



MAKU IIBFD

Journal of Mehmet Akif Ersoy University
Economics and Administrative Science Faculty

Volume: 11

Issue: 4

December, 2024



e-ISSN: 2149 - 1658

December, 2024

e-ISSN: 2149-1658

MAKU IIBFD

Journal of Mehmet Akif Ersoy University
Economics and Administrative Science Faculty

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Analysis of the Misconceptions Taking Accounting Education Students About Accounting Education: Example of TRB 1 Region

Meltem GÜL¹, Özcan DEMİR², Zülküf NARLIKAYA³

Abstract

Misconceptions are encountered in the field of accounting education as in every field. Since misconceptions in the field of education will affect the student's future life, these misconceptions should be identified and eliminated in advance. This study aims to determine the misconceptions of accounting education students about accounting education. For this purpose, the Misconceptions Analysis in Accounting Education (MAAE) scale was applied to the students who continue their education in the departments of business administration, business administration and accounting/tax practices at the undergraduate and associate degree level of state universities in TRB 1 region. The data collected within the scope of the research were analysed in SPSS 22 programme. According to the results of the research, it was determined that the perceptions of misconceptions about accounting of students studying accounting education are high, and the highest misconceptions are related to the idea that accounting is a recording process and students' general accounting knowledge. It has been observed that the general accounting course is perceived by the students as a course in which general information is given as an introduction to accounting. With this perception, the student associated the course as easier in his/her mind. However, when they are fully acquainted with accounting education, it becomes difficult for students to perceive the course as a result of the mismatch between their expectations and what they see. With the results obtained from the study, it is expected that the difficulties experienced by the students in accounting courses and the misconceptions they have acquired will be identified and will help to eliminate the mistakes that will be experienced in the name of accounting in the future. It is extremely important to eliminate these misconceptions in order to have a positive impact on the department that students choose as a profession, which will affect their future lives. Eliminating these misconceptions will undoubtedly contribute to increasing the quality of accounting education. It is thought that the results of the study will attract the attention of all academicians interested in accounting education, contribute to the way accounting academicians handle the course and contribute to the misconceptions in the literature.

Keywords: Accounting Education, Accounting Students, Misconception



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<https://doi.org/10.30798/makuiibf.1400121>

Article Type
Research Article

Application Date
December 4, 2023

Admission Date
December 23, 2024

1. INTRODUCTION

An effective education is achieved through a comprehensive understanding of science concepts. Failure to understand or misunderstand the concepts will also lead to misunderstanding of the information intended to be given in education. Accounting education can be defined as educating students in determining, collecting, recording, summarizing, reporting, analyzing and auditing data that will guide decisions in the business (Ay, 2011). In order to have a positive impact on students' lives after education, it is necessary to identify the misconceptions about accounting education and to eliminate this misconception.

In many studies conducted to date, technology in accounting education (Morris et al., 2016), (Helfaya, 2019), curriculum in accounting education (Yüksel & Kayalı, 2021), learning approaches in accounting education (Effah et al., 2021), student profile in accounting education (Şenol & Tüfekçi 2007), expectations from accounting education (Akpınar & Çevik 2021), etc., there are many studies. However, it is seen that studies on misconception in accounting education are quite limited. In the study of Demirel Utku and Erol (2015), in which they focused on the misconceptions that occurred in the financial accounting course, it was observed that the students were faced with misconceptions in subjects such as account transactions and accounting logic. Yıldız and Ülkü (2017) in their study on misconceptions in accounting education; They stated that since the expressions used by students in daily life are similar in accounting education, they cause misinterpretation when using them in accounting education. As an example, they stated that expressions such as debt - credit, buyers - sellers are very confused. Akpınar and Yıldız (2018) tried to identify the metaphors for accounting perceptions of students taking accounting education. According to the authors, students see accounting as a difficult, boring and complex course. The results obtained in the study by Ay and Altın (2019) in which they analyzed the misconceptions of 4th grade students in the Department of Business Administration at Karamanoğlu Mehmetbey University in accounting education are similar to the studies of Yıldız and Ülkü (2017). Ay et al., (2020) in their study investigating misconceptions in accounting education, stated that 45% of students have misconceptions. According to the authors, this misconception complicates the understanding of accounting courses. Hiçyorulmaz and Akdoğan (2023) analyzed the misconceptions of students studying accounting at public and foundation universities. According to the results obtained; it was stated that the misconception levels of students in accounting education were the same and there was no relationship between demographic characteristics and accounting misconceptions. The limited number of studies on the related field in the aforementioned literature is the most important reason for the preference of this subject. This study is important in terms of identifying students' misconceptions about accounting education and suggesting solutions in order to put accounting education on solid foundations. The aim of the study is to identify the misconceptions of students about accounting education and to try to prevent these misconceptions by meeting with the relevant stakeholders. The study only expresses the misconceptions of students studying accounting in TRB 1 region. In this

respect, in order to make a general assessment, it is important to draw attention to the importance of the subject by making misconception analyzes of students studying accounting in different provinces and regions in future studies.

1.1. Purpose and Importance of the Research

The aim of this study is to determine the misconceptions that arise in accounting education and to determine whether the misconception levels of accounting students show a significant difference according to demographic characteristics. When both international and national studies on misconceptions in accounting education are examined in the literature, it is seen that the studies conducted in this field are insufficient. Misconceptions in accounting education cause students to perceive the course as difficult and make it difficult to understand the course. In addition, misconceptions in accounting education cause students to develop prejudice towards the course and negatively affect student achievement. For this reason, it is thought that studies should be carried out to prevent these misconceptions. This study is important in terms of determining students' misconceptions about accounting education and suggesting solutions in order to put accounting education on a healthy basis. This study, which focuses on misconceptions in accounting education, is important in terms of targeting the correct understanding of accounting, considering that all accounting courses are a chain, since the subject in one course will affect the other. In addition, it is important in terms of determining what is misexplained or misunderstood in the accounting education given in the future, making corrections and increasing the quality of students receiving accounting education.

1.2. Limitations of the Research

As the most important limitation of the study, it can be said that the data were collected only from the departments of business administration, business administration and accounting/tax practices, which provide the most accounting education. The reason for collecting data only from these departments is that they can give more opinions about accounting education since they have more accounting courses compared to other departments in faculties and colleges. In addition, the data were collected from the students who continue their education in the departments of business administration, business administration and accounting/tax practices of public universities in TRB 1 provinces, not throughout the country. Therefore, the limited sample limits the generalizability of the study. The results of this study are limited to the period between 24 March 2022 and 5 May 2022, the period in which the research was conducted. The reason why the study was conducted in this time interval is that the ethics committee approval was obtained on 24 March, and the data collection started on this date. In addition, the time interval before the end of the semester courses, when the students were at school intensively, was taken into consideration. For this reason, the research data were completed between 24 March and 5 May.

1.3. The Hypotheses of the Research

The hypotheses created for the purpose of the study are as follows:

H₁: The misconceptions of accounting education students about accounting education show a statistically significant difference according to age.

H₂: The misconceptions of the students who receive accounting education about accounting education show a statistically significant difference according to the department.

H₃: The misconceptions of the students who receive accounting education about accounting education show a statistically significant difference according to the class.

H₄: The misconceptions of students who receive accounting education about accounting education show a statistically significant difference according to their desire to work in the accounting profession.

H₅: The misconceptions of accounting education students about accounting education show a statistically significant difference according to their liking for accounting.

H₆: The misconceptions of the students who receive accounting education about accounting education show a statistically significant difference according to the reason they like accounting.

2. METHODOLOGY

In the research, the survey method, which is one of the primary data collection methods, was used in order to overcome the constraints such as time, cost and feasibility in data collection. Ethics committee approval for the study was obtained from the Firat University Ethics Committee on March 24, 2022, with document number 06-13. The survey study consists of two parts. In the first part, there are 9 demographic questions for the participants. In the second part, there is the Misconception Analysis in Accounting Education (MAAE) Scale. Information about the scale is given below.

2.1. Misconception Analysis in Accounting Education (MAAE) Scale

In the study, the “Misconceptions Analysis in Accounting Education (MAAE) Scale” developed by Yılmaz (2022) was used to measure students' misconceptions in accounting education. The Cronbach Alpha reliability coefficient of the scale was calculated as 0.85. In the research, a 5-point Likert scale was used. The statements in the scale are (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree). The MAAE scale consists of 28 items in 8 different dimensions.

In the study, normality analysis of the MAAE scale was performed. The results related to the analysis are given in Table 1.

Table 1. Analysis of Normality

Scale	N	Skewness	Kurtisos
MAAE Scale General	332	-.079	-.309
General Accounting Misconception	332	-.996	.691
Misconception About the Relationship Between Accounting Courses and Sub-Disciplines (other courses)	332	.077	-.624
Misconception About Who Accounting Education is for	332	-.081	-.868
The Misconception that Accounting Courses are Directly Related to Mathematics	332	-.318	-.922
The Misconception that Accounting Lessons are Based on Memorization	332	-.010	-.970
Theory and Practice are Very Different Misconception	332	-.132	-.007
The Misconception that Accounting is for Tax	332	-.166	-.453
The Misconception that it is the Accounting Registration Process	332	-.975	.386

According to the results given in Table 1, it was determined that the kurtosis and skewness values for the scale and its sub-dimensions showed normal distribution, since the Skewness (S) and Kurtosis (K) values were between -2 and +2 (George and Mallery, 2010). As the data showed a normal distribution, parametric tests were preferred in the study. In the study, the analysis of the data was made with the SPSS-22 program. In the analysis of the data, descriptive statistics, factor analysis, reliability analysis, and One-way analysis of variance analysis methods were used.

In Table 2, the explanatory factor analysis and reliability analysis for the MAAE scale is given.

According to the factor analysis findings for the MAAE scale in Table 2, the KMO value was realized as .774. This data shows that the sample size is sufficient to be able to perform factor analysis on the scale. Factor loads vary between .516 and .913. The total variance, on the other hand, was calculated as 71,726. As a result, the factor analysis findings for the MAAE scale support the factor structure and validity of the scale in question (Büyüköztürk, 2012p. 169).

In the study, Cronbach's Alpha Reliability Coefficient was used in the evaluation of the reliability of the scale and its sub-dimensions.. When Table 2 is examined, it is seen that the scale and its sub-dimensions have medium and high reliability. (Kılıç, 2016p. 48; Düşükcan et al, 2019p. 437).

Table 2. Factor and Reliability Analysis

Factor	Substance	Factor Loads								Explained Variance	Cronbach's Alpha
		1	2	3	4	5	6	7	8		
General Accounting Misconception	s2		.823							24.256	.834
	s1		.827								
	s3		.765								
	s5		.690								
	s4		.564								
Misconception About the Relationship Between Accounting Courses and Sub-Disciplines (Other Courses)	s6		.831							12.571	.774
	s7		.800								
Misconception About Who Accounting Education is for	s10		.841							10.237	.812
	s8		.777								
	s9		.742								
	s11		.562								
The Misconception that Accounting Courses are Directly Related to Mathematics	s12			.913						6.206	.867
	s13			.838							
The Misconception that Accounting Lessons are Based on Memorization	s16				.856					5.794	.854
	s15				.793						
	s14				.792						
	s17				.776						
Theory and Practice are Very Different Misconception	s21				.849					4.629	.773
	s19				.729						
	s18				.646						
	s22				.583						
	s20				.516						
The Misconception that Accounting is for Tax	s25				.828					4.516	.853
	s26				.820						
	s24				.811						
	s23				.650						
The Misconception that it is the Accounting Registration Process	s28					.750				3.517	.791
	s27					.552					
Overall										71.726	.879

KMO: .774; Bartlett K. T.: Chi-square: 5152.978 df: 378; p: .000

2.2. Participants

The research population was determined as the students who continue their education in the departments of business administration, business management and accounting/tax practices of state universities in TRB 1 (Elazığ, Malatya, Tunceli and Bingöl) provinces in the 2021-2022 academic year. The reason why these departments are preferred is that the variety of accounting courses in the curriculum is higher than other departments. Yılmaz (2022) conducted the MAAE scale on 38 universities in his study. Since TRB 1 region universities were not included among these universities, TRB 1 region universities were preferred as the study population. The fact that this region was chosen as the study population is important in terms of the fact that a study on misconceptions in accounting education will be applied to this region for the first time and contributes to the generalisability of the research results. According to the Higher Education Institution YÖK Atlas Application data (yokatlas, 2022); it was determined that there are 2,073 students enrolled in the departments of business administration, business management and accounting/tax practices of state universities in the TRB 1 region provinces (Elazığ, Malatya, Tunceli and Bingöl) in the 2021-2022 academic year. The study was conducted on this population.

