that, at the macro level, countries' ESG scores were positively related to banks' environmental and social sustainability indicators, but not to any governance indicators. Furthermore, the study found that banks in countries

with higher economic freedom tended to focus more on ESG, while this tendency was weak among banks in developing countries, particularly during financial crises, which reduced banks' focus on ESG.

Ahmed et al. (2019) examined the contribution of the implementation of regulatory policy guidelines related to sustainability initiatives to financial performance. The study used data from 30 private commercial banks in Bangladesh, comparing the period between 2012 and 2018. By calculating ESG scores and correlating them with financial performance through regression analysis, the study found that the overall sustainability performance of banks increased by 33% from 2012 to 2018. Furthermore, it was determined that policy guideline initiatives had a positive impact on bank sustainability.

Di Tommaso and Thornton (2020) examined the impact of ESG scores on risk-taking behaviour and bank value in a sample of European banks. They found that high ESG scores are associated with a moderate reduction in risk-taking for both high- and low-risk banks, and that this effect depends on the characteristics of the board of directors. Despite the positive indirect link between ESG scores and bank value, the decrease in bank value increases the impact of ESG scores on risk-taking.

Citterio and King (2023) aimed to determine the relationship between the non-financial performance of banks and their risk levels using data from 362 commercial banks operating in the United States (US) and the European Union (EU) for the period 2012-2019. The research findings concluded that social sustainability, one of the components of ESG, has a risk-reducing effect on banks. Additionally, the study revealed that non-financial performance has predictive power over bank risk.

In the study by Ishizaka et al. (2021), which aimed to cluster the performance evaluation of U.S. banks based on a series of financial and non-financial (environmental, social, and governance) criteria, it was found that domestically owned banks generally ranked among the best-performing clusters.

In their study, Reig-Mullor and Brotons-Martinez (2021) used the CAMELS components as financial criteria and ESG indicators as non-financial criteria for six commercial banks operating in Spain during the 2015-2017 period. According to the Fuzzy AHP and TOPSIS methods, the performance ranking of the banks was determined, with Banco de Santander ranked first and Banco Sabadell ranked last.

Şimşek and Çankaya (2021) examined the relationship between the ESG scores and financial performance of all banks listed on stock exchanges in G8 countries. Return on assets (ROA) and return on equity (ROE) were used as measures of financial performance in the study. Additionally, the ESG scores of the banks were used separately as independent variables. In the study, which employed panel data analysis, it was found that both ROA and ROE had a negative and significant relationship with the environmental score, while the social score had a positive and significant relationship. However, the governance score was found to have no statistically significant relationship with either profitability ratio.

Çetenak et al. (2022) examined the impact of ESG scores on the financial performance of deposit banks operating in Türkiye. In the study, which applied panel data analysis for the period 2010-2020, it was found that the banks' total ESG score, as well as their social and governance scores, positively influenced accounting- and market-based performance indicators (ROA and Tobin's Q). However, the environmental score was found to have no statistically significant effect on either indicator.

In their study, Packin and Nippani (2022) explored the role of banks operating in the U.S. in advancing the government's fiscal policy and social agenda, focusing on ethics in banking and the recent rise of ESG objectives. The study suggests that the interests of banks aiming to maximize shareholder wealth alone may not be sufficient to align successfully with the government's social policy goals. Additionally, the study comments that even if banks choose to advance certain ESG-based goals, they are likely to do so while pursuing their own strategic objectives. Without clear standards and laws, efforts to accelerate ESG-based operations are likely to be non-transparent, ambiguous, and primarily public relations efforts that do not genuinely reflect their actual commercial interests and practices.

Bernardelli et al. (2022) examined the determinants of the ESG ratings of the world's largest 60 banks and how closely these ratings are related to their actual credit and investment risks. The results of the research, which used logistic regression methods, show that an increase in the Sustainable Development Index (SDI) corresponds to a lower probability of being assigned to the high-risk ESG group and a higher probability of being assigned to the low or medium-risk ESG group.

Yeh et al. (2022) measured the efficiency of Taiwanese banks through the perspective of banking integrity, environment, social, ESG, and Fintech using Network Data Envelopment Analysis (DEA). The results indicate that the main reason for differences in bank efficiency stems from the governance

and innovation stages. Banks affiliated with financial holding companies are more efficient at every stage compared to independent banks. The overall efficiency of public banks is lower than that of privately-owned banks, especially due to low efficiency scores in the innovation stage.

In their study, Niedziółka et al. (2023) examined the impact of cultural differences and credit ratings on the ESG scores of commercial banks using regression analysis. Based on data from 330 banks across 50 countries, the study found that the region with the highest ESG risk assigned to banks was the Arab countries, while the regions with the lowest ESG risk were Western Europe and Scandinavian countries. Furthermore, an increase in the average credit rating reduces the likelihood of a bank being classified as having high or medium ESG risk compared to low ESG risk.

Osuji (2023) examined the relationship between ESG strategies and corporate financial performance using data from 226 global banks in the context of firm size. The results of the moderated multiple regression analysis indicated that ESG risk scores and firm size were significant in explaining the variations in corporate financial performance.

Siklósi (2023) analyzed the ESG disclosures of international commercial banks in Hungary based on data from annual reports published between 2019 and 2022. The results indicate that the quality of ESG disclosures by international commercial banks in Hungary has, on average, improved from 2019 to 2022.

In his study, Bolibok (2024) aims to systematize and develop the theoretical foundations of the relationship between firm size and ESG risk in banks, highlighting its potential non-linear nature, and empirically investigate it within the international banking sector. This research uses both univariate and multivariate, linear and non-linear regression analyses applied to a sample of 668 banks with Morningstar Sustainalytics ESG Risk Ratings assigned for the year 2021. The results suggest that, although firm size appears to be negatively related to ESG risk on average, the relationship is non-linear and follows a U-shape.

Pyka and Nocoń (2024) examined the changes in ESG risk management in the Polish banking sector. The research findings confirm the adopted hypothesis, showing that the awareness and knowledge of ESG risk in commercial banks in Poland have increased, which is reflected in practical activities related to bank risk management systems. The study demonstrates that Polish banks are increasingly aware of ESG risk and the need to incorporate this risk into their risk management processes.

Onocak (2024) examined the impact of non-financial criteria, such as ESG, on the performance of six deposit banks operating in Türkiye using the CAMELS method. In the analysis, in addition to the CAMELS components as performance criteria, the banks' ESG score components were also used. The weights of the components used as performance criteria were determined according to the Entropy method. When determining the performance ranking of the banks included in the analysis, a scoring was first done based on the CAMELS component values, and then the ESG component values were included in the analysis, and the scores were recalculated. The scores calculated for both cases were compared, and it was found that including the ESG components in the analysis led to differences in the banks' performance scores and changed the performance rankings of Akbank and Garanti BBVA for the years 2019 and 2022.

Nizamuddin et al. (2024) examined how ESG risk scores affect the financial performance of banks in India. The study evaluates financial performance using metrics such as return on assets (ROA), return on capital employed (ROCE), and return on equity (ROE), while also considering factors like size (the logarithm of total assets) and leverage (Debt/Equity) as financial risk indicators. Data from 25 public and private banks for the years 2021-2022 were analysed cross-sectionally. To investigate how ESG risk affects the financial performance of Indian banks, Ordinary Least Squares (OLS) regression was used. The findings suggest that ESG risk scores have a negative impact on the overall financial performance of the banks.

When examining the literature using the LODECI method, it is observed that it has been used in a very limited scope. Pala (2024a) for assessing social progress in the European Union; Pala (2024b) for evaluating social discrimination in OECD countries; Yalçın et al. (2024) for commercial insurance selection; and Pala et al. (2024) for analysing the financial performance of the cement industry. As a result, since the LODECI method is newly introduced in the literature, only a few studies have utilized it. On the other hand, when looking at the literature related to CRADIS, many studies are evident. Puška et al. (2022b) used it for green supplier selection in agriculture under uncertain conditions; Starčević et al. (2022) for evaluating the impact of foreign direct investment on the sustainability of the economic system; Dordevic et al. (2022) for production optimization; Krishankumar and Ecer (2023) for selecting IoT service providers for sustainable transportation; Puška et al. (2023) for case study selection of electric vehicles; Ulutaş et al. (2023) for environmental impact and energy use in production; Keleş (2023) for evaluating livable power center cities in

G7 countries and Türkiye; Xu et al. (2023) for assessing sustainable mountain tourism; Wang et al. (2023) for risk assessment in the energy sector; Altıntaş (2023) for analyzing the welfare performance of G7 countries; Taşçı (2024) for performance evaluation of the Natural Disaster Insurance Institution in Türkiye; Kanmaz (2024) for electric vehicle selection; and Asker (2024) for evaluating the impact of the COVID-19 pandemic on the participation banking sector.