In order to determine the most appropriate sample size for the purposes of the study, Cochran Formula was used, where n is the sample size, N is the volume of the universe, t is the table value of the reliability level, p and q are the probability of occurrence and non-occurrence of the event of interest, and d is the sensitivity level (Hayran, 2012):

In order to determine the most suitable sample size for the purposes of the study; n is sample size; N is the volume of the universe; Cochran Formula was used, where t is the table value of the reliability level, p and q are the probability of occurrence and absence of the event of interest, and d is the sensitivity level (Hayran, 2012):

Sample Size

$$n = N.(t^2.p.q) / (d^2.(N-1) + (t^2.p.q))$$

When the population size (N) is taken as 2073, the sample size should be at least (n) 324 according to the above formula, also known as Cochran Formula. It can be said that a sample of this size will have the power to represent the universe at 95% confidence level. The study was conducted with the participation of 332 students. From Firat University, 156 students (115 at associate degree level and 41 at undergraduate level) participated in the study. 94 students from Inonu University, 56 at associate degree level and 38 at undergraduate level, participated in the study. From Bingöl University, 52 students (39 at associate degree level and 13 at undergraduate level) participated. From Tunceli Munzur University, 30 students participated only at the associate degree level.

3. FINDINGS

Table 3 shows the demographic findings of the participants.

As seen in Table 3, 66% of the students who received accounting education were female and 34% were male. It was observed that the majority of the students were composed of participants between the ages of 21-24. 39.2% of the students continue their education in the accounting and tax applications program, 33.1% in the business administration program and 27.7% in the business department. 38.3% of the students are in the 1st grade, 56.3% in the 2nd grade, 3.9% in the 3rd grade and 1.5% in the 4th grade. A great majority of the students, such as 47.6%, think of working in the field of accounting. However, 25.6% of them are undecided and 26.8% of them do not have the idea of working in the field of accounting. It was observed that 42.7% of the students liked accounting, but 38.9% were undecided. A majority of the students, such as 49.7%, stated that they like accounting itself. As the first accounting course taken, the majority of the students stated that they took General Accounting / General Accounting I / General Accounting II courses. These results show that the students are mostly between the ages of 21-24, they like accounting and they are thinking of working in the field of accounting in the future.

Table 3. Demographic Findings

PARTICIPANT PROFILE		
Gender	F	%
Female	219	66.0
Male	113	34.0
Age	F	%
18-20	130	39.2
21-24	183	55.1
25-28	14	4.2
29and above	5	1.5
Department	F	%
Business	92	27.7
Accounting/Tax Applications	130	39.2
Business Management	110	33.1
Grade	F	%
1st Grade	127	38.3
2nd Grade	187	56.3
3rd Grade	13	3.9
4th Grade	5	1.5
Working in the Field of Accounting	F	%
I Never Think	29	8.7
I Don't Think	60	18.1
What I'm Thinking What I'm Not Thinking	85	25.6
I am Thinking	125	37.7
I'm Definitely Thinking	33	9.9
Interest in Accounting	F	%
I don't like at all	29	8.7
I do not like	32	9.6
What I Like What I Don't Like	129	38.9
I love	117	35.2
I love so much	25	7.5
The Reason to Love Accounting	F	%
The Accounting Itself	165	49.7
Lecturers in the Courses	34	10.2
Method of Teaching the Lessons	88	26.5
Other	45	13.6
First Accounting Lesson Taken	F	%
General Accounting / General Accounting I / General Accounting II	274	82.5
Accounting Introduction	43	13.0
Accounting / Accounting I / Accounting II	10	3.0
Introduction to Accounting Science	3	0.9
Introduction to Financial Accounting	2	0.6

Arithmetic means were taken into account in the evaluation of the scale mean scores. The criteria ranges taken into account in the evaluation are given below (Tekin, 2017).

Table 4. Scale Score Ranges

Scale Ranges	Correspondence to the Scale
1.00 ≤ mean ≤ 1.80	Strongly Disagree
1.80 ≤ mean ≤ 2.60	Disagree
2.60 ≤ mean ≤ 3.40	Neither Agree Nor Disagree
3.40 ≤ mean ≤ 4.20	Agree
4.20 ≤ mean ≤ 5.00	Strongly Agree

Table 5. Evaluation of Professional Accountants and Average of MAAE Scale Total and Sub-Dimension Scores

Scale	Mean	Sd.
General Accounting Misconception	3.65	.97
Misconception about the relationship between accounting courses and sub-disciplines (other courses)	2.91	1.16
Misconception about who accounting education is for	3.15	1.13
The Misconception that Accounting Courses are Directly Related to Mathematics	3.16	1.25
The Misconception that Accounting Lessons are Based on Memorization	2.88	1.15
Theory and Practice are Very Different Misconception	3.18	.89
The Misconception that Accounting is for Tax	3.11	1.02
The Misconception that it is the Accounting Registration Process	3.88	1.05
MAAE Scale General	3.24	.62

According to the evaluation of the students who received accounting education, the total mean score of the MAAE scale is 3.24 ± 0.62 . The mean scores for the sub-dimensions were 3.65 ± 0.97 in the general accounting misconception, 2.91 ± 1.16 in the sub-disciplines (other courses) misconception, and 3.15 ± 1.13 in the misconception about who it was for. The misconception that it is directly related to mathematics a 3.16 ± 1.25 , the misconception that memorization is weighted 2.88 ± 1.15 , the theory and practice are very different 3.18 ± 0.89 , the misconception is that accounting is for tax 3.11 ± 1.02 and the misconception that it is the accounting recording process is 3.88 ± 1.05 . These results show that the misconceptions of accounting education students about accounting education are at medium and high levels.

The results of the one-way analysis performed to determine whether the MAAE scale scores of the students receiving accounting education show a statistically significant difference according to the age variable are given in Table 6 with its sub-dimensions.

According to the analysis findings in Table 6, there was a statistically significant difference between the general MAAE scale misconception scores of the students who received accounting education according to age ($p < 0.05$). On the other hand, no difference was found between the memorization-weighted misconception score. In line with this result, the H_1 hypothesis, which states that the misconceptions of accounting education students about accounting education differ in terms of age, was accepted.

When the average scores were examined, it was seen that the opinions of the students who received accounting education about the MAAE scale in general were higher than the students aged 29 and above (mean: 3.80; sd: 0.56) than the students in other age groups. It has been observed that the views of the misconception that it is the accounting recording process are higher for students between the ages of 21-24 (mean: 4.01; sd: 1.01) than for students in other age groups. It was observed that the misconceptions of all other sub-dimensions were more common in students aged 29 and over.

Table 6. Distribution of Accounting Educational Misconceptions and Sub-Dimension Scores of the Students taking Accounting Education by Age

Factor	Age	N	Mean	Sd.	F	p
MAAE Scale General	18-20	130	3.22	.62	9.627	.000
	21-24	183	3.30	.60		
	25-28	14	2.47	.42		
	29 and above	5	3.80	.56		
General Accounting Misconception	18-20	130	3.67	.98	3.442	.017
	21-24	183	3.71	.97		
	25-28	14	2.85	.91		
	29 and above	5	3.48	.10		
Misconception about the relationship between accounting courses and sub-disciplines (other courses)	18-20	130	2.93	1.01	8.352	.000
	21-24	183	2.97	1.22		
	25-28	14	1.57	.54		
	29 and above	5	4.00	1.36		
Misconception about who accounting education is for	18-20	130	3.04	1.12	6.553	.000
	21-24	183	3.29	1.09		
	25-28	14	2.08	.80		
	29 and above	5	3.90	1.50		
The Misconception that Accounting Courses are Directly Related to Mathematics	18-20	130	3.06	1.27	3.144	.025
	21-24	183	3.27	1.22		
	25-28	14	2.35	1.13		
	29 and above	5	3.80	1.64		
The Misconception that Accounting Lessons are Based on Memorization	18-20	130	3.02	1.16	1.963	.119
	21-24	183	2.83	1.16		
	25-28	14	2.30	.74		
	29 and above	5	2.95	.95		
Theory and Practice are Very Different Misconception	18-20	130	3.22	.82	3.285	.021
	21-24	183	3.15	.93		
	25-28	14	2.87	.64		
	29 and above	5	4.28	.98		
The Misconception that Accounting is for Tax	18-20	130	2.95	.98	7.451	.000
	21-24	183	3.25	1.03		
	25-28	14	2.35	.42		
	29 and above	5	4.30	.95		
The Misconception that it is the Accounting Registration Process	18-20	130	3.81	1.07	5.751	.001
	21-24	183	4.01	1.01		
	25-28	14	2.85	1.09		
	29 and above	5	3.70	.27		

p<0.05= Accept; p>0.05= Rejection

The results of the one-way analysis performed to determine whether the MAAE scale scores of the students receiving accounting education show a statistically significant difference according to the department variable are given in Table 7 with its sub-dimensions.

Table 7. Distribution of Accounting Educational Misconceptions and Sub-Dimension Scores by Departments of the Students who received Accounting Education

Factor	Department	N	Mean	Sd.	F	p
MAAE Scale General	Business	92	3.24	.61	5.614	.004
	Accounting and Tax Applications	130	3.35	.62		
	Business Administration	110	3.07	.61		
General Accounting Misconception	Business	92	3.77	.95	5.033	.007
	Accounting and Tax Applications	130	3.74	.93		
	Business Administration	110	3.38	1.02		
Misconception about the relationship between accounting courses and sub-disciplines (other courses)	Business	92	2.85	1.16	.288	.750
	Accounting and Tax Applications	130	2.96	1.22		
	Business Administration	110	2.91	1.09		
Misconception about who accounting education is for	Business	92	3.19	1.14	2.637	.073
	Accounting and Tax Applications	130	3.28	1.18		
	Business Administration	110	2.93	1.01		
The Misconception that Accounting Courses are Directly Related to Mathematics	Business	92	3.43	1.11	6.865	.001
	Accounting and Tax Applications	130	3.19	1.29		
	Business Administration	110	2.79	1.27		
The Misconception that Accounting Lessons are Based on Memorization	Business	92	2.95	1.21	1.021	.361
	Accounting and Tax Applications	130	2.77	1.15		
	Business Administration	110	2.96	1.07		
Theory and Practice are Very Different Misconception	Business	92	3.00	.82	10.815	.000
	Accounting and Tax Applications	130	3.46	.99		
	Business Administration	110	3.02	.70		
The Misconception that Accounting is for Tax	Business	92	3.00	.97	5.052	.007
	Accounting and Tax Applications	130	3.33	1.09		
	Business Administration	110	2.93	.91		
The Misconception that it is the Accounting Registration Process	Business	92	3.89	1.11	3.719	.025
	Accounting and Tax Applications	130	4.04	.93		
	Business Administration	110	3.65	1.12		

p<0.05= Accept; p>0.05= Rejection

According to the analysis findings in Table 7, a statistically significant difference was found between the general MAAE scale misconception scores of the students who received accounting education according to the department ($p<0.05$). On the other hand, no difference was found between the misconception of its relation with sub-disciplines (other courses), the misconception about who it is for, and the memorization-weighted misconception. In line with this result, the H_2 hypothesis, which states that the misconceptions of accounting education students about accounting education differ in terms of department, was accepted.