3. Method

This study, which aims to identify the impact of non-financial ESG risk ratings on the performance of banks, employs the CRADIS method for performance analysis. In the analysis, both financial ratios and the banks' ESG risk ratings are used as performance criteria. The weights of the criteria in the analysis of financial ratios and ESG risk ratings are determined using the LODECI method. The research question of this study is defined as: "Does the inclusion of ESG risk ratings in the performance analysis of banks affect the performance ranking?" In this context, first, the CRADIS analysis was conducted using only financial ratios, and then ESG risk ratings were also included in the analysis. The performance ranking of the banks was determined and compared for both cases. In this context, during the methodology phase, the LODECI and then the CRADIS methods are detailed.

3.1. LODECI Method

Pala (2024a) proposed the LODECI method as an approach that reconciles Hwang and Yoon's (1981) Entropy method with the MEREC (Method Based on the Removal Effects of Criteria) method introduced by Keshavarz-Ghorabaee et al. (2021). The method is based on the distances, or divergences, between the alternative scores for each criterion.

The maximum normalization approach proposed for the decision matrix $X=\|x_{ij}\|_{(nxm)}$ in MCDM problems can be applied for LODECI as shown in Equations 1 and 2.

$$a_{ij} = \frac{x_{ij}}{x_j^{max}} \quad \textit{for utility-orientated criteria} \tag{1}$$

$$a_{ij} = 1 - \frac{x_{ij}}{x_j^{max}} \text{ , for cost-orientated criteria} \quad (2)$$

The Divergence Value (DV) is calculated using a_{ij} as shown in Equation 3.

$$DV_{ij} = max \left\{ \left| a_{ij} - a_{rj} \right| \right\} r \neq i,\ r = 1,2,\ldots,n \quad (3)$$

The Logarithmic Divergence Value (LDV) for each criterion is calculated as shown in Equation 4.

$$LDV_j = ln\left(1 + \frac{\sum_{i=1}^{n} DV_{ij}}{n} \right) \quad (4)$$

The importance levels of the criteria, w_j, are obtained according to Equation 5.

$$w_j = \frac{LDV_j}{\sum_{j=1}^{m} LDV_j} . \quad (5)$$

3.2. CRADIS Method

The CRADIS (Compromise Ranking of Alternatives from Distance to Ideal Solution) approach proposed by Puška et al. (2022a) has emerged as a combination of commonly used methods in MCDM problems. The implementation stages of the CRADIS approach can be expressed as follows:

The normalization process for the decision matrix $C=\|c_{ij}\|_{(nxm)}$ is carried out using Equations 6 and 7.

$$x_{ij} = \frac{c_{ij}}{c_j^{max}} \text{ , for utility-orientated criteria} \quad (6)$$

$$x_{ij} = \frac{c_j^{min}}{c_{ij}} \text{ ,for cost-orientated criteria} \quad (7)$$

The weighted decision matrix is calculated using Equation 8.

$$v_{ij} = x_{ij} * w_j \quad (8)$$

The ideal and anti-ideal values for the entire decision matrix are found as shown in Equations 9 and 10.

$$t_i = max\left(v_{ij}\right) \tag{9}$$

$$t_{ai} = min\left(v_{ij}\right) \tag{10}$$

The distances from the ideal and anti-ideal solutions are calculated as shown in Equations 11 and 12.

$$d^+ = t_i - v_{ij} \tag{11}$$

$$d^- = v_{ij} - t_{ai} \tag{12}$$

The deviations of the alternatives from the ideal and anti-ideal solutions are calculated as shown in Equations 13 and 14.

$$s_i^+ = \sum_{j=1}^{m} d^+ \tag{13}$$

.

$$s_i^- = \sum_{j=1}^{m} d^- \tag{14}$$

n Equations 15-16, the notations s_0^+ and s_0^- are used to represent the sum of the minimum deviations from the ideal values for each criterion and the sum of the maximum deviations from the anti-ideal values for each criterion, respectively. These are used to calculate the utility values for the alternatives.

$$K_i^+ = \frac{s_0^+}{s_i^+} \tag{15}$$

$$K_i^- = \frac{s_i^-}{s_0^-} \tag{16}$$

.

The final ranking is calculated as shown in Equation 17, with the alternative having the highest Qi value being ranked first.

$$Q_i = \frac{K_i^+ + K_i^-}{2} \tag{17}$$

Findings

The study uses data from 8 deposit banks listed in the BIST Banking Index for the year 2023, for which financial ratios and ESG risk ratings were available during this period. The list of the banks included in the study is presented in Table 1.

Table 1. Selected Banks Included in the Study

Rank	Stock Code	Company Name
1	AKBNK	Akbank T. A. Ş.
2	QNBFB	QNB Finansbank A. Ş.
3	SKBNK	Şekerbank T. A. Ş.
4	GARAN	Türkiye Garanti Bankası A. Ş.
5	HALKB	Türkiye Halk Bankası A. Ş.
6	ISCTR	Türkiye İş Bankası A. Ş.
7	VAKBN	Türkiye Vakıflar Bankası T. A. O.
8	YKBNK	Yapı ve Kredi Bankası A.Ş.

In the study, 8 financial ratios reflecting capital structure, income-expense structure, liquidity, and profitability are used, based on the literature. A financial ratio is a comparison between elements of financial statements that reflects a financial health indicator at a specific point in time. Ratios are a mathematical relationship that explains one amount in terms of another or compares one amount to another. Many ratios can be used to assess the financial performance of banks (Ak et al., 2024). The ratios used in this study are among the significant ratios identified through the literature review (Aydogan & Geoffrey Booth, 1996; Akbulut & Albayrak, 2009; Ata, 2009; Demireli, 2010; Uçkun & Girginer, 2011; Bağcı & Rençber, 2014; Çalışkan & Eren, 2016; Kandemir & Karataş, 2016; Şişman & Doğan, 2016; Tezergil, 2016; Özkan, 2017; Yamaltdinova, 2017). In terms of research on the banking sector in the literature, the financial ratios used in this study, ESG risk ratings, and optimization aspects are presented in Table 2.

Table 2. Evaluation Criteria for Selected Banks

Ratio Type	**Ratio**	**Code**	**Optimization**
Capital Structure	Capital Adequacy Ratio	C1	+
	Equity/ Total Assets	C2	+
Income and Expenditure Structure	Total Revenues/Total Expenses	I1	+
	Interest Income/ Interest Expense	I2	+
Liquidity Ratios	Liquid Assets/ Short Term Liabilities	L1	+
	Liquid Assets / Total Assets	L2	+
Profitability Ratios	Net Profit/ Equity	P1	+
	Net Profit / Total Assets	P2	+
ESG Risk	-	E1	-

The Capital Adequacy Ratio (C1), which is based on balancing banks' equity with the risks they undertake and ensuring their continuity, is an important ratio for the safe sustainability of the banking sector (Hazar et al., 2017). The Equity/Total Assets ratio (C2) indicates how much of the assets are covered by equity, while also reflecting how unexpected losses will be covered, demonstrating capital adequacy that ensures the bank's general safety and soundness (Almazari, 2013; Sarıtaş et al., 2016). The difference between a bank's interest income and interest expenses is a crucial issue for analysis. The Interest Income/Interest Expenses ratio (I1) is preferred to be high for banks. The Income-Expense ratio, obtained by comparing total income to total expenses, is used for benchmarking while reviewing the bank's overall efficiency (Almazari, 2013; Dao & Nguyen, 2020). The Liquid Assets/Short-Term Liabilities ratio (L1) shows whether a bank's total liquid assets are sufficient to meet short-term debt obligations. The higher the Liquid Assets/Total Assets (L2) ratio, the better the bank's liquidity, as it means the bank has more liquid assets within its total assets (Tran et al., 2019). The Net Profit/Equity (P1) ratio shows the profit per unit of capital provided by the bank's owners and shareholders. A high value of this ratio indicates better performance for the bank (Sebayang, 2020). The Net Profit/Total Assets (P2) ratio is a profitability indicator that determines the effective use of a bank's assets. This ratio, which shows how much profit is made per unit of asset, allows the comparison of profitability among banks operating in the industry (Ekinci & Poyraz, 2019; Tezergil, 2016). Sustainalytics' ESG risk ratings assess how companies manage environmental, social, and governance risks, which directly affect their valuations and cash flows. These ratings help investors understand the impact of these factors on financial performance and long-term sustainability. Furthermore, they provide a key tool for decision-making in responsible investment, financial

product development, and sustainability-focused portfolio management by determining risk levels that vary from negligible to serious across various sectors globally (Puente De La Vega Caceres, 2024).