When the average scores are examined, it is seen that the misconceptions of the students who continue their education in the accounting and tax applications program (mean: 3.35; sd: 0.62) about the general MAAE scale are higher than the students who continue their education in other departments. It is seen that the general accounting misconception and the view that the students who continue their

education in the department of business administration are directly related to mathematics are higher than the students who continue their education in other programs/departments.

The results of the one-way analysis performed to determine whether the MAAE scale scores of the students receiving accounting education show a statistically significant difference according to the class variable are given in Table 8 with its sub-dimensions.

Table 8. Distribution of Accounting Education Misconceptions and Sub-Dimension Scores of the Students who received Accounting Education by Class

Factor	Grade	N	Mean	Sd.	F	p
MAAE Scale General	1nd Grade	127	3.10	.64	3.266	.022
	2nd Grade	187	3.33	.60		
	3nd Grade	13	3.23	.62		
	4nd Grade	5	3.35	.57		
General Accounting Misconception	1nd Grade	127	3.59	1.07	.529	.623
	2nd Grade	187	3.71	.91		
	3nd Grade	13	3.61	.73		
	4nd Grade	5	3.40	1.47		
Misconception about the relationship between accounting courses and sub-disciplines (other courses)	1nd Grade	127	2.85	1.20	.696	.592
	2nd Grade	187	2.92	1.15		
	3nd Grade	13	3.23	.90		
	4nd Grade	5	3.30	1.25		
Misconception about who accounting education is for	1nd Grade	127	3.03	1.16	1.452	.228
	2nd Grade	187	3.25	1.11		
	3nd Grade	13	2.82	1.06		
	4nd Grade	5	3.35	.60		
The Misconception that Accounting Courses are Directly Related to Mathematics	1nd Grade	127	2.88	1.33	4.562	.004
	2nd Grade	187	3.38	1.16		
	3nd Grade	13	2.88	1.29		
	4nd Grade	5	2.80	1.30		
The Misconception that Accounting Lessons are Based on Memorization	1nd Grade	127	2.89	1.21	.702	.551
	2nd Grade	187	2.85	1.10		
	3nd Grade	13	3.05	1.30		
	4nd Grade	5	3.55	.83		
Theory and Practice are Very Different Misconception	1nd Grade	127	2.99	.81	3.269	.022
	2nd Grade	187	3.30	.94		
	3nd Grade	13	3.35	.64		
	4nd Grade	5	3.28	.62		
The Misconception that Accounting is for Tax	1nd Grade	127	2.88	.94	3.765	.011
	2nd Grade	187	3.25	1.07		
	3nd Grade	13	3.05	.83		
	4nd Grade	5	3.60	.37		
The Misconception that it is the Accounting Registration Process	1nd Grade	127	3.70	1.23	3.117	.026
	2nd Grade	187	4.02	.90		
	3nd Grade	13	3.92	.81		
	4nd Grade	5	3.20	1.60		

p<0.05= Accept; p>0.05= Rejection

According to the analysis findings in Table 8, there was a statistically significant difference between the MAAE scale misconception scores of the students who received accounting education according to the grade ($p < 0.05$). On the other hand, no difference was found between the general accounting misconception, the misconception of its relation with sub-disciplines (other courses), the misconception about who it is for, and the memorization-weighted misconception. In line with this result, the H_3 hypothesis, which states that the misconceptions of accounting education students about accounting education differ in terms of grade, was accepted.

When the average scores were examined, it was seen that the 4th grade students who received accounting education had higher views on the MAAE scale (mean: 3.35; sd: 0.57) than the students in other classes. It has been observed that the 2nd grade students' misconceptions that accounting is directly related to mathematics, and that their theory and practice are very different, are higher than the students in other classes.

The results of the one-way analysis performed to determine whether the MAAE scale scores of the students receiving accounting education show a statistically significant difference according to the variable of working in the field of accounting are given in Table 9 with its sub-dimensions.

The MAAE scale misconception scores of the students who received accounting education, according to their working status in the field of accounting ($p < 0.05$). On the other hand, no difference was found between the misconception of its relation with sub-disciplines (other courses), the misconception that it is directly related to mathematics, and the memorization-weighted misconception. In line with this result, the H_4 hypothesis, which states that the misconceptions of accounting education students about accounting education differ in terms of working in the field of accounting, was accepted.

When the average scores are examined, it is seen that the opinions of the students who stated that they definitely want to work in the field of accounting (mean: 3.56; sd: 0.57) about the MAAE scale were higher than those who stated other statements about working in the field of accounting.

Table 9: Distribution of Accounting Educational Misconceptions and Sub-Dimensional Scores of the Students Taking Accounting Education by Working Status in the Field of Accounting

Factor	Working in the Field of Accounting	N	Mean	Sd.	F	p
MAAE Scale General	I Never Think	29	3.15	.64	5.513	.001
	I Don't Think	60	3.07	.62		
	What I'm Thinking What I'm Not Thinking	85	3.14	.73		
	I am Thinking	125	3.31	.51		
	I'm Definitely Thinking	33	3.56	.57		
General Accounting Misconception	I Never Think	29	3.53	.92	8.621	.000
	I Don't Think	60	3.39	.91		
	What I'm Thinking What I'm Not Thinking	85	3.34	1.12		
	I am Thinking	125	3.87	.88		
	I'm Definitely Thinking	33	4.24	.54		

(Table 9 Cont.)

Factor	Working in the Field of Accounting	N	Mean	Sd.	F	p
Misconception about the relationship between accounting courses and sub-disciplines (other courses)	I Never Think	29	2.84	1.52	1.069	.372
	I Don't Think	60	3.00	1.08		
	What I'm Thinking	85	2.95	1.06		
	Not Thinking					
	I am Thinking	125	2.78	1.14		
Misconception about who accounting education is for	I'm Definitely Thinking	33	3.21	1.25	3.744	.005
	I Never Think	29	3.25	1.18		
	I Don't Think	60	3.13	1.05		
	What I'm Thinking	85	2.94	1.21		
	Not Thinking					
The Misconception that Accounting Courses are Directly Related to Mathematics	I am Thinking	125	3.11	1.04	.829	.507
	I'm Definitely Thinking	33	3.81	1.15		
	I Never Think	29	3.29	1.16		
	I Don't Think	60	2.94	1.20		
	What I'm Thinking	85	3.10	1.22		
The Misconception that Accounting Lessons are Based on Memorization	Not Thinking				2.309	.058
	I am Thinking	125	3.03	1.06		
	I'm Definitely Thinking	33	2.42	1.23		
	I Never Think	29	2.66	1.16		
	I Don't Think	60	2.81	1.14		
Theory and Practice are Very Different Misconception	What I'm Thinking	85	2.97	1.22	2.467	.045
	Not Thinking					
	I am Thinking	125	3.23	.83		
	I'm Definitely Thinking	33	3.54	1.35		
	I Never Think	29	3.10	.64		
The Misconception that Accounting is for Tax	I Don't Think	60	2.96	.67	2.865	.023
	What I'm Thinking	85	3.15	.99		
	Not Thinking					
	I am Thinking	125	3.16	.97		
	I'm Definitely Thinking	33	3.50	1.30		
The Misconception that it is the Accounting Registration Process	I Never Think	29	3.60	1.19	6.094	.000
	I Don't Think	60	3.75	.87		
	What I'm Thinking	85	3.58	1.11		
	Not Thinking					
	I am Thinking	125	4.06	1.03		
	I'm Definitely Thinking	33	4.45	.82		

p<0.05= Accept; p>0.05= Rejection

The results of the one-way analysis performed to determine whether the MAAE scale scores of the students receiving accounting education show a statistically significant difference according to the variable of liking accounting are given in Table 10 with its sub-dimensions.

Table 10. Distribution of Accounting Educational Misconceptions and Sub-Dimension Scores of the Students who received Accounting Education by their Love for Accounting

Factor	Interest in Accounting	N	Mean	Sd.	F	p
MAAE Scale General	I don't like at all	29	3.09	.69	2.974	.020
	I do not like	32	3.16	.67		
	What I Like	129	3.19	.59		
	What I Don't Like					
	I love	117	3.28	.58		
	I love so much	25	3.60	.75		

(Table 10 Cont.)

Factor	Interest in Accounting	N	Mean	Sd.	F	p
General Accounting Misconception	I don't like at all	29	3.28	1.23	9.060	.000
	I do not like	32	3.18	.78		
	What I Like What I Don't Like	129	3.51	.98		
	I love	117	3.89	.80		
	I love so much	25	4.32	1.01		
Misconception about the relationship between accounting courses and sub-disciplines (other courses)	I don't like at all	29	2.94	1.31	.019	.999
	I do not like	32	2.90	.94		
	What I Like What I Don't Like	129	2.91	1.07		
	I love	117	2.90	1.22		
	I love so much	25	2.96	1.47		
Misconception about who accounting education is for	I don't like at all	29	3.21	1.25	.063	.993
	I do not like	32	3.10	1.15		
	What I Like What I Don't Like	129	3.14	1.07		
	I love	117	3.18	1.05		
	I love so much	25	3.11	1.60		
The Misconception that Accounting Courses are Directly Related to Mathematics	I don't like at all	29	2.82	1.40	5.591	.000
	I do not like	32	3.68	.86		
	What I Like What I Don't Like	129	3.18	1.09		
	I love	117	2.91	1.35		
	I love so much	25	3.92	1.33		
The Misconception that Accounting Lessons are Based on Memorization	I don't like at all	29	3.03	1.24	.389	.816
	I do not like	32	2.72	1.22		
	What I Like What I Don't Like	129	2.87	1.07		
	I love	117	2.87	1.14		
	I love so much	25	3.04	1.44		
Theory and Practice are Very Different Misconception	I don't like at all	29	2.91	.86	1.903	.110
	I do not like	32	3.28	1.01		
	What I Like What I Don't Like	129	3.15	.87		
	I love	117	3.19	.87		
	I love so much	25	3.55	.81		
The Misconception that Accounting is for Tax	I don't like at all	29	2.96	.84	1.549	.188
	I do not like	32	3.03	.77		
	What I Like What I Don't Like	129	3.03	.96		
	I love	117	3.16	1.14		
	I love so much	25	3.54	1.10		
The Misconception that it is the Accounting Registration Process	I don't like at all	29	3.56	1.27	2.866	.023
	I do not like	32	3.87	1.15		
	What I Like What I Don't Like	129	3.79	1.08		
	I love	117	3.94	.96		
	I love so much	25	4.46	.72		

p<0.05= Accept; p>0.05= Rejection

According to the analysis findings in Table 10, a statistically significant difference was found between the MAAE scale general misconception scores of the students who received accounting education, according to their liking for accounting (p<0.05). In line with this result, the H₅ hypothesis, which states that the misconceptions of accounting education students about accounting education differ in terms of liking accounting, was accepted. When the average scores are examined, it is seen that the

misconceptions of the students who stated that I love accounting very much about the MAAE scale were higher than the students who stated other statements about the state of liking accounting.

Table 11. Distribution of Accounting Educational Misconceptions and Sub-Dimensional Scores of the Students who received Accounting Education by the Reason for Loving Accounting

Factor	The Reason to Love Accounting	N	Mean	Sd.	F	p
MAAE Scale General	The Accounting Itself	165	3.23	.68	2.382	.069
	Lecturers in the Courses	34	3.47	.60		
	Method of Teaching the Lessons	88	3.23	.51		
	Other	45	3.10	.60		
General Accounting Misconception	The Accounting Itself	165	3.68	1.01	.872	.456
	Lecturers in the Courses	34	3.86	.80		
	Method of Teaching the Lessons	88	3.58	.94		
	Other	45	3.55	1.03		
Misconception about the relationship between accounting courses and sub-disciplines (other courses)	The Accounting Itself	165	3.21	1.25	5.213	.002
	Lecturers in the Courses	34	3.11	.77		
	Method of Teaching the Lessons	88	2.63	1.05		
	Other	45	2.57	1.09		
Misconception about who accounting education is for	The Accounting Itself	165	3.29	1.11	2.994	.031
	Lecturers in the Courses	34	2.97	1.08		
	Method of Teaching the Lessons	88	3.16	1.09		
	Other	45	2.76	1.21		
The Misconception that Accounting Courses are Directly Related to Mathematics	The Accounting Itself	165	3.10	1.38	5.211	.002
	Lecturers in the Courses	34	3.95	.85		
	Method of Teaching the Lessons	88	3.07	1.02		
	Other	45	3.05	1.24		
The Misconception that Accounting Lessons are Based on Memorization	The Accounting Itself	165	2.83	1.19	3.159	.025
	Lecturers in the Courses	34	3.44	.94		
	Method of Teaching the Lessons	88	2.84	1.11		
	Other	45	2.73	1.14		
Theory and Practice are Very Different Misconception	The Accounting Itself	165	3.10	.94	2.077	.103
	Lecturers in the Courses	34	3.48	.82		
	Method of Teaching the Lessons	88	3.27	.82		
	Other	45	3.11	.82		
The Misconception that Accounting is for Tax	The Accounting Itself	165	3.09	1.14	.182	.909
	Lecturers in the Courses	34	3.14	.86		
	Method of Teaching the Lessons	88	3.09	.95		
	Other	45	3.21	.76		
The Misconception that it is the Accounting Registration Process	The Accounting Itself	165	3.74	1.14	4.176	.006
	Lecturers in the Courses	34	4.08	.96		
	Method of Teaching the Lessons	88	4.17	.83		
	Other	45	3.68	1.07		

p<0.05= Accept; p>0.05= Rejection

The results of the one-way analysis performed to determine whether the MAAE scale scores of the students receiving accounting education show a statistically significant difference according to the variable of the reason for liking accounting are given in Table 11 with its sub-dimensions.

According to the analysis findings in Table 11, there was no statistically significant difference between the MAAE scale general misconception scores of the students who received accounting education, according to the reason for liking accounting ($p>0.05$). In line with this result, the H_6 hypothesis, which states that the misconceptions of accounting education students about accounting education differ in terms of the reason for liking accounting, was rejected.

4. RESULTS, DISCUSSION AND RECOMMENDATIONS

Misconception in education is one of the most important issues that should be considered in meaningful and effective learning. This study, which deals with the misconceptions in accounting education, was carried out with 332 students studying accounting at public universities in Elazığ, Malatya, Tunceli and Bingöl, which are the provinces of TRB 1 region. In the light of the findings obtained in the research, the following conclusions were reached.

Among the factors in the MAAE scale of the students studying accounting, the highest misconception average of 3.88 is the perception that accounting is a registration process. The second highest misconception average of 3.65 belongs to the general accounting factor. According to the expressions in this factor, students; They perceive the general accounting course as a course in which general information about accounting will be given and they have the perception that the general accounting course should be given before the financial accounting course. (Yılmaz, 2022) drew attention to a similar result in his study.

A relationship was found between the age of the students and their misconceptions about accounting education. In this case, it was observed that students aged 29 and over had higher misconceptions. The highest misconception of the students in this age group belongs to the factor that accounting is for tax. According to the expressions in this factor, students; accounting has the perception that it produces information for the tax payable to the state. It has been observed that the students studying in the 4th class have the same perception. Albrecht and Sack (2001) stated in their study that students associate accounting with tax. The second highest misconception belongs to the factor that the theory and practice of accounting are very different. According to this factor, students have the misconception that the theoretical knowledge learned in accounting courses and accounting practices in business life are different from each other. Temelli (2018) also reached a similar conclusion in her study.

A relationship has been determined between the department that the students study and their misconceptions about accounting education. In this case, it was seen that the misconception perceptions of the students studying in the accounting and tax applications department at the associate degree level were higher. The highest misconception of the students studying in this department belongs to the factor of accounting registration process. At the same time, it belongs to the factor of accounting record keeping process, which is the highest misconception of students who want to work in the field of accounting after graduation. Likewise, when they evaluate the lessons they have taken as a whole, it is

seen that the highest misconception perception of the students who state that they love accounting very much belongs to the factor of accounting recording process. According to the expressions in this factor, students; In short, it is seen that accounting has the perception of being a recording process. Akpınar and Yıldız (2018) stated in their study that when people think of accounting, a prescriptive and boring concept usually comes to mind, and the reason for this is the thought and perception that accounting only imposes some duties and responsibilities on people who are interested in this profession, such as keeping book records and dealing with repetitive accounting transactions. The second highest perception of misconception belongs to the general accounting factor. According to this factor, students; perceives the general accounting course as a course in which general information about accounting will be given. Demir and Çam (2006) stated in their study that the most important reason for failure, according to students' opinions, is that the course is taught with the idea that they have basic accounting knowledge.

In this study, which was carried out using the MAAE scale, the following suggestions can be made in order to prevent misconceptions in accounting education and to make accounting education more effective:

The high rate of misconceptions regarding the general accounting factor suggests that there is a misconception arising from the name of this course. In this respect, as Gül and Aksu (2022) stated in their studies, a standard should be provided for course names that are taught under different names among universities but have similar contents.

In order to eliminate the misconception about the factor of accounting is the recording process, it is necessary to determine whether this perception arises from the way the lesson is taught or whether it is due to the work of the members of the profession.

It is thought that the factor that states that the theory and practice of accounting are different, causing high misconceptions on students, is due to the fact that accounting education includes practice-oriented knowledge. Especially during the internship period, students who meet the intense work tempo in accounting have this perception towards accounting. However, the student should be taught that accounting does not only consist of practice and that the application will be inadequate without theoretical knowledge.

It is thought that the factor indicating that accounting is directly related to mathematics causes misconceptions on students, due to the use of too many numbers and formulas in accounting. Accounting, of course, needs mathematics, numbers, calculations, and four operations. However, there is a logic that can be expressed verbally in the infrastructure and basis of accounting. Accounting operates on the basis of this logic. The numerical aspect of accounting never takes precedence over the verbal aspect.

With this study, it was tried to determine the misconceptions of the students about accounting education. Concentrating on the causes of these misconceptions in future studies will undoubtedly contribute to increasing the quality of accounting education.

Ethics committee approval for the study was obtained from the Fırat University Ethics Committee on March 24, 2022, with document number 06-13.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article.

The authors declare their contributions to the study as follows: the first author handled data collection, writing, reviewing, and editing; the second author focused on writing the original draft and conceptualization; and the third author carried out data analysis and contributed to writing the original draft.

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Migration Governance from an Institutional Perspective: An Index for “Good” Migration Governance

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<https://doi.org/10.30798/makuiibf.1405045>

Abstract

The widespread socio-economic effects of migration make migration governance critical from an administrative and institutional perspective. Based on good governance principles, this article develops an Index for Good Migration Governance (IGMG). For this purpose, five principles of good governance (effectiveness, transparency, accountability, participation and legal framework) were selected. These principles are contained in documents published by the World Bank, the United Nations or the International Monetary Fund, which have made significant contributions to the development of good governance principles. The index is calculated using the methodology used by the European Commission in business and consumer surveys. Unlike the migration indexes developed in the past, IGMG builds on the selected principles of good governance from an institutional perspective and focuses on institutional structures related to migration governance. IGMG aims to raise the awareness of organizations on migration policies and practices and enable them to take the necessary steps for good migration governance.

Keywords: *Migration, Migration Governance, Good Governance, Migration Governance Index*

Article Type	Application Date	Admission Date
Research Article	December 14, 2023	December 19, 2024

1. INTRODUCTION

Migration means changing the place of residence, either by human will or by necessity, and it is an issue that is increasingly emphasized and needs to be solved in the international arena and relations due to immigrant influxes. Recently, there has been migration from countries such as Haiti, Cuba, Nicaragua, Venezuela, Syria, Ukraine, and Palestine-Gaza to the surrounding regions, and it continues to be an increasingly important phenomenon in the international arena. Considering a movement of displacement that expresses and emphasizes the borders of states, the issue of migration falls within the scope of the discipline of international relations. Emphasizing the relationship between the phenomenon of migration and borders also brings the issue of "security" to the fore. The issue of "security", which has a different dimension from the known dynamics of migration, forms the basis of addressing the phenomenon of migration on the international agenda.

International migration and its socio-economic impacts on states and societies increasingly occupy the global governance agenda. The total estimated 281 million people living in a country other than their countries of birth in 2020 was 128 million more than in 1990 and over three times the estimated number in 1970. The number of international migrants corresponds to 3.6 percent of the world population (IOM, 2021).

The term migration is used in different contexts. Movement can be driven by many reasons such as the search for better living conditions, studying and gaining new skills, or escaping from armed conflict, authoritarian regimes, natural disasters, or the negative effects of climate change (Delidji & Valeria, 2022). It may include internal mobility between rural and urban areas or international movement across state borders. It may include a permanent reorientation to a destination or an ongoing connection to an origin (Gamlen & Marsh, 2011).

Human mobility has rapidly increased across international borders, reflecting wider trends in transboundary interconnections (Betts & Kainz, 2017). In a broad sense, governance is a concept related to the institutional environment in which all stakeholders, including citizens, interact with each other and participate in public affairs. Since governance is related to the institutions by which authority is exercised and affects planning, strategies and practices, the success to be achieved in these areas also determines the success of development (Chaudhary, 2020). The two key features of the concept of 'governance' are plurality and self-organization. Governance includes the interaction of a wide variety of traditional and non-traditional actors, including nation-states, NGOs, corporations, and various networks and 'communities'. Governance requires self-organizing interactions between actors (Gamlen & Marsh, 2011). Migration governance operates through a multi-level framework that includes interrelated sub-national, national, regional and international (multilateral) policies (Delidji & Valeria, 2022).

By their very nature, international migration and displacement are transnational issues concerning states of origin, destination, and ‘transit’ states. Yet, paradoxically, most migration governance has historically remained in individual States, and migration-related policies and regulations have typically been made at the national level (IOM, 2015; IOM, 2019). The concerns of states about losing their sovereignty over immigration slowed down their initiatives in establishing formal institutions and binding norms (Gamlen & Marsh, 2011). However, migration is a transnational, complex and multifaceted issue that affects most states as countries of origin, transit and destination. It cannot be governed only by the unilateral policies of the countries (Crepeau & Atak, 2016). Despite the need to manage migration through global cooperation, no global regime encompasses the full spectrum of migration (Robinson, 2018).

This study aims to provide a quantitative indicator as a practical instrument to enable migration-related institutions to assess and improve migration governance in line with good governance principles. For this purpose, this paper establishes a conceptual bridge between good governance and migration, and constructs an Index for ‘Good’ Migration Governance (IGMG) based on good governance principles, to identify the migration governance attributes of institutions. From an institutional perspective, IGMG is designed to be applied to employees of organizations responsible for determining or implementing immigration policies. The following section summarizes the concept of governance and good governance with its principles referring to the agenda of international organizations. Section 3 focuses on the migration governance in both theory and practice. Section 4 presents the IGMG. Its first sub-section presents the principles of good governance selected for IGMG and the second sub-section addresses the method for calculating the IGMG. The last section concludes the paper with some policy suggestions.