In the study, the financial ratios used were obtained from the Türkiye Bankalar Birliği (TBB) (TBB, 2024). Additionally, ESG risk ratings were sourced from Sustainalytics and integrated into the financial performance analysis (Sustainalytics, 2024). The financial data obtained from TBB and the ESG risk ratings from Sustainalytics correspond to the most up-to-date year, 2023, ensuring temporal alignment in the data used for the study.

Using Microsoft Excel, the LODECI and CRADIS analyses were initially conducted by including ESG risk ratings for the 8 financial ratios, and then again without including them. The results obtained were compared to determine whether the ESG risk ratings influence the financial performance of banks. Table 3 presents the decision matrix consisting of the banks' financial ratios and ESG risk ratings.

Table 3. Decision Matrix

Company	**C1**	**C2**	**I1**	**I2**	**L1**	**L2**	**P1**	**P2**	**E1**
AKBNK	21.922	11.804	158.287	140.465	36.578	19.132	36.447	4.642	14.800
QNBFB	16.656	8.263	159.498	139.617	35.142	18.741	52.703	4.174	28.000
SKBNK	27.221	9.345	175.659	194.021	43.649	23.612	39.771	3.382	27.100
GARAN	20.573	12.683	183.900	153.791	37.702	22.404	43.942	5.667	24.000
HALKB	14.260	5.849	109.769	115.699	19.548	13.190	9.266	0.564	22.500
ISCTR	21.595	10.914	143.722	143.158	36.346	23.097	31.476	3.742	18.100
VAKBN	15.091	6.130	131.796	119.909	30.549	18.530	17.992	1.119	18.600
YKBNK	20.284	10.287	165.397	149.892	30.253	16.730	44.580	4.778	14.800

The normalized decision matrix obtained for LODECI using Equations 1 and 2 is calculated as shown in Table 4.

Tablo 4. LODECI Normalized Decision Matrix

Company	**C1**	**C2**	**I1**	**I2**	**L1**	**L2**	**P1**	**P2**	**E1**
AKBNK	0.805	0.931	0.861	0.724	0.838	0.810	0.692	0.819	0.471
QNBFB	0.612	0.651	0.867	0.720	0.805	0.794	1.000	0.737	0.000
SKBNK	1.000	0.737	0.955	1.000	1.000	1.000	0.755	0.597	0.032
GARAN	0.756	1.000	1.000	0.793	0.864	0.949	0.834	1.000	0.143
HALKB	0.524	0.461	0.597	0.596	0.448	0.559	0.176	0.099	0.196
ISCTR	0.793	0.860	0.782	0.738	0.833	0.978	0.597	0.660	0.354
VAKBN	0.554	0.483	0.717	0.618	0.700	0.785	0.341	0.197	0.336
YKBNK	0.745	0.811	0.899	0.773	0.693	0.709	0.846	0.843	0.471

The DV matrix and LDV values calculated using Equations 3 and 4 are given in Table 5. According to this, the highest differentiation is achieved by P2 (Net Profit / Total Assets). The lowest level of differentiation is achieved by I2 (Interest Income / Interest Expense).

Table 5. LODECI, DV Matrix and LDV Values

Company	C1	C2	I1	I2	L1	L2	P1	P2	E1
AKBNK	0.281	0.470	0.264	0.276	0.390	0.252	0.516	0.720	0.471
QNBFB	0.388	0.349	0.270	0.280	0.357	0.235	0.824	0.637	0.471
SKBNK	0.476	0.276	0.358	0.404	0.552	0.441	0.579	0.497	0.439
GARAN	0.244	0.539	0.403	0.207	0.416	0.390	0.658	0.901	0.329
HALKB	0.476	0.539	0.403	0.404	0.552	0.441	0.824	0.901	0.275
ISCTR	0.269	0.399	0.218	0.262	0.385	0.420	0.421	0.561	0.354
VAKBN	0.446	0.517	0.283	0.382	0.300	0.226	0.659	0.803	0.336
YKBNK	0.255	0.350	0.302	0.227	0.307	0.291	0.670	0.744	0.471
LDV	0.303	0.357	0.272	0.266	0.342	0.291	0.497	0.542	0.332

Table 6 shows the calculated criterion importance levels using Equation 5. In both analyses, with and without the inclusion of ESG risk ratings, the most important criterion was P2 (Net Profit / Total Assets), while the criterion with the lowest importance weight was I2 (Interest Income / Interest Expense).

Table 6. LODECI Criteria Importance Levels

w_j Value	C1	C2	I1	I2	L1	L2	P1	P2	E1
Including ESG Risk	0.095	0.112	0.085	0.083	0.107	0.091	0.155	0.169	0.104
Excluding ESG Risk	0.106	0.124	0.095	0.093	0.119	0.101	0.173	0.189	-

In the study, the performance ranking of companies was carried out based on the CRADIS method. Using the data from Table 3, the CRADIS normalized decision matrix was calculated according to Equations 6 and 7, and it was obtained as shown in Table 7.

Table 7. CRADIS Normalised Decision Matrix

Company	C1	C2	I1	I2	L1	L2	P1	P2	E1
AKBNK	0.805	0.931	0.861	0.724	0.838	0.810	0.692	0.819	1.000
QNBFB	0.612	0.651	0.867	0.720	0.805	0.794	1.000	0.737	0.529
SKBNK	1.000	0.737	0.955	1.000	1.000	1.000	0.755	0.597	0.546
GARAN	0.756	1.000	1.000	0.793	0.864	0.949	0.834	1.000	0.617
HALKB	0.524	0.461	0.597	0.596	0.448	0.559	0.176	0.099	0.658
ISCTR	0.793	0.860	0.782	0.738	0.833	0.978	0.597	0.660	0.818
VAKBN	0.554	0.483	0.717	0.618	0.700	0.785	0.341	0.197	0.796
YKBNK	0.745	0.811	0.899	0.773	0.693	0.709	0.846	0.843	1.000

The normalized decision vector has been weighted according to Equation 8 and is presented in Table 8.

Table 8. CRADIS Weighted Decision Matrix

Company	C1	C2	I1	I2	L1	L2	P1	P2	E1
AKBNK	0.076	0.104	0.073	0.060	0.089	0.073	0.107	0.139	0.104
QNBFB	0.058	0.073	0.074	0.060	0.086	0.072	0.155	0.125	0.055
SKBNK	0.095	0.082	0.081	0.083	0.107	0.091	0.117	0.101	0.057
GARAN	0.072	0.112	0.085	0.066	0.092	0.086	0.129	0.169	0.064
HALKB	0.050	0.051	0.051	0.050	0.048	0.051	0.027	0.017	0.068
ISCTR	0.075	0.096	0.066	0.061	0.089	0.089	0.093	0.112	0.085
VAKBN	0.053	0.054	0.061	0.051	0.075	0.071	0.053	0.033	0.082
YKBNK	0.071	0.091	0.076	0.064	0.074	0.064	0.131	0.143	0.104

The deviations from the ideal and anti-ideal solutions, as well as the utility values obtained using CRADIS, are calculated as shown in Table 9. GARAN, which performs relatively well in both deviations from the anti-ideal and the ideal, has demonstrated better performance than other companies in both K_i^+ and K_i^- values. On the other hand, HALKB has the worst performance in both parameters, lagging.

Table 9. CRADIS Deviations from Ideal and Anti-Ideal Solutions and Utility Values

Company	s_i^+	s_i^-	K_i^+	K_i^-
AKBNK	0.698	0.674	0.751	0.795
QNBFB	0.768	0.605	0.683	0.713
SKBNK	0.711	0.662	0.738	0.780
GARAN	0.649	0.723	0.807	0.853
HALKB	1.112	0.260	0.471	0.307
ISCTR	0.759	0.614	0.691	0.724
VAKBN	0.991	0.382	0.529	0.450
YKBNK	0.707	0.666	0.742	0.785

The final CRADIS rankings and scores for the selected deposit banks in the BIST banking sector, both including and excluding ESG risk ratings, are shown in Table 10.