2. GOVERNANCE THROUGH THE LENS OF INTERNATIONAL ORGANIZATIONS

International organizations have played an important role in developing the concepts of good governance and in conceptualizing its principles. Good governance is particularly high, is on the agenda of the World Bank, the United Nations, and the International Monetary Fund (IMF). International organizations emphasize the concept of governance for their activities that promote political, administrative and public policy changes in developing countries. Many definitions of good governance relate it closely to the government's management and performance and the government's regulatory framework (Kaufmann et al., 2003).

The World Bank has made a great contribution to the development of the concept of governance. The word ‘governance’ came to be widely used in connection with the Bank’s work on public sector management (Lateef, 2016). The World Bank first used the word ‘governance’ in its 1989 report titled ‘Sub-Saharan Africa – from Crisis to Sustainable Growth’ to describe the need for institutional reform and a better and more efficient public sector in Sub-Saharan countries (Tripathi, 1997). In 1991, the

World Bank, in its discussion paper entitled 'Managing Development - The Governance Dimension' identified four dimensions (key areas) of governance: (1) improving public sector management; (2) accountability; (3) predictability and the legal framework for development; (4) information and transparency.

As noted in Lateef (2016), the paper focuses specifically on the last three dimensions. The concept of accountability in this paper means holding public officials accountable for their actions. At a broad level, the economic objectives of public accountability include alignment between public policy and actual practice, effective allocation, and use of public resources. According to Brautigam (1991), the paper defines predictability as standard operating procedures, institutionalized rules, non-personalized decision-making and, modest levels of discretion and regularized procedures for establishing and implementing policies. A sound legal framework or the rule of law is a key element of predictability. The paper includes several conditions regarding the basic dimensions of the rule of law. First, there must be a set of coherent rules already known and actually in force. On the other hand, the execution should include the executive branch's flexibility and discretion. Disputes arising during execution should be resolved by binding decisions of an independent judicial body or by arbitration. Finally, in the face of changing conditions, there should be procedures for changing the rules that lose their functionality and do not serve their purpose. Information and transparency, another dimension of good governance, refers to the availability of information and the transparency of decision processes related to accessing them. Transparency in decision-making processes is a safeguard against corruption and abuse of executive authority (World Bank, 1991).

In 1992, the World Bank conceptualized governance in its report titled 'Governance and Development'. In this publication, governance was defined 'as how power is exercised in the management of a country's economic and social resources for development' (World Bank, 1992). World Bank, in its 1998 annual report 'Governance in Asia: From Crisis to Opportunity', elaborated the four key components of governance as accountability, transparency, predictability, and participation. Accountability is the capacity to call authorities to account for their actions. Transparency ensures cost-effective and timely access to relevant information. Predictability arises from laws and regulations that are clear, established in advance, and effectively enforced. Participation is essential to gather reliable information and to validate government actions with real-world perspectives (World Bank, 1998).

The United Nations is another international organization that emphasizes the concept of good governance. The term 'good governance' is included in the Report of the Second United Nations Conference on the Least Developed Countries held in 1990. According to the Report, good governance is essential for economic and social progress for all countries. UN Development Program (UNDP) underlines that human development cannot be sustainable without good governance and that capacity building for good governance will be the main tool for eradicating poverty. UNDP (1997) defines governance as 'the exercise of political, economic and administrative authority in managing a country's

affairs at all levels. Governance comprises the mechanisms, processes and institutions through which citizens and groups articulate their interests.’

UNDP details three interrelated basic types of governance: economic, political, and administrative. Good governance, which encompasses these three elements, defines the processes and structures that shape socio-economic and political relations (UNDP, 1997; UNDP, 2007). Governance also covers the social and economic fields and includes civil society organizations and the private sector as well as the state. Good governance is characterized as participatory, transparent, accountable, effective, equitable, and promoting the rule of law. Participation provides the opportunity to voice views directly or through legitimate intermediaries or representatives. This principle also includes freedom of expression and an organized civil society. The principle of transparency means that those who will be affected by decisions and their implementation have free access to information. Accountability refers to the responsibilities of government agencies, the private sector or non-governmental organizations to the public and their corporate stakeholders who will be affected by their decisions or actions. Effectiveness means that processes and institutions can produce results that meet the needs of society while using resources. According to the principle of equality, all groups, including especially the most vulnerable, have opportunities to improve or maintain their well-being. The rule of law requires establishing and impartially applying fair legal frameworks (UNDP, 1997; UNESCAP, n.d.).

The International Monetary Fund (IMF) has always emphasized good governance in its activities and relations with member countries. In 1996, the policy-making committee of the Board of Governors emphasized that promoting good governance in all its aspects, such as ensuring the rule of law, improving the efficiency and accountability of the public sector, and fighting corruption, are key elements of a framework in which economies can prosper (IMF, 2005). In order to promote greater attention to governance issues, the IMF Executive Board adopted in 1997 a Guidance Note titled ‘The Role of the IMF in Governance Issues’ and a Policy Paper titled ‘Review of 1997 Guidance Note on Governance – a Proposed Framework for Enhanced Fund Engagement’ in 2018. In the Guidance Note, the IMF states that policy recommendations should be based on the broadly agreed best international practices of economic management and the principles of transparency, simplicity, accountability, and fairness (IMF, 1997).

The IMF defines governance as a broad concept that encompasses all aspects of how a country is governed. This concept includes elements such as a country’s economic policies, regulatory framework, and adherence to the rule of law (IMF, 2020). According to IMF (2018), good governance, is a normative concept that recognizes that the quality of governance can affect its effectiveness and efficiency in achieving desired results. Greater transparency and accountability may be expected to improve the quality of economic decisions and to make and strengthen the international financial system (IMF, 2005). From the mid-1990s to the present, the IMF’s role in promoting good governance has greatly increased, though still limited to the economic aspect of governance. Good governance is also

followed in IMF-supported programs. Technical assistance provided by the IMF is also directly linked to improved governance (IMF, 2020).

3. MIGRATION GOVERNANCE IN THEORY AND PRACTICE

Migration governance has a different conceptual content than migration management. The concept of ‘migration management’ was introduced in the early 1990s to obtain a new international framework for global mobility and migration. The management function is concerned with running of programs in the context of strategies, policies, processes and procedures. However, global developments in the field of migration have transformed migration management into migration governance. Thus, states have chosen a more structured and strategic approach to migration in order to address economic, social, demographic, and other relevant issues in coordination with other countries and especially neighboring countries, while maintaining the day-to-day functioning of their national migration policies (Crepeau & Atak, 2016).

Governance is at the core of the development and implementation of any migration measure or policy involving key actors (IOM, 2019). In the Glossary on Migration of IOM, migration governance is defined as ‘the combined frameworks of legal norms, laws and regulations, policies and traditions as well as organizational structures (subnational, national, regional and international) and the relevant processes that shape and regulate states’ approaches with regard to migration in all its forms, addressing rights and responsibilities and promoting international cooperation. (Sironi et al, 2019).

In parallel with the increasing importance of the phenomenon of migration on the world stage, the effects of international migration in practice and various dimensions of migration governance theoretically have attracted the attention of many researchers, (i.e., Batista & Vicente, 2011; Aksoy & Tumen; 2020; Lavenex & Piper; 2021; Delidji & Valeria, 2022). Migration flows are reshaping traditional ties between governments, international organizations and regional integration actors. The migration crisis rearranges the balance of power between the global, supranational, regional and national levels. The concept of multi-level governance (MLG) developed by Marks (1993) has been examined as an appropriate approach to make these power shifts and changes understandable (Panizzon & Riemsdijk, 2018). MLG refers to the dispersion of authority from the central government upstream to supranational jurisdictions, downstream to subnational jurisdictions, and sideways to public-private networks (Marks & Hooghe, 2004).

The primary purpose of global migration governance is to transform a traditionally unregulated phenomenon into a more regular and predictable process by regulating the causes and consequences of migration by enabling states to work together to better fulfill their goals (Crepeau & Atak, 2016; Betts & Kainz, 2017). Betts and Kainz (2017) defines global migration governance as the norms and organizational structures that regulate and facilitate states’ and other actors’ responses to migration. Unlike many other cross-border policy areas, there is no coherent global governance regime for global

migration governance. However, there is numerous regional and global initiatives. In addition to states and non-state actors such as NGOs and private companies, migration governance involves global and transnational bodies and institutions (Geiger & Pecoud, 2010; Likić-Brborić, 2018). The biggest obstacle to the development of global migration governance is the concern that the increase in migration governance will reduce the sovereignty of states. Sovereign states usually decide on their migration policies. On the other hand, the political perspectives towards migration and the fact that countries cannot always solve this issue in isolation bring increased international cooperation to the agenda in order to cope with the challenges faced by international migration (Betts, 2011).

UN has taken a several important initiatives in terms of global migration governance. Among them, the adoption by the UN General Assembly, of the UN Convention on Migrant Workers in 1990; the Global Commission on International Migration in 2003; creation of the Global Migration Group (GMG) by the UN Secretary-General in 2006 and the General Assembly’s organization of the first high-level Dialogue (HLD) on International Migration and Development in 2006 have been major milestones in the field of global migration governance. However, as stated in Crepeau and Atak (2016), global migration governance discussions largely fall outside the UN framework. Among them, the Global Forum on Migration and Development (GFMD) was created by States, outside the UN framework. Furthermore, several non-UN IGOs have experienced rapid and substantial growth over the last decades at the global level. The International Organization for Migration (IOM) and, to a lesser degree, the International Centre for Migration Policy Development (ICMPD) emerge as key players in this respect.

4. AN INDEX FOR ‘GOOD’ MIGRATION GOVERNANCE

Various institutions have developed indexes that quantify the migration policies of many countries in order to measure and compare migration policies. These indexes aggregate and measure the components that underpin countries’ migration policies and compare them over time. The report titled “Migration Policy Indexes” prepared by Joint Research Centre (JRC), the European Commission’s Science and Knowledge Service maps and analyzes the main migration policy indexes and presents their methodologies and main findings (Scipioni & Urso, 2018).

The table below lists the main migration indexes included in the report in terms of the years covered, the specific policy areas they focus on and their scope:

Table 1. Main Migration Indexes

	Family Reunification	Borders	Labour Migration	International Protection	Irregular Migration	Students	Years Covered
Comprehensive Approach							
DEMIG	+	+	+	+	+	+	1945-2013
Global Migration Barometer	+	-	+	-	-	-	2007
ICI (Immigrants' Climate Index)	-	-	+	-	-	-	2005-2012
IMPALA (International Migration Policy and Law Analysis)	+	+	+	+	+	+	1999-2008
IMPIC (Immigration Policies in Comparison)	+	+	+	+	+	-	1980-2010
MGI (Migration Governance Index)	+	+	+	-	+	+	2015-2016
MIPEX (Migrant Integration Policy Index)	+	-	+	-	-	+	2004, 2007-2014
Ortega&Peri (Tightness of immigration reforms over time)	-	-	+	+	-	-	1980-2005
Sectoral Approach							
Cerna's Index	-	-	+	-	-	-	2007, 2012
The Openness Index and Migrant Right Index	-	-	+	-	-	-	2009
Deterrence Index	-	-	-	+	-	-	1985-1999
Asylum Policy Index	-	-	-	+	-	-	1996-2006

Source: Scipioni and Urso, 2018

Among these indexes, MGI, prepared by the Economist Intelligence Unit, specifically focuses on the migration governance. This report analyzes 15 countries' migration policies between October 2015 and February 2016. The MGI evaluates the countries across the following five domains, (1) Institutional capacity, (2) Migrant rights, (3) Safe and orderly migration, (4) Labor migration management, and (5) Regional and international cooperation and other partnerships. The institutional capacity domain measures the availability of countries' institutional and legal frameworks, migration strategies, data and transparency (The Economist Intelligence Unit, 2016).

These indexes have been applied to developed and developing countries in different cultural, economic and political contexts. The evaluation criteria, scope and focus of these indexes vary. Migration indexes aim to assess countries' migration policies and identify areas for improvement. For

this aim, they provide policymakers with data on migration management and practices, enabling them to make comparisons and identify best practices in the field of migration.

Unlike indexes developed to date, the index for ‘Good’ Migration Governance (IGMG) builds on selected principles of good governance from an institutional perspective and focuses on institutional structures related to migration governance. In this respect, IGMG is at the intersection of good governance principles and migration governance. The following sections will first describe the principles of good governance selected for the IGMG and then the method of calculating the index.

4.1. The Principles and Questions

The scope and nature of good governance principles may vary according to sectors, institutions or objectives. In this study, six principles were selected considering the governance perspectives of international organizations. These principles are contained in documents published by at least two of the World Bank, United Nations and International Monetary Fund. The selected principles of good governance are (1) Effectiveness, (2) Transparency, (3) accountability, (4) Participation, and (5) Legal framework.

From an institutional perspective, IGMG is designed to be applied to employees of organizations responsible for determining or implementing migration policies. To measure good migration governance, twenty questions were included within the scope of each principle. Below are brief explanations of each principle:

4.2. Effectiveness

Effectiveness in the public sector refers to the extent to which public services provided using public resources meet the needs of society. While evaluating the effectiveness in the public sector, the criteria such as institutional structure and decision-making mechanisms, human resources, physical and technological infrastructure, consultation and feedback mechanisms, and the use of public resources are considered. Institutional structure and decision-making mechanisms include the determination of the strategic goals and objectives of the institution, the duties and responsibilities of the employees, keeping accountability at the forefront, an institutional structure suitable for cooperation, coordination and adapting to changing conditions, and a participatory decision-making process.

Human resources refers to the presence of qualified and highly motivated employees for providing quality service. In this respect, it is related to corporate culture and strategic vision. Physical and technological infrastructure refers to the existence of the physical and technological infrastructure necessary for quality service delivery and cost-effectiveness. Consultation and feedback mechanisms mean taking the opinion of the public before the service provided by the Institution and receiving feedback on its quality. Finally, the use of public resources refers to cost-effectiveness and value for money. The questions for the principle of effectiveness for IGMG are included in Table 2.

Table 2. Principle of Effectiveness

		Yes	No
1	Do you have information about the strategic goals and objectives and the contribution of your migration unit towards their realization?		
2	Are there mechanisms to measure the extent to which your migration unit's operational goals have been achieved?		
3	Are indicators of the migration unit's performance clearly defined?		
4	Is there an institutional monitoring mechanism for the migration unit for the systematic monitoring of performance indicators and their modification when necessary?		
5	Are business, processes and processes being improved by taking into account the opinions/feedbacks of the employees who are served?		
6	Are there written procedures regarding the activities, financial decisions and transactions of your migration unit, covering the initiation, implementation and conclusion stages?		
7	Have you associated the performance indicators with the use of corporate resources?		
8	Are performance expectations and the capacity of employees (authorities, abilities, resources) linked, consistent and balanced?		
9	Is there a regular review mechanism to ensure that job descriptions are properly implemented?		
10	Are the training needs required for each task determined in your migration unit, and training activities to meet this needs are planned and carried out every year?		
11	Are process models reviewed periodically to ensure that work is done most effectively?		
12	Does your organization have mechanisms to prevent task conflicts?		
13	Is there an institutional impact analysis or impact assessment that reveals the possible effects of the decisions taken by the migration unit or the outputs produced?		
14	Is the physical working environment of your unit/institution suitable for efficient working?		
15	Is there a study that analyzes the strengths and weaknesses of your unit and the opportunities and threats it faces?		
16	Are there precautionary mechanisms to strengthen weaknesses and eliminate threats?		
17	Are the possible effects and probabilities of the risks identified, measured and prioritized according to their importance?		
18	Is there a risk management system or action plan in which duties and responsibilities are clearly and in writing in order to minimize the effects of risks if they occur?		
19	Have you been adequately informed about your duties and responsibilities regarding risk management?		
20	Is the effectiveness of control activities implemented in your migration unit regularly reviewed?		

Source: Authors

4.3. Transparency

This concept refers to stakeholders' quick and accurate access to information about institutional mechanisms. In the context of public administration, transparency means making the information necessary for the public and citizens' proper evaluation of institutions available to relevant stakeholders.

Transparency is examined in two dimensions as internal and external transparency. In terms of public institutions, the policies and strategies carried out affect all stakeholders in the society. External transparency relates to the responsibilities of institutions to the public for their policies and performance. In this framework, obtaining information about the functioning of institutions and being informed about which policy and strategy is implemented at what level is considered a right and responsibility of the stakeholders. Internal transparency is the sharing of information necessary for achieving individual or corporate goals by managers with those in a hierarchical relationship.

Internal communication patterns can potentially have positive and negative effects on transparency. In addition, information systems are an important component in ensuring transparency as they enable effective information sharing among individuals and within the organization. Table 3 includes questions for the principle of transparency.

Table 3. Principle of Transparency

		Yes	No
1	Does your migration unit have a documented transparency or disclosure strategy?		
2	Are strategic plans prepared and shared with the public, including the objectives, principles and policies, goals and priorities, performance indicators, methods to be followed to achieve these, and resource allocations of your institution?		
3	Are the migration unit's activity reports prepared and shared with the public?		
4	Do the activity reports of your unit include the degree of realization of the targets and the deviation from the target, and if any, the reasons for these and the measures to be taken in this direction?		
5	Do you prepare and share with the public the financial reports (eg, corporate financial situation and expectations report) that include the periodic budget implementation results of your unit, as well as the periodic expectations, targets and activities?		
6	Is there a communication strategy to ensure that the public is informed about the outputs produced by your migration unit, regardless of demand?		
7	Has a standard been developed in the migration unit regarding the duration and method of the services provided directly to the relevant stakeholders?		
8	Do you think that the migration unit provides timely, accurate and sufficient information to relevant stakeholders regarding its fields of activity?		
9	Are periodic studies carried out to ensure that the web page of the migration unit reflects the content of your work areas accurately and up-to-date?		
10	Do you think the official document filing plan is clear and simple enough to facilitate in-departmental information gathering?		
11	Are there electronic and interactive communication channels (online system, web questionnaire, etc.) that enable or facilitate information sharing for citizens or service units and individuals?		
12	Are there written documents/mechanisms that reveal the process for resolving complaints regarding access to information?		
13	Are there clearly defined standards for the protection of the right to know of the persons or institutions and employees served?		
14	Does the migration unit have a communication strategy or a written procedure regarding horizontal and vertical communication between employees in its fields of activity?		
15	Does your migration unit have an electronic internal communication system (intranet) that enables or facilitates communication between employees in its fields of activity?		
16	Is there a systematic sharing process for transmitting the outputs (meeting reports, related documents) produced in your migration unit to other relevant departments..?		
17	Are periodic information meetings attended by the employees in the migration unit?		
18	Can you easily access all kinds of information about your job, printouts and files that do not bear the phrase ‘confidentiality’?		
19	Are there institutional mechanisms to accurately inform and guide employees on business procedures and processes?		
20	Are training programs organized to ensure that the migration unit's employees are familiar with the new system, regulations, procedures, and rules?		

Source: Authors

4.4. Accountability

Accountability means that a person or institution makes a statement against another authority due to their actions, attitudes, and behaviors. Accountability requires public institutions and organizations to be accountable to the public and other stakeholders and to be responsive, especially about the policies they follow, the decisions they make, and the actions they take regarding the use of public resources.

The principle of accountability and the principle of transparency are two intertwined concepts. Effective and well-functioning accountability processes are needed to ensure transparency in management, and open and transparent policies are needed for effective and well-functioning accountability processes. The questions concerning the principle of accountability are included in Table 4:

Table 4. Principle of Accountability

		Yes	No
1	Has a written accountability framework been established (is there a written document containing the accountability standards) that sets out the powers and responsibilities for accessing or disclosing the information and documents requested from your migration unit?		
2	Have the employees been informed in writing about their rights and obligations and the limits of their authorities?		
3	Have employees been informed about their financial and human resources and their appropriate use?		
4	Are there communication channels (web page, social media, etc.) that will provide information to the public or interested parties regarding the migration unit's activities?		
5	Do existing internal and external communication systems allow staff or external stakeholders to communicate their expectations, suggestions and complaints in a timely and complete manner?		
6	Are there consultation mechanisms to receive public feedback on the work carried out in your migration unit?		
7	Are there systematic checks and periodic compliance audits to measure that goods and services are procured by procurement procedures?		
8	Is there an internal compliance audit that allows to measure the relevance of the goods and services received and the full value for money?		
9	Could you associate the performance indicators with the use of corporate resources in your migration unit?		
10	Is there an administrative control mechanism for detecting the irregular actions of the employees and applying the necessary sanctions?		
11	Are the approval, implementation, recording and control tasks of each activity or financial decision and transaction performed by different persons in your migration unit?		
12	Are measures (periodic monitoring mechanisms, control of expenditures) taken for expenditures subject to preliminary financial control to undergo preliminary financial control?		
13	Is there an archive and documentation system by the determined standards covering the recording, classification, protection and access of the business and transactions of the migration unit?		
14	Have the procedures regarding who will prepare which reports in your unit, how often, when, and to whom they will be submitted, and their control procedures been announced to the personnel?		
15	Is regular monitoring done through an internal audit?		
16	Are necessary measures taken to improve the negative issues in the internal audit reports?		
17	Is the internal control system implemented and periodically reviewed?		
18	Do the migration unit manager and employees have information about their authority and responsibilities in establishing the internal control system?		
19	Are there monitoring mechanisms (e.g., reporting system, periodic unit meetings, etc.) that reveal the compliance of the work produced in the unit with the standards?		
20	Are the personnel informed about the methods and methods of monitoring and evaluation of their work?		

Source: Authors

4.5. Participation

Participation refers to the involvement of citizens in policy-making processes or the representation of all different ideas and interests in a local, national, regional and global context. Participation can be provided directly or through legitimate intermediary institutions or representatives.

Today, the policies created, and the services carried out by public institutions are in close relation with the duties of other public institutions. On the other hand, the decisions taken by public institutions and the policies implemented are closely related to other stakeholders (citizens, universities, non-governmental organizations, etc.). In this framework, public institutions' achievement of their goals depends not only on their own efforts but also on their cooperation with other stakeholders. In accordance with the principle of participation, the inclusion of stakeholders in the decision-making processes of the institutions will ensure the efficient use of resources and achieve the targeted results.