Tablo 10. CRADIS Performance Scores and Rankings with and without ESG Risk Ratings

	Including ESG Risk		**Except ESG Risk**	
Company	**Score**	**Rank**	**Score**	**Rank**
AKBNK	0.773	2	0.748	3
QNBFB	0.698	6	0.724	5
SKBNK	0.759	4	0.792	2
GARAN	0.830	1	0.865	1
HALKB	0.389	8	0.364	8
ISCTR	0.708	5	0.699	6
VAKBN	0.490	7	0.461	7
YKBNK	0.763	3	0.738	4

In the performance ranking with ESG risk ratings included, the top three positions are occupied by GARAN, AKBNK, and YKBNK, while the bottom three positions are held by HALKB, VAKBN, and QNBFB. In the performance ranking excluding ESG risk ratings, the top three positions are occupied by GARAN, SKBNK, and AKBNK, while the bottom three positions are held by HALKB, VAKBN, and ISCTR.

In the analysis including ESG risk ratings, GARAN, which ranked first in both analyses, had a CRADIS score of 0.865 in the analysis excluding ESG risk ratings, which decreased to 0.830 in the analysis including ESG risk ratings. Despite GARAN's rank remaining unchanged in both analyses, the decline in the CRADIS score could be attributed to the fact that, while all its financial ratios are high compared to the sector, its ESG risk rating (24.00) is relatively high.

SKBNK, which ranked second in the analysis excluding ESG risk ratings, had a CRADIS score of 0.792, but in the analysis including ESG risk ratings, its rank dropped to fourth, and its CRADIS score fell to 0.759. This decrease in SKBNK's rank and CRADIS score in the analysis including ESG risk ratings could be due to its relatively high ESG risk rating (27.10).

AKBNK, which ranked third in the analysis excluding ESG risk ratings, had a CRADIS score of 0.748, but in the analysis including ESG risk ratings, its rank rose to second, and its CRADIS score increased to 0.773. The rise in AKBNK's rank and CRADIS score in the analysis including ESG risk ratings could be attributed to its relatively low ESG risk rating (14.80).

YKBNK, which ranked fourth in the analysis excluding ESG risk ratings, had a CRADIS score of 0.738, but in the analysis including ESG risk ratings,

its rank rose to third, and its CRADIS score increased to 0.763. The rise in YKBNK's rank and CRADIS score in the analysis including ESG risk ratings could be attributed to its relatively low ESG risk rating (14.80).

QNBFB, which ranked fifth in the analysis excluding ESG risk ratings, had a CRADIS score of 0.724, but in the analysis including ESG risk ratings, its rank dropped to sixth, and its CRADIS score decreased to 0.698. This drop in QNBFB's rank and CRADIS score in the analysis including ESG risk ratings could be due to its relatively high ESG risk rating (28.00).

ISCTR, which ranked sixth in the analysis excluding ESG risk ratings, had a CRADIS score of 0.699, but in the analysis including ESG risk ratings, its rank rose to fifth, and its CRADIS score increased to 0.708. The rise in ISCTR's rank and CRADIS score in the analysis including ESG risk ratings could be attributed to its relatively low ESG risk rating (18.10).

VAKBN, which ranked seventh in both analyses, had a CRADIS score of 0.461 in the analysis excluding ESG risk ratings, which increased to 0.490 in the analysis including ESG risk ratings. Despite VAKBN's rank remaining unchanged in both analyses, the increase in its CRADIS score could be due to its relatively low ESG risk rating (16.60).

HALKB, which ranked last in both analyses, had a CRADIS score of 0.364 in the analysis excluding ESG risk ratings, which increased to 0.389 in the analysis including ESG risk ratings. Despite HALKB's rank remaining unchanged in both analyses, the increase in its CRADIS score could be due to its relatively low ESG risk rating (22.50).

In the analysis including ESG risk ratings, while GARAN's rank remained unchanged, its CRADIS score decreased. This could be attributed to GARAN's relatively high ESG risk rating (24.00). On the other hand, VAKBN and HALKB's CRADIS scores increased, despite their ranks remaining unchanged, possibly due to their relatively low ESG risk ratings (18.60 and 22.50, respectively). Furthermore, AKBNK, YKBNK, and ISCTR showed an improvement in both their performance ranks and CRADIS scores, likely due to AKBNK and YKBNK's lowest ESG risk ratings (14.8) and ISCTR's relatively low ESG risk rating (18.10). Conversely, SKBNK and QNBFB saw declines in both their performance ranks and CRADIS scores, which could be attributed to their highest ESG risk ratings (28.00 and 27.10, respectively). In this context, it is observed that banks with lower ESG risks had higher CRADIS scores, while those with higher ESG risks experienced a decline in their CRADIS scores.

5. Conclusions and Discussion

Within the scope of the purpose of the study, the research question was determined as "Does the inclusion of ESG risk ratings in the performance analysis of banks affect the performance ranking?". In the study, MCDM techniques were used to analyse the effect of ESG risk ratings of companies in the BIST Banking sector on financial performance. LODECI technique, which objectively determines the importance levels of the criteria and integrates the perspectives of two basic approaches, Entropy and MEREC methods, and at the same time creates acceptable and robust weight vectors, was used. The performance ranking of the companies was carried out with CRADIS, which has utility functions created according to ideal and anti-ideal values.

In the analysis conducted, in addition to financial ratios, the banks' ESG risk ratings were also used as performance criteria. When determining the financial performance ranking of the included banks, first, a scoring was done based on financial ratios and ESG risk ratings. Then, the ESG risk ratings were excluded from the analysis, and the scores were recalculated. The scores calculated for both scenarios were compared, and it was determined that including ESG risk ratings in the analysis led to differences in the performance scores and rankings.

In the performance ranking conducted with the inclusion of ESG risk ratings, the top three positions were held by GARAN, AKBNK, and YKBNK, while the bottom three positions were held by HALKB, VAKBN, and QNBFB. In the performance ranking conducted without including ESG risk ratings, the top three positions were held by GARAN, SKBNK, and AKBNK, while the bottom three positions were held by HALKB, VAKBN, and ISCTR. In the analysis with the inclusion of ESG risk ratings, it was observed that QNBFB's rank dropped from five to six, and SKBNK's rank dropped from two to four. It was found that companies with low ESG risk ratings improved their financial performance rankings, while those with high ESG risk ratings experienced a decline in their rankings. This finding shows that lower ESG risk ratings are effective in improving financial performance and is supported by the studies of Di Tommaso and Thornton (2020), Çetenak et al. (2022), and Onocak (2024).

This study, with a specific focus on Türkiye, makes a significant contribution to the existing literature by investigating the impact of ESG risks on the banking sector in emerging economies. The insights gained from this research could provide a valuable foundation for researchers to explore similar aspects of ESG risks in other developing countries that are

showing significant progress. Through empirical analysis, the study enhances the understanding of whether ESG factors contribute to improved financial performance, particularly in banking sectors of emerging economies like Türkiye. Furthermore, the study identifies the primary ESG risks that significantly influence the financial success of banks in Türkiye. The results unmistakably show that ESG risks have a distinctly negative impact on the financial performance of the banking sector in Türkiye.

To support these findings, future research is encouraged to conduct more comprehensive analyses. This could involve expanding the sample size, exploring alternative measures of profitability and performance, and employing advanced research methodologies. Such studies would contribute to the literature on ESG risk and bank performance, particularly in the context of Türkiye. The results of this study have policy implications not only for managers in the corporate sector but also for government officials, emphasizing the importance of cautious investment practices and decision-making in ESG projects. By integrating ESG factors into corporate operations, organizations can position themselves for enhanced long-term financial performance.

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Chapter 6

Determinants of Financial Performance In Energy Companies: A Comparative Analysis Before And After Covid-19

Uğur Sevim[1]

Abstract

The COVID-19 pandemic has had significant economic impacts worldwide. The pandemic has also caused serious effects on businesses, which are one of the key elements of the economy. Although a few sectors benefited from the pandemic, the majority experienced significant negative impacts. One of the sectors affected by the pandemic is the energy sector. The energy sector stands out as an important industry due to its role in sustaining daily life and its direct and indirect connections with other sectors. Based on this, this study investigates the impact of the COVID-19 pandemic on the determinants of the financial performance of businesses in the energy sector. The data for the study were compiled from the financial statements of the 20 largest energy companies by market capitalization listed on the U.S. stock exchanges, and these data were analyzed using the multiple linear regression analysis method. The results of the study reveal that the COVID-19 pandemic had significant effects on the determinants of financial performance in energy companies.