Participation of relevant stakeholders in decision-making processes, continuous information flow and cooperation between stakeholders is necessary for effective participation. Making decisions in

the public sector with a participatory approach and at a level that covers those affected by the decision will increase the likelihood of successful implementation of these decisions. The questions concerning the principle of participation are included in Table 5:

Table 5. Principle of Participation

	Yes	No
1		
2		
3		
4		
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8		
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Source: Authors

4.6. Legal framework

It is necessary to ensure the compliance of the works and transactions with the relevant legislation while considering the public interest. In this context, public institutions should be based on public integrity in all actions and decisions and should be in a strong commitment to ethical values and legal regulations at every stage. The questions concerning the principle of legal framework are included in Table 6:

Table 6. Principle of Legal Framework

		Yes	No
1	Does your migration unit have written business standards for its employees?		
2	Are there monitoring mechanisms in place to ensure that the business standards established by your migration unit are applied consistently and without discrimination?		
3	Are there monitoring mechanisms that ensure the accuracy and compliance of the outputs produced by your migration unit with business standards?		
4	Is there a monitoring system that ensures that the outputs produced by your migration unit comply with laws and regulations?		
5	Is there a monitoring mechanism that follows the legislation or legislative changes related to the working areas of your migration institution/unit?		
6	Are there written ethical values for the employees of your migration unit?		
7	Are employees informed in writing about ethical behavior principles and their responsibilities regarding these principles (Have employees signed an ethics agreement?)		
8	Are there verbal or written mechanisms to prevent employees from engaging in behavior that undermines the public's confidence in the public service, raises suspicion, and undermines the principle of justice?		
9	Are the values necessary for observing the public interest in the works and transactions carried out by your migration unit included in the written documents created in your unit?		
10	Do you think that the monitoring and inspection mechanisms to combat corruption and prevent bribery and corruption have been adequately established?		
11	Are awareness-raising measures taken in the fight against corruption and the prevention of bribery and corruption?		
12	Are measures taken in your migration unit for the use of public goods and resources by employees within the framework of public purposes and service requirements?		
13	Are measures taken to ensure that employees fulfill their duties without providing personal benefits?		
14	Are measures taken to prevent the relatives, friends and relatives of employees from benefiting from public services in a privileged way?		
15	Are measures taken to prevent employees from accepting gifts that affect or may affect impartiality, performance and performance of the task?		
16	Is there an official communication mechanism (whistleblowing) that ensures that unethical acts that violate the policies of your migration institution/unit are reported to the relevant authorities and that those who communicate are responsible for their actions?		
17	Do the employees of your migration unit know about the procedures for notifications and complaints to be made from inside and outside the administration?		
18	Do you know what to do if bribery, corruption or fraud is suspected?		
19	Does the whistleblowing system (if any) contain appropriate means for reporting potential or ongoing irregularities, corruption and problems from within and outside your migration unit?		
20	Does the whistleblowing system (if any) include procedures to ensure the safety of the reporting personnel (such as not being subjected to unfair and discriminatory treatment) in your migration unit?		

Source: Authors

5. THE CALCULATION METHOD

The Index for Good Migration Governance is an indicator that aims to reveal the migration governance scores of administrative units. The index is calculated using the methodology used by the European Commission in its business and consumer surveys. According to the method, balances calculated for each question are the difference between positive and negative answering options measured as a percentage score of total answers (European Commission, 2016). The total index is calculated by taking the arithmetic average of the balances of each question. Values approaching 200 (or 1) in the Index, which takes values in the range of 0 - 200 (or 0-1), indicate that a good migration governance score is high and, thus, indicates better migration governance. On the contrary, values approaching zero indicate that good migration governance score is low for the relevant administrations and indicates that migration governance is insufficient. In order to calculate the administration's index score on good migration governance, the average of the scores obtained by the employees who answered these questions should be taken.

The questions in the sample below are assumed to be asked of five people working in an administration that takes responsibility for migration governance. The numbers in the following example indicate the total number of ‘yes’ or ‘no’ answers to each question. Measurement questions is given in Table 6:

Table 6. Measurement Questions

Measurement Questions	Yes	No
Q1	4	1
Q2	2	3
Q3	0	5

For each question, the percentage of those who answered ‘yes’ is subtracted from the percentage of those who answered ‘no’ and 100 is added to this difference:

$$(80-20) + 100 = 160$$

$$(40-60) + 100 = 80$$

$$(0-100) + 100 = 0$$

The arithmetic mean of the numbers is: $(160 + 80 + 0) / 3 = 80$. Based on this result, the administration’s ‘good’ migration governance score is 0.4 by calculating 80/200.

6. CONCLUSION

Nowadays, the concept of governance is transforming due to reasons such as the phenomenon of globalization, the inability of the bureaucracy to manage complex social and economic organizations, and the innovations brought by information technologies. These changes are forcing institutions to adapt and to cope with these changes, institutional functions, roles and their impacts need to be reconsidered. In this context, the concept and principles of good governance can be considered tools to achieve the change and transformation institutions need in their managerial roles and functions.

Parallel with migration's increasing importance in the global arena, migration governance is one of the areas where organizations need to adapt and progress. Effective migration governance paves the way for the development of ideal structures and mechanisms and contributes positively to the relationship between the state and migrants. To this end, this study links good governance with migration governance.

IGMG provides a quantitative indicator of the extent to which good migration governance can be achieved from an institutional perspective. As listed below, the index has the potential to contribute to migration governance in five dimensions from an administrative perspective:

- The Index provides an opportunity for the administration better to understand itself in the context of migration governance. In this context, the index functions as a checklist, enabling the administration to increase self-awareness about its strengths and weaknesses and institutional needs.

- The index enables the administration to develop appropriate strategies and policies to achieve better migration governance. Thus, the administration can increase its self-management capability to take appropriate measures to improve migration governance and to achieve its objectives effectively.

- By applying the index periodically within the same administration, it allows the administration to periodically compare its practices in migration governance. Thus, the index functions as an institutional mechanism for the administration to improve its weaknesses and maintain its strengths over time.

- By applying the index to sub-units within the same administration, it allows for inter-unit comparisons and identifying institutional differences in the field of migration governance. This paves the way for seeing the best practices among the units and making use of these practices throughout the administration.

The Index provides a comparative view of the scores of administrations working in the field of migration governance. Thus, it is possible to make comparisons and evaluations between institutions and benefit from good practices across the country.

Furthermore, this study provides a theoretical framework for researchers working on migration governance and provides guidance for structuring applied studies in this context. With IGMG, researchers have the opportunity to conduct practical, measurable and comparable studies on migration. Linking the principles of good governance to migration governance offers a unique perspective on clarifying the theoretical criteria that can be considered in migration governance. As this study provides researchers with a practical methodology, they will be able to adapt this methodology in their own data collection and analysis processes. Since the IGMG provides a basis for researchers to compare migration policies and practices, researchers will be able to conduct analyses within countries or across regions or countries using IGMG. The index's focus on institutional operating structures offers a unique perspective to develop concrete institutional recommendations from an academic perspective. This will allow researchers to have a more direct impact on migration issues and society through their studies.

It is important for policy-makers to ensure proper communication of migration issues to relevant stakeholders and to develop a corporate communication strategy for this purpose. As stated in Cornelissen (2019), a communication strategy involves establishing a desired position on how the organization wants to be perceived by different stakeholder groups. In this sense, it is significant to develop a written communication strategy that provides a framework for effective coordination of all internal and external communication to build and maintain a positive corporate reputation among stakeholder groups on migration. In this regard, institutions involved in migration management should

coordinate with relevant stakeholders within the framework of a written communication strategy, using media, websites and other communication channels.

This paper highlights the possible contributions of the concept and principles of good governance for migration governance. In this sense, the study broadens the administrative and institutional perspective for organizations to have better migration governance.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that they all equally contributed to all processes of the research.

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Emotional Labor in Aviation: A Phenomenological Research on Cabin Crew

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Abstract

The aim of this study is to examine the factors affecting the emotional labor behavior of cabin crew in aviation and the results of emotional labor. For this aim, qualitative research method was used to examine the research topic in detail. The research was guided by using the phenomenology design, which is one of the qualitative research designs. The research sample was determined according to purposeful sampling and saturation point methods. In this context, the sample of the research consists of 11 cabin attendants working in different airline companies in Turkey. Interview method was used as a data collection tool. The data obtained was subjected to content analysis with an inductive and descriptive approach. As a result of the content analysis, the research findings were grouped under two main themes as factors affecting emotional labor and the results of emotional labor. Factors affecting emotional labor behavior were examined under six sub-themes: organizational factors, individual factors, demographic features, passenger type, physical work environment and content of the flight task. The results of emotional labor were examined under two sub-themes as organizational and individual results. While organizational results are positive results that increase organizational performance and create a positive organizational impression, it has been observed that individual results seen on cabin crew have positive and negative sides.

Keywords: *Emotional Labor, Cabin Crew, Flight Attendant, Aviation*



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<https://doi.org/10.30798/makuiibf.1420508>

Article Type	Application Date	Admission Date
Research Article	January 15, 2024	December 16, 2024

1. INTRODUCTION

The idea of “working life”, wherein individuals devote a large portion of their lives, has persisted throughout history and will do so in the future. Modern factories, workplaces, and working styles have seen several changes since the industrial revolution. Realizing the worth and significance of the human element for businesses has been one of the most significant of these changes. The methods of the past, in which social connections and emotions were disregarded and individuals were viewed as machines that contributed to the industrial process, have been abandoned in this setting. It has been recognized throughout history that people, or more specifically, employees, are the most precious resource that not only physically but also emotionally contributes to organizational success and gives firms a competitive edge.

People are emotional beings. Emotions influence conduct directly, therefore ignoring them hurts people's performances. For this reason, an awareness of emotions is necessary to comprehend and control employees' organizational behaviors (Akçay & Çoruk, 2012). Employees must engage in emotional labor to comprehend client requests, solve their problems, and please them, especially in the service industry. Emotional labor is crucial to the aviation industry, which is a significant part of the transportation sector since it has a functioning system that offers passengers constant service. According to Ashforth and Humphrey (1993), emotional labor is characterized by employee behaviors that are dictated by organizational policies rather than their true feelings. The behaviors that employees display in the workplace align with the expectations set by the firm. In this situation, emotional labor is expressed by the effort and self-control that employees must exhibit to demonstrate the desired behaviors (England & Farkas, 1986). When the reasons behind employees' emotional labor are examined, it becomes clear that employees essentially express their feelings by what their employers demand of them (Seçer, 2007). Based on this fundamental rationale, incompatibility between the emotions felt and displayed results in undesirable outcomes such as burnout, decreased job satisfaction, and stress (Gürel & Bozkurt, 2016). Even if emotional incompatibilities put employees in unpleasant situations, emotional labor has a favorable impact on the productivity and efficiency of the company (Aslan, 2023; Steinberg & Figart, 1999). In this regard, this study aimed to examine the variables influencing emotional labor and its outcomes. The study was carried out on cabin crew, who have frequent social encounters with passengers in aviation and who serve as the public face of airline companies. To achieve this aim, a review of previous research on the topic was done before using a qualitative research approach called content analysis to assess the data from participant interviews.

2. LITERATURE REVIEW

In this section of the study, which includes a literature review, the concept of emotional labor is first defined, then the factors affecting emotional labor and the results of emotional labor on organizations and employees are examined.

2.1. Emotional Labor

Combining the ideas of emotion and labor creates the concept of emotional labor. Emotions are the internal states people experience in response to stimuli and then project onto their conduct. The sociology of emotions concerns people's feelings, desires, and attempts to feel, as well as how they express, manage, categorize, and make meaning of their emotions (Seçer, 2007; Barsade & Gibson, 2007). Primary and secondary emotions are the two types of human emotions. Primary emotions are the fundamental, innate, and taught emotions that humans experience. These include feelings of joy, rage, fear, surprise, contempt, or humiliation. Experiences teach and grant the acquisition of secondary emotions. Secondary emotions can differ depending on a person's personality features and are a mixture of basic emotions. Among the secondary emotions are pride, humiliation, regret, anger, enthusiasm, and boredom (Kemer & Dost, 2020). On the other hand, the Turkish Language Association dictionary defines labor as “body and head power spent to do a job; sweat of forehead” (<https://sozluk.gov.tr>). Emotions, a human quality, are inextricably linked to the concept of labor since, as its definition makes it clear, labor is the power that individuals expend intellectually and physically.