1. Introduction

In times of global peace, the COVID-19 pandemic precipitated one of the most severe and rapid contractions in economic activity in modern history. However, the extent of this impact varied greatly across different sectors of the economy. While some sectors seized the opportunities that emerged during the pandemic and strengthened, many others suffered considerable setbacks due to its negative effects (European Commission, 2021: 1). For example, the surge in interest in digital platform services—

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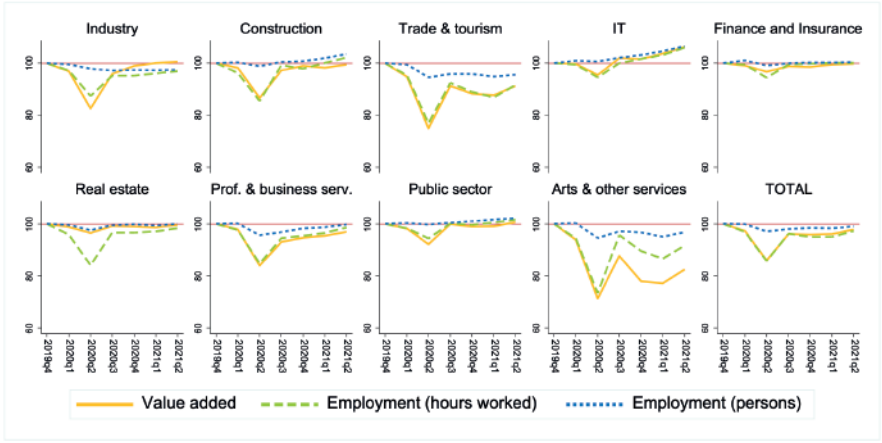
allowing individuals to access diverse content without physical and temporal restrictions—was driven by the lockdowns. This led to a positive impact on the information technology sector (Erdem et al., 2023: 93). In contrast, the transportation sector, unlike the IT sector, was severely affected as lockdown measures brought transportation activities to a near halt.

The pandemic had a profound impact on most sectors, especially the service sector. The industries most affected were those that rely heavily on personal interaction, such as retail, hospitality, transportation, arts, and entertainment. At the peak of the first wave in the second quarter of 2020, economic activity in these sectors across Europe fell 25% below pre-COVID-19 levels. In contrast, sectors requiring less physical contact between customers or employees, such as manufacturing and construction, were relatively less affected. For example, the manufacturing sector saw a 17% contraction during this period, while the construction sector experienced a 13% contraction. On the other hand, sectors involving highly skilled workers and those more adaptable to remote work, such as information and communication technologies, finance, and real estate, were moderately impacted, with most showing a contraction of less than 5% (Canton et al., 2021: 2). Figure 1 illustrates the impact of the pandemic on various sectors across Europe from different perspectives, including sectoral value added, employment, and working hours.

Figure 1: Changes in Sectoral Value Added, Employment, and Working Hours, EU27 Average



Source: (Canton vd., 2021: 2).

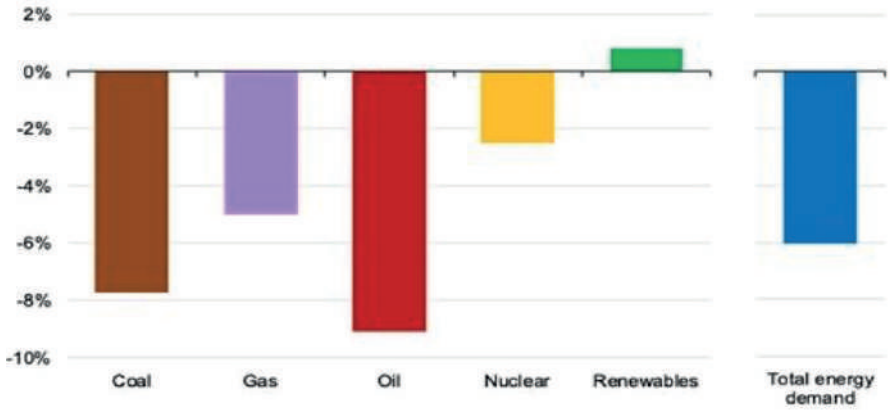
An analysis of Figure 1 reveals that, although sectors across Europe responded differently to the pandemic, as noted earlier, there was an overall significant decline in the relevant indicators. Notably, one of the sectors most affected by the pandemic was the industrial sector, which includes many subsectors, with manufacturing being one of the most prominent. Among these subsectors is the energy sector.

Since energy is a fundamental input for almost all sectors, the energy sector is closely intertwined with other industries. In recent years, factors such as the rapid advancement of technological developments, the dependence of these developments on energy, and the increasing use of automation in production processes have led to a growing global reliance on energy. As a result, energy demand has reached very high levels annually (Sevim, 2014: 1). Therefore, considering its strong ties with other sectors, the energy sector, like the industrial sector, was significantly impacted by the pandemic.

The most significant impact of the pandemic on the energy sector has been a substantial decline in the demand for primary energy resources. The restrictions imposed worldwide during the pandemic brought many sectors, particularly transportation, to a standstill, leading to a drastic reduction in energy demand, which is a crucial input for these industries. For example, approximately 60% of global oil demand originates from the aviation sector. Consequently, the near cessation of the aviation industry due to the pandemic severely impacted global oil demand. By the end of 2020, global oil demand had contracted by 8.8% (Sevim, 2021: 3).

However, it is also true that the pandemic created opportunities, especially for renewable energy. During this period, renewable energy sources—such as wind, solar, geothermal, and biomass—were less affected by the pandemic and began to experience increased demand (Gollakota and Shu, 2023: 94). The effects of the pandemic on global energy demand are summarized in Figure 2.

Figure 2: Distribution of Energy Demand (Comparative 2019-2020)



Source: (World Energy Council Turkey, 2020: 1).

As can be seen from the information presented in Figure 2, global energy demand showed an overall decrease of approximately 6% in the first quarter of 2020 compared to 2019, while demand for renewable energy experienced an increase.

The COVID-19 pandemic has had widespread negative effects across various sectors, as previously noted. Assessing these impacts from the perspective of firms is essential, as their performance and condition reflect the severity of the pandemic's effects on each industry. However, when assessed independently of specific sectors, similar factors can be identified as contributing to the negative effects of the pandemic on firms. These factors can be summarized as follows (Deloitte, 2020: 1).

- Declining and unpredictable demand and the deteriorating supply chain create cash and working capital problems in businesses,
- Suppliers failing to deliver critical components to manufacturers, delaying or completely halting the production process,
- The downturn in consumer demand is causing businesses to build up their inventories, making it increasingly difficult for them to clear their inventories,
- Difficulties in collecting receivables from cash-strapped customers on time,
- Delays in supplier payments due to short-term cash flow constraints,
- The fact that post-dated cheques, which play a critical role in commercial life and are used as a receivable financing method, cause serious collection problems due to cash flow problems in this period,

- Because post-dated cheques are used as collateral by businesses, they have certain legal consequences in case of non-payment.

As outlined, the pandemic has significantly disrupted businesses across various sectors, leading to severe negative impacts on their operations and performance. So much so that as of August 2020, it was reported that more than 3 million employees lost their jobs only in the energy sector worldwide (Acar and Saygın, 2020: 3).

As of today, it is seen that businesses are now gradually emerging from the negative effects of the pandemic. Of course, the effects of the damage caused by the pandemic cannot be expected to disappear immediately. However, it should also be considered that businesses are now returning to normal operating processes. During the pandemic process, the impact of the process on businesses has been addressed by many researchers around the world and many findings regarding the period have been put forward. Since a certain period has passed since the pandemic period, it is now important to carry out studies comparing the pre-pandemic and post-pandemic period on various issues such as what are the real effects of the damage caused by the pandemic on businesses and to what extent businesses can recover from the impact of the pandemic.

In this sense, one of the most focused issues for businesses is financial performance. There are many internal and external factors affecting the financial performance of companies. For example, the management structure, liquidity status and capital structure of companies can affect performance, while factors such as gross product, inflation and interest rates can also affect business performance. The pandemic process may have revealed different situations in terms of the effects of these factors on business performance. Considering that the pandemic has caused changes in the operating structures or ways of doing business, it is a question that needs to be investigated whether a factor that is or is expected to be effective on financial performance before the pandemic affects the performance to the same extent after the pandemic. From this point of view, this study investigates the impact of the COVID-19 pandemic on the determinants of the financial performance of companies in the energy sector. For this purpose, in the next part of the study, firstly, the literature on the subject will be presented, and then the study will be completed by presenting an analysis on whether the impact of the financial performance determinants on financial performance in energy companies varies between pre-and post-pandemic periods..

2. LITERATURE REVIEW

2.1. Financial Performance in Energy Companies

Financial performance is an important indicator for the interest groups of the businesses. For this reason, financial performance has been the subject of many studies. Due to the increasing importance of the energy sector over the years, especially in recent years, the number of studies examining financial performance in companies operating in the energy sector has been increasing. Most of these studies focus on the internal and external factors affecting these measures by considering different financial performance measures specific to the energy sector. For example, in their study Luts et al. (2021), focusing on renewable energy firms in Germany and revealed that factors such as current ratio, leverage ratio, firm size, and gross domestic product (GDP) have different effects on different financial performance measures. In the study conducted on 783 firms using panel data analysis method, it is stated that the effect of firm-based (endogenous) determinants on performance is higher than the effect of industry and economy-based (exogenous) determinants. It is also revealed that the current ratio has a positive effect on return on assets (ROA) in small and medium-sized companies (SMEs) and a negative effect on return on equity (ROE) in large companies, while the leverage ratio has a positive effect on financial performance in large companies with the luxury of taking risks. For GDP has a positive effect on ROA especially in small enterprises.

In their study on the determinants of the performance of energy firms in Portugal, Neves et al. (2021) used different financial performance metrics—such as ROE for shareholders, EBITDA for managers, and ROA for other stakeholders—reflecting the expectations of various stakeholders on financial performance. Their findings indicated that different internal determinants have varying effects on different performance measures. In the study, which analyzed data from 457 firms using the GMM model, it was found that leverage and size have a negative effect on ROA, while leverage and liquidity have a positive effect on ROE. For EBITDA, leverage has a positive effect, whereas liquidity has a negative effect. Bunea et al. (2019) conducted a study using ANOVA and linear regression models on 1253 firms operating in the energy sector in Romania and found that leverage ratio has a negative effect on ROE for small firms and a positive effect for medium and large companies, while asset turnover ratio has a positive effect for all business groups. Westerman et al. (2020), in their study conducted using regression analysis on 129 energy firms from 19 European countries, investigated the determinants of financial performance

through a comparative analysis of conventional and renewable energy firms. Unlike other studies, in addition to ROA, they used the Tobin's Q ratio, a market-based financial performance measure. The study's results indicated that, considering Tobin's Q, the performance of renewable energy firms was better than that of conventional firms. Additionally, leverage and firm size had a negative effect on performance in both firm groups, while GDP and inflation rates had no significant effect.

Hussain et al. (2021) conducted a study on the determinants of financial performance on 21 energy companies listed on the Pakistan Karachi Stock Exchange using panel data analysis method and found that receivables turnover and inventory turnover do not have a significant effect on financial performance as a different finding from other studies. Jin et al. (2021) conducted a financial efficiency research with the data of 122 firms using data envelopment analysis in their study considering businesses operating in China on energy conservation and environmental protection. In the study where ROE and EBITDA are used as financial performance measures, it is stated that leverage, GDP and inflation have a negative effect on financial efficiency, while firm size has a positive effect. Gupta (2017) conducted a study on 9799 alternative energy firms from 26 countries and investigated the determinants of financial performance using panel data analysis method. As a result of the study, it is stated that leverage and GDP have a negative effect on financial performance, while firm size has a positive effect.

2.2. Financial Performance in Businesses in the Context of COVID-19 Pandemic

Since it is an important indicator in terms of evaluating the situation of businesses, financial performance has been one of the important focal points of researchers in studies investigating the impact of the COVID-19 pandemic on businesses. In many studies, the effects of the pandemic on businesses have been tried to be revealed through financial performance. For example, in their study aimed at revealing the impact of COVID-19 on businesses through financial performance, Shen et al. (2020) found that the pandemic had a negative effect on business performance in China, and this effect was notably more significant in small-scale businesses. Atayah et al. (2021) examined the impact of COVID-19 on the financial performance of logistics firms in G-20 countries, aiming to compare these firms' financial performance during the pandemic. In the study, which used financial performance indicators such as ROA and ROE, it was found that in 14 of the G-20 countries—except for Germany, South Korea, Russia, Mexico, Saudi Arabia, and the United Kingdom—financial performance in the relevant

sector generally increased significantly during the pandemic, while firms in the other six countries were financially negatively affected during the same period. Also, Ataman et al. (2022) investigated the impact of the pandemic on sectoral performance in Turkey and found that assets, equity and net sales increased in the energy sector during the pandemic period, while net profit, net profit margin and return on assets decreased similar to other sectors. Emirhan and Sakin (2021) analysed the effects of the COVID-19 pandemic on the profitability ratios of firms traded on the stock exchange. In the study of 153 firms, the Du Pont method, a widely known tool for analysing the profitability of firms, was used and return on equity (ROE) was calculated based on total asset turnover (TAT), net profit margin (NPM) and equity multiplier (EM). These ratios were used as variables in the dynamic panel data model applied in the study. The results revealed noteworthy findings that differ from other studies. In the sample that included all firms, the dummy variable representing COVID-19 had a positive effect on ROE but a negative effect on ROA and NPM, with the negative effect on NPM being particularly reported. Furthermore, in the analysis of manufacturing firms, the COVID variable had a negative effect on both ROE and ROA, while surprisingly showing a positive effect on NPM. In the analysis of non-manufacturing firms, COVID had a negative impact on NPM and ROA but a positive impact on ROE. The positive effect on the NPM of manufacturing firms could indicate that these firms managed their costs more efficiently during the pandemic. On the other hand, the negative effects on ROE and ROA might suggest inefficient management of assets and equity.

Alsamhi et al. (2022) examined the effects of the COVID-19 pandemic on the financial performance of firms operating in the construction, tourism and hospitality, food and consumer sectors in India. In the study, comparative analyses were conducted on 371 firms traded on the Bombay Stock Exchange before and after the pandemic, and it was found that while significant decreases in revenue, net sales and profits were observed especially in the tourism and hospitality sectors after the pandemic, the food sector was relatively less affected by the pandemic. Ngo and Duoung (2024), in their study examining the effects of the COVID-19 pandemic on the financial performance of companies operating in different sectors in Vietnam with the difference-in-difference method on 402 firms, revealed that the pandemic caused a significant decline in ROA and ROE of companies. In addition, it was stated that sectors such as retail, construction, real estate and tourism were more negatively affected compared to other sectors. In her study, Valaskova (2023) aimed to analyze the impact of the COVID-19 pandemic on the financial performance of businesses in Slovakia. Using financial

data from the years 2018 to 2021, the research examined the effect of the pandemic on companies' debt ratios. As a result of the analyses conducted using the Friedman test, statistically significant differences were found across the years in critical indicators such as the total debt ratio, equity-to-debt ratio, and financial independence ratio. The study revealed that the pandemic particularly had a negative impact on the debt levels of firms in 2020 and 2021. These findings indicated that companies need to strengthen their long-term financial resilience.

It can be said that the number of studies on the subject directly focusing on the energy sector is relatively less. In this sense, Fu and Shen (2020) investigated the impact of COVID-19 on business performance through companies operating in the Chinese energy sector. In the study, it was stated that the pandemic had a negative impact on the financial performance of companies operating in the energy sector. In some studies, as in this study, the issue has been addressed by associating the determinants of financial performance in energy companies with the COVID-19 pandemic. Makki and Alqahtani (2023) examined the impact of the COVID-19 pandemic on the financial performance of companies in Saudi Arabia's energy sector. The study evaluated changes in financial performance before, during, and after the pandemic by analyzing data from 2019, 2020, and 2021. Using a hybrid Multi-Criteria Decision Making (MCDM) approach, the performance of companies was analyzed across four main financial dimensions: efficiency, profitability, leverage, and liquidity. The results indicated that during the pandemic, the most important financial dimensions were efficiency and profitability, while leverage and liquidity were of lesser importance. In their study, Nurlia et al. (2023) conducted a comprehensive analysis of the global impacts of COVID-19 on energy sector companies. The analysis considered company characteristics, market distinctions (developed and emerging markets), and sector differences (fossil fuels and alternative fuels). Using panel data analysis, the study examined the financial statement data of 1,252 companies across 64 countries from 2018 to 2022. The findings revealed that COVID-19 had a negative impact on the performance of energy sector companies across all market and sector categories. Furthermore, the results emphasized that company characteristics, such as size, liquidity, and capital structure, played a significant role in shaping the performance outcomes of energy sector companies.

3. DATA AND METHODOLOGY

When creating the dataset for the study, a literature review was first conducted to identify the most suitable variables for the purpose of the study.

Upon reviewing the relevant literature, it was observed that various variables have been used in similar studies for measuring financial performance, as well as for assessing the internal and external factors affecting financial performance. However, when evaluated generally, it is noteworthy that studies tend to prefer the ratios of return on assets and return on equity for measuring financial performance. As for the internal factors affecting financial performance, financial ratios such as the current ratio in terms of liquidity, leverage ratio (total debt ratio, debt/equity ratio) in terms of capital structure, and accounts receivable turnover and inventory turnover in terms of asset utilization efficiency are commonly used in the studies. Regarding firm size, total assets and total sales are typically preferred. As for the external factors affecting financial performance, it can be said that studies generally favor gross domestic product and inflation rate. Based on this, information about the variables decided to be used in the study is summarized in Table 1.