It is feasible to claim that emotional labor is connected to people's inner lives in their working lives when the concept is examined. The idea of emotional labor was initially proposed and published by Hochschild (1979). According to Hochschild (1979), managing emotions in exchange for the money one receives from this exchange is emotional labor. Emotions are traded like commodities. Asforth and Humphrey (1993) considered emotional labor as an impression management strategy and, in contrast to Hochschild (1983), placed more emphasis on behaviors than emotions. They defined emotional labor as the behaviors that employees exhibit rather than how they feel at work. Since actions are observable and have an immediate impact on the other person. According to England and Farkas (1986), emotional labor is the effort and self-control exerted by employees on the actions that are expected of them within the context of organizational expectations at work. Emotional labor involves transforming one's emotions to perform in a way that satisfies employment criteria, particularly in industries that demand intimate client-customer relationships (Karaman, 2017).

According to Grandey (2000), emotional labor refers to emotion regulation theory. Emotion regulation theory (Gross, 1998) refers to a process related to how, when, and how emotions are displayed. The emotion regulation process can be realized in two ways: antecedent-focused and response-focused. In the process of antecedent-focused regulation, the individual perceptually changes the current situation, while in response-focused regulation, the individual changes his/her reaction to the situation (Kamber, 2014). Individuals' reactions are the behaviors and feelings expected from them by the organizations they work for. In this context, there are two ways of displaying emotion. The first is superficial, and the other is deep behavior (Hochschild, 1983). The superficial behavior dimension of emotional labor is that the employee shows the expected behaviors to the service recipients through gestures, mimics, body language, or tone of voice by differentiating them from their own emotions and

controlling them (Aslan, 2023). Superficial behavior is when the employee shows his/her emotions to the customer in a fake way. In-depth behavior, on the other hand, is when employees suppress their own emotions to show their emotions in line with the organization's expectations or make an effort to enter the desired emotion and act like an actor (Hochschild, 1983).

A phony display of emotion by an employee toward a customer is known as superficial behavior. On the other hand, in-depth conduct occurs when staff members try to project the intended mood and behave theatrically, or when they repress their own emotions in order to express their feelings in accordance with organizational standards (Hochschild, 1983). According to Thoits (1989), there are two ways we can manipulate our emotions: through surface acting and deep acting. We transform our emotions from the exterior to the inside when we engage in surface acting. We alter our emotions from the inside out when we engage in deep acting. Employees may exhibit surface behavior when asked to hide their negative emotions, such as anger, resentment, etc., but they will also exhibit deep behavior when they feel the positive behaviors that are expected of them, such as smiling, empathizing, and helping the other party (Kim, 2008). In addition to the deep and surface behavior components of emotional labor, Ashfort and Humphrey (1993) introduced a third dimension: sincere behavior. In terms of sincere behavior, employees sometimes exhibit the behaviors expected of them without effort. Stated differently, sincere behavior occurs when an employee experiences the feelings that are required of them and effortlessly conveys those feelings to the client. As a result, the worker feels less stressed and is more motivated at work.

2.2. Factors Affecting Emotional Labor

Emotion regulation and management is referred to as emotional labor. People express their emotions differently in both their personal and professional lives (Erkuş & Günlü, 2018). Hochschild (1983) highlighted three important traits of emotional labor in the workplace. The first of these traits is that for employees to demonstrate emotional labor, they must be in contact with customers over the phone or in person. Second, staff members must put the customers' needs ahead of their feelings. Lastly, employees must behave in a way consistent with the organization's behavior patterns in the interaction between them and their customers.

Organizational values and belief systems are interwoven with the display of emotional labor. The employees' emotional expression guidelines become apparent when considering the relevant values and belief systems. Emotional labor pertains to determining which feelings one should exhibit in specific circumstances or elicit from the other person. Display rules refer to the rules governing which behaviors are required in particular contexts, whereas emotion rules specify which feelings should be felt in specific circumstances (Ashforth & Humphrey, 1993). Various factors can influence emotional labor behavior in the workplace outside of behavioral norms and organizational expectations. Emotional labor behavior is influenced by both organizational and individual elements, including support from

coworkers and bosses, as well as individual factors like gender, emotional intelligence, and emotional influencing ability (Grandey, 2000).

2.3. Results of Emotional Labor

In the context of emotional labor behavior, controlling and managing employees' emotions leads to various beneficial organizational outcomes, including reaching targeted objectives, boosting performance, making a good impression on the target audience, and guaranteeing customer satisfaction. However, suppression of emotions can result in emotional conflicts, consumer dissatisfaction, and employee emotional resource exhaustion (Ezilmez, 2018). Customers perceive employees as the company since they are the public face of the enterprise. Consequently, consumers' perceptions of quality service are directly correlated with the emotional labor that personnel perform (Ashforth & Humphrey, 1993). Employee emotional incompatibilities resulting from emotional labor lead to stress, job discontent, and burnout over time in industries where there is a fierce rivalry and performance-based compensation (Duman, 2017).

3. METHODOLOGY

The aim of this study is to examine the factors affecting the emotional labor behavior of cabin crew in aviation and the results of emotional labor. For this aim, qualitative research method was used to examine the research topic in detail. The research was guided by using the phenomenology design, which is one of the qualitative research designs. The phenomenology design, which both guides and gives flexibility to the researcher without leaving the focus of the research, allows the in-depth and detailed examination of unknown phenomena (Yıldırım & Şimşek, 2018).

3.1. Sample, Data Collection Tool and Process

Participants in the research were selected according to the purposeful sampling method. The purposeful sampling method allows the researcher to select participants who provide the best understanding of the research problem (Creswell, 2017). For this reason, cabin crew working in civil aviation companies in Turkey were selected as the research sample. The reason why the sample of the research consists of cabin crew is because these employees, who work under extremely flexible working conditions in aviation that provides service at all hours of the day, have to communicate face to face with passengers for a long time and exhibit intense emotional labor towards passengers during this communication.

Semi-structured interview method was used to collect data in the research. The research questions prepared by taking into account the literature review and scales regarding the concept of emotional labor and addressed to the participants are presented in Table 1.

Table 1. Research Questions

Questions
1. Does your job as a cabin crew require emotional labor?
2. When you perform emotional labor, do you do it because of your job or do you actually want it? What factors influence this behavior?
3. In your opinion, does performing emotional labor differ according to demographic features?
4. What are the results of emotional labor in your job in terms of organizational performance?
5. Does emotional labor as part of your job have a positive impact on your individual skills at work or in daily life?

Due to the intensity of the participants' workload, flexible working hours, and time constraints, the interviews were held online with each participant separately between May and July 2023. 50 minutes were planned for the interview with each participant. However, the duration of some interviews exceeded the planned time to collect sufficient data. The data collection process was finished when it reached the saturation point. In qualitative research, data collection is finished if the data obtained for the formation of research themes reaches a certain level of saturation and new perspectives do not emerge (Creswell, 2017). The data collection process was finished after interviewing 11 participants within the framework of the saturation point. Descriptive statistics of participants are presented in Table 2.

Table 2. Descriptive Statistics

Participant	Gender	Marital Status	Age	Education Level	Job Title	Working Time (Year)
P1	Female	Single	46	Master's Degree	Cabin Chief	20
P2	Female	Married	37	Bachelor's Degree	Cabin Chief	13
P3	Male	Married	29	Bachelor's Degree	Attendant	4
P4	Female	Single	41	Bachelor's Degree	Cabin Chief	13
P5	Female	Married	38	Master's Degree	Cabin Chief	14
P6	Female	Single	27	Bachelor's Degree	Attendant	5
P7	Male	Married	37	Bachelor's Degree	Cabin Chief	11
P8	Female	Single	37	Bachelor's Degree	Cabin Chief	12
P9	Male	Single	28	Bachelor's Degree	Attendant	6
P10	Male	Married	38	Master's Degree	Attendant	6
P11	Male	Single	26	Bachelor's Degree	Attendant	3

3.2. Data Analysis Method

The audio recordings obtained through the interviews were deciphered and edited together with the notes taken by the researchers during the interviews and evaluated according to content analysis. Content analysis, which is the most suitable method for qualitative research (Kitzinger & Farquhar, 1999), consists of coding the data, finding categories and themes, organizing the resulting codes, categories, and themes, and interpreting the findings (Yıldırım & Şimşek, 2018). The emerging themes were supported by quotes from participant statements, and the findings were interpreted by the researchers in the conclusion. In addition, the findings obtained during the content analysis were supported by quantitative data such as frequency and percentage and visualized by creating a word

cloud. The approaches adopted regarding the validity and reliability of the research are listed below (Creswell, 2017; Yıldırım & Şimşek, 2018; Sığırı, 2021):

- While determining the research topic and questions, experts working in the aviation industry were interviewed and the content of the research was guided according to their feedback.
- Information about the research method, process, and results are explained in detail.
- The sample of the research was determined according to the purposeful sampling method.
- Long-term interaction was achieved with the data obtained in the research; The data were cross-examined separately by two researchers and the raw data was stored.
- The codes, categories, and themes that emerged from content analysis were presented to the reader without being interpreted by the researchers.

4. FINDINGS AND ANALYSIS

The themes of the research resulting from the content analysis are presented in Table 3 below.

Table 3. Themes of The Research

Themes	Sub-Themes	Categories	Codes	Code Freq.	Sub-Themes/ Categories Freq.	Sub-Themes %	
Factors Affecting Emotional Labor	Organizational Factors		Organizational Rules	16	41	%11.4	
			Organizational Trainings	16			
			Professionalism	9			
	Individual Factors			Feeling Good	11	39	%10.8
				Internalizing Emotions	3		
				Loving Your Job	4		
				Personal Satisfaction	5		
				Desire to Please Passengers	15		
				Fear of Dismissal	1		
	Demographic Features			Gender	11	50	%13.8
				Age	11		
				Working Time	11		
				Marital Status	10		
				Personality Traits	7		
	Passenger Type	Special Passengers		Passenger with Fear of Flying	11	70	
				Passenger with Child/Baby	12		
				Disabled Passenger	11		
				Sick Passenger	11		
				Elderly Passenger	11		
			Some Destination Passengers	14			
Unruly Passengers				Drunk Passenger	14	79	%41.5
				Stressed Passenger	3		
				Group Passenger VIP	15		
				Business/Economy	14		
				Demanding Passenger	12		
				Famous and Government Official	16		
		Tired Passenger	3				
		Swearing Passenger	2				

Physical Work Environment		Narrow Space	3	22	%6
		Pressure	5		
		Light	6		
		Noise	3		
		Small Aircraft	2		
		Temperature	3		
Task Type		Night Flight	5	7	
		Long Flight	2		
Content of The Flight Task	Critical and Urgent Phases of the Flight Task	Passenger Welcoming	6	52	%16.5
		Passenger Settlement	1		
	Departure	6			
	Service Phase	22			
	Turbulence	3			
	Descent	10			
	Slide Explosion	2			
	Unsafe Door Opening	2			
Total		360	%100		
Organizational Results		Organizational Profit Increase	11	41	%36.6
		Positive Organizational Impression	8		
		Organizational Advertisement	7		
		Happy Passenger	4		
		Frequent Flyer	1		
		Increase in the Number of Loyal Passenger	8		
			2		
Results of Emotional Labor	Negative	Emotional Dissonance	4	24	
		Internal Conflict	4		
		Suppression of Emotions	4		
	Individual Results	Burnout	3		
		Stress	7		
		Outbursts of Anger	2		
Positive	Patience	18	50	%63.4	
	Anger Management	5			
	Conflict Management	2			
	Problem Solving	7			
	Practical Thinking	3			
	Empathy	9			
	Self-Confidence	3			
	Crisis Management	2			
Discipline	1				
Total		115	%100		

As seen in Table 3, the research findings are grouped under two main themes as factors affecting emotional labor and the results of emotional labor. The theme of factors affecting emotional labor is divided into six sub-themes, and the theme of the results of emotional labor is divided into two sub-themes. However, some sub-themes are divided into categories within themselves. The classification of categories and sub-themes were made according to codes that create semantic integrity with each other. The content analysis carried out by taking into account the themes is presented below.

4.1. Theme 1: Factors Affecting Emotional Labor