Table 1: Information on the Variables Used in the Study

Variable	Defination	Source
Return on Assets (ROA)	Net Profit/Total Assets	Luts vd. 2021, Neves vd. 2021
Cari Oran (LİQ)	Total Current Assets/Total Current Liabilities	Nurlia vd. 2023, Hussain vd. 2021
Debt to Equity Ratio (LEV)	Total Liabilities/Total Shareholders' Equity	Valaskova 2023, Luts vd. 2021
Inventory Turnover Rate (ITR)	Cost of Sales / Average Inventories	Hussain vd. 2021
Business Size (lnTA)	Natural Logarithm of Total Assets	Gupta 2017, Neves vd. 2021
Gross Domestic Product (DGDP)	Growth of Gross Domestic Product	Jin vd. 2021, Luts vd. 2021
Inflation (DINF)	Inflation Rate Growth (Consumer Prices)	Westerman vd. 2020, Jin vd. 2021

In the study, a dataset concerning the variables presented in Table 1 was created using information from the financial statements of the 20 largest energy firms by market value listed on American stock exchanges (NYSE, NASDAQ, NASDAQ Other OTC, NYSE MKT). The financial statement data for the relevant companies were compiled from the Macrotrends website. The dataset was structured to include quarterly data for two distinct periods: the pre-COVID-19 period from 2016 to 2018 and the post-COVID-19 period from 2021 to 2023. In this context, data from the years 2019 and 2020, when the pandemic was impactful, were excluded from the analysis.

The study employed multiple linear regression analysis as its methodological approach. Regression analysis, in its broadest definition, is a statistical method that examines the numerical relationship between dependent and independent variables. The application of regression analysis can vary based on the number of variables used in the analysis. If there is one dependent variable and a single independent variable affecting it, simple regression is applied. Conversely, if there is one dependent variable corresponding to multiple independent variables, multiple regression analysis is used. Additionally, if the relationship between the variables is linear, the analysis is called linear regression analysis; if it is not linear, it is referred to as nonlinear (curvilinear) regression analysis (Deniz and Koç, 2019: 106).

A simple linear regression model is expressed as follows (Karabulut and Şeker, 2018: 1059):

$$Y = \beta_0 + \beta_1 X + \varepsilon \quad (1)$$

In Equation 1, Y represents the dependent variable, while X represents the independent variable. β_0 denotes the constant term (the value of Y when X=0), β_1 represents the regression coefficient (a measure of the change in the dependent variable corresponding to a one-unit change in the independent variable), and ε denotes the error term. Furthermore, a multiple linear regression model with multiple independent variables, for example, k independent variables, is expressed as follows (Deniz and Koç, 2019: 106; Karabulut and Şeker, 2018: 1059):

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots + \beta_k X_k + \varepsilon \quad (2)$$

In Equation 2, Y again represents the dependent variable, while X_1, ……, X_k represent the independent variables. β_0 denotes the constant term, β_0, ……, β_k are the unknown parameters, and ε represents the error term.

Moreover, there are certain assumptions that the relevant model must satisfy for the linear regression method to be applicable. These assumptions can be summarized as follows (Deniz and Koç, 2019: 106):

- It is known that the sample used is a random sample or largely represents the population.
- It is assumed that the dependent variable contains random errors and that the mean error is zero.
- Regression analysis does not encompass systematic errors.
- The variance of the error term is constant, and errors are not dependent on each other over time.

- There is no autocorrelation problem in the model. In other words, the error variance is constant and is assumed not to change between the data points.
- Errors follow a normal distribution.
- There is no multicollinearity problem among the variables, meaning that the independent variables are not related to each other.

Considering the determined data set and the applied method together, two regression models were established within the scope of the study, one for pre-COVID-19 and one for post-COVID-19. The regression models are as follows:

Model 1:

$$ROA_{prec} = \beta_0 + \beta_1 LIQ + \beta_2 LEV + \beta_3 ITR + \beta_4 lnTA + \beta_5 DGDP + \beta_6 DINF + \varepsilon_i$$

Model 2:

$$ROA_{postc} = \beta_0 + \beta_1 LIQ + \beta_2 LEV + \beta_3 ITR + \beta_4 lnTA + \beta_5 DGDP + \beta_6 DINF + \varepsilon_i$$

4. FINDINGS

As part of the findings of the study, descriptive statistics related to the variables will first be presented, followed by findings regarding whether the established models meet the necessary assumptions for the application of multiple linear regression analysis. Finally, the regression results related to the models will be presented and evaluated. Accordingly, Table 2 contains the descriptive statistics for the variables.

Table 2: Descriptive Statistics

Variables	Model 1			Model 2		
	Mean	Standard Deviation	Observation	Mean	Standard Deviation	Observation
ROA	,6232	2,63469	240	2,3464	1,97771	204
LIQ	1,4013	,83914	240	1,2373	,46286	204
LEV	,7564	,55505	240	,8579	,56011	204
ITR	3,1346	2,74457	240	3,4223	2,63998	204
DINF	1,9451	,56807	240	5,9639	2,11170	204
DGDP	,5875	,21645	240	,7306	1,07372	204
lnTA	10,6644	,90752	240	10,9372	,79938	204

When the descriptive statistics presented in Table 2 are evaluated overall, it is observed that the firms included in the study have higher asset profitability in the post-pandemic period compared to the pre-pandemic period, while their liquidity is lower. Additionally, regarding the capital structures of the firms, it is noted that their debt burdens have increased in the post-pandemic period, while their asset sizes have remained at similar levels. Furthermore, in terms of macroeconomic indicators, there is a noticeable positive growth in gross domestic product (GDP) in the post-pandemic period compared to before, while inflation shows a negative growth.

When evaluating whether the established regression models meet the necessary assumptions, the study first investigated whether the variables used in the relevant models follow a normal distribution. It was determined that all variables, in their utilized forms within the models, exhibit a normal distribution.

For issues of multicollinearity and autocorrelation, indicators such as inter-variable correlations, the Durbin-Watson autocorrelation test, and tolerance and VIF values related to the models were considered. Accordingly, as one of the indicators for detecting multicollinearity issues, inter-variable correlations were examined, and the findings from the correlation analysis are summarized in Table 3.

Table 3: Correlation Results Related to the Models

Model 1							
	ROA	**CO**	**BÖS**	**SDH**	**DENF**	**DGSYİH**	**lnTA**
ROA	1,000						
LIQ	-,229	1,000					
LEV	-,043	-,314	1,000				
ITR	,173	-,104	,138	1,000			
DINF	,301	-,099	-,044	,051	1,000		
DGDP	,090	-,082	-,028	,005	,235	1,000	
lnTA	,073	-,296	-,099	-,264	,048	,012	1,000
Model 2							
	ROA	**LIQ**	**LEV**	**ITR**	**DINF**	**DGDP**	**lnTA**
ROA	1,000						
LIQ	,174	1,000					
LEV	-,269	-,204	1,000				
ITR	,103	-,256	,101	1,000			
DINF	,488	,013	-,042	,165	1,000		
DGDP	-,155	,023	,078	-,030	-,284	1,000	
lnTA	-,096	-,098	-,374	,213	-,083	-,055	1,000

When examining the values in Table 3, it can be seen that there are no correlations among the variables used in the relevant models that would lead to a multicollinearity problem[2]. To detect whether there is an autocorrelation problem among the variables, the Durbin-Watson autocorrelation test was conducted. In this context, Table 4 contains both summary information regarding the models established in the study and the findings from the Durbin-Watson test results.

Table 4: Model Summaries

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R^2 Change	F Change	df1	df2	Sig. F Change	
1	,405	,164	,143	2,43954	,164	7,628	6	233	,000	1,576
2	,591	,350	,330	1,61886	,350	17,662	6	197	,000	1,041

When examining the summary information in Table 4 related to the models, it is found that the Durbin-Watson test statistic values for both models fall between 1 and 3, indicating that there is no autocorrelation problem among the variables in the relevant models[3]. Additionally, when looking at the R^2 values presented in the table, it can be observed that the independent variables explain 16.4% of the variance in the dependent variable for Model 1 and 33% for Model 2.

In addition to meeting the assumptions from the perspective of regression analysis, another important aspect is determining whether the regression models established within the analysis are significant as a whole. Table 5 contains the findings from the variance analysis conducted as an indicator of the significance of the relevant models.

2 The presence of correlations of 0.80 and above among the variables is considered an indicator of multicollinearity problems (Küçüksille, 2016: 267).

3 The fact that the Durbin-Watson test statistic value takes a value ranging between 1-3 is accepted as an indicator that there is no autocorrelation problem among the variables (Karasakaloğlu, 2022: 360).

Table 5: Variance Analysis Table Related to the Models

Model 1	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	272,382	6	45,397	7,628	,000
Residual	1386,661	233	5,951		
Total	1659,043	239			
Model 2	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	277,724	6	46,287	17,662	,000
Residual	516,277	197	2,621		
Total	794,001	203			

When examining the findings presented in Table 5, it is observed that the significance (sig.) value for both models is less than 0.05, indicating that the models established within the study are significant as a whole. The final analysis results related to the models established in the study are summarized in Table 6. The tolerance and VIF values included in the table are evaluated as indicators of whether there is a multicollinearity problem among the variables, similar to the correlation analysis. Accordingly, a VIF value below 10 and a tolerance value above 0.2 are considered indicators that there is no multicollinearity problem among the variables (Tonta, 2008: 30; Karasakaloğlu, 2022: 360; Yılmaz and Erdem, 2021). As can be seen from the information in Table 6, the VIF and tolerance values related to the relevant models meet the specified conditions. Therefore, considering both the inter-variable correlation values and the VIF and tolerance values, it can be confidently stated that there is no multicollinearity problem among the variables used in the models established in the study.

Table 6: Coefficients Table Related to the Models

Model 1	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Err.	Beta			Tolerance	VIF
Cons.	-1,743	2,438		-,715	,476		
LIQ	-,676	,216	-,215	-3,129	,002*	,758	1,319
LEV	-,562	,308	-,118	-1,825	,069	,852	1,174
ITR	,154	,061	,161	2,533	,012**	,889	1,125
DINF	1,222	,288	,263	4,245	,000*	,931	1,074
DGDP	,076	,752	,006	,101	,920	,939	1,065
lnTA	,078	,195	,027	,400	,689	,794	1,259
Model 2	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**	**Collinearity Statistics**	
	B	**Std. Err.**	**Beta**			**Tolerance**	**VIF**
Cons.	5,187	2,011		2,580	,011		
LIQ	,516	,261	,121	1,978	,049**	,884	1,131
LEV	-1,100	,231	-,311	-4,768	,000*	,773	1,293
ITR	,102	,047	,136	2,172	,031**	,840	1,190
DINF	,402	,058	,429	6,952	,000*	,866	1,155
DGDP	-,033	,111	-,018	-,300	,764	,910	1,099
lnTA	-,481	,163	-,194	-2,949	,004*	,760	1,316

* It indicates that the coefficients are significant at 1% level.
** It indicates that the coefficients are significant at 5% level.

When examining the findings related to parameter estimates for the variables presented in Table 6, it is observed that the LIQ, ITR, and DINF variables have a significant effect on ROA in both models. However, the LEV and lnTA variables have a significant effect on ROA only in Model 2.

When the findings presented in the table are examined more comprehensively, it is observed that in Model 1, the LIQ variable has a significant negative effect on ROA, while the ITR and DINF variables have significant positive effects. Specifically, a one-unit increase in the LIQ variable results in a decrease of 0.67 units in ROA, whereas a one-unit increase in the ITR and DINF variables leads to increases of 0.15 (ITR) and 1.22 (DINF) units in ROA, respectively. In Model 2, similar to Model 1, the ITR and DINF variables have significant positive effects on ROA. However, while the LIQ variable had a negative effect on ROA in Model 1, it shows a positive effect in Model 2. Additionally, unlike Model 1, it has been determined that the LEV and lnTA variables also have significant

negative effects on ROA in Model 2. A detailed examination of the results of Model 2 reveals that a one-unit increase in the LIQ, ITR, and DINF variables results in increases of 0.51 (LIQ), 0.10 (ITR), and 0.40 (DINF) units in ROA, respectively. Conversely, a one-unit increase in the LEV and lnTA variables leads to decreases of 1.10 (LEV) and 0.48 (lnTA) units in ROA, respectively.

When the findings obtained from the study are compared with the literature, it is notable that the results align significantly with existing studies. A review of the literature reveals findings regarding the positive and negative relationships of liquidity with financial performance. For example, Neves et al. (2021) present findings indicating a negative effect of the current ratio on financial performance, while Gupta (2017) provides evidence of a positive effect of the current ratio on business performance. In this regard, when evaluating the findings of the study, it can be stated that the negative impact of liquidity on financial performance in the pre-pandemic period and its positive impact in the post-pandemic period is a finding consistent with the literature. Additionally, considering that liquidity-based difficulties became prominent during the pandemic, the findings obtained from the study can be interpreted as a shift from the approach of enhancing financial performance through low liquidity before the pandemic to an approach aimed at increasing financial performance through higher and more robust liquidity structures after the pandemic.

Similarly, when evaluating the impact of leverage on financial performance, it is noteworthy that, like liquidity, the literature reports both positive effects (Neves et al., 2021; Luts et al., 2021) and negative effects (Westerman et al., 2020; Bunea et al., 2019). In this regard, the finding from the study that the debt to equity ratio has a negative effect on financial performance can be said to be consistent with the literature. Furthermore, the significant manifestation of the negative effect of leverage on financial performance in the post-pandemic period can be interpreted as businesses preferring to adopt a more robust capital structure due to the adverse effects of the pandemic.

It is also observed that the findings related to inventory turnover and asset size are consistent with the literature. A review of the literature shows that there are findings indicating a positive effect of efficiency ratios on financial performance (Bunea et al., 2019), while business size is reported to have a negative effect (Neves et al., 2021; Westerman et al., 2020). In this regard, it can be stated that the lower flexibility of larger businesses compared to smaller ones has put larger businesses in a more disadvantageous position

in the short term during the transition from pandemic conditions to post-pandemic conditions.

When the literature is evaluated regarding the impact of inflation on financial performance, a similar situation is observed. The literature reports findings indicating both positive effects (Abreu and Mendes, 2001; Vong and Chan, 2006) and negative effects (Supriyono and Herdhayinta, 2019; Jin et al., 2021) of inflation on financial performance. Therefore, it can be stated that the finding from the study indicating a positive relationship between inflation and financial performance is consistent with the literature.

When all the findings obtained from the study are evaluated together, it can be stated that the COVID-19 pandemic has had significant effects on the determinants of financial performance in energy companies. In this regard, it can be said that the pandemic has brought liquidity and capital structure to the forefront in businesses within the energy sector, and the effects of these factors on financial performance have changed significantly between the pre-pandemic and post-pandemic periods. Specifically, the differing effects of the current ratio, considered a measure of liquidity, on financial performance before and after the pandemic can be regarded as an important indicator of this situation.

5. CONCLUSION

The COVID-19 pandemic stands out as one of the most significant events of the modern era in many respects. The pandemic has led to serious economic impacts on both micro and macro levels worldwide. The pressures created by the mandatory measures brought about by the pandemic have naturally reflected on businesses, which are important building blocks of the economy, in various ways. One of the sectors affected by the pandemic is the energy sector. The importance of the energy sector, both for the continuity of daily life and its relationship with other sectors, has made it a significant subject for research concerning the effects of the pandemic. In this context, this study has investigated the impact of the COVID-19 pandemic on the determinants of financial performance in energy companies.

As a result of the study, significant findings have been obtained regarding the determinants of financial performance in energy companies during the pre-pandemic and post-pandemic periods. Accordingly, it has been revealed that the LIQ, ITR, and DINF variables significantly affect the financial performance of companies in both the pre-pandemic and post-pandemic periods, while the effects of the LEV and lnTA variables on financial performance are only valid for the post-pandemic period. In

terms of the effects of the variables on financial performance, it was found that the LIQ variable had a negative effect on financial performance in the pre-pandemic period, while it had a positive effect in the post-pandemic period. Additionally, the ITR and DINF variables were shown to have a positive effect on financial performance in both the pre-pandemic and post-pandemic periods, whereas the LEV and lnTA variables had a negative effect on financial performance in the post-pandemic period.

Overall, it can be stated that the pandemic period has had an impact on the determinants of financial performance in the energy sector. Accordingly, the pandemic period has led to changes in the liquidity and capital structures of energy companies, and findings have been presented regarding the changing effects of these factors on the financial performance of businesses. In other words, in terms of financial performance, liquidity and capital structure elements have become more prominent in the post-pandemic period compared to before in the energy sector. Therefore, it can be stated that a more robust liquidity and capital structure, influenced by the pandemic, is among the key determinants of financial performance in energy companies.

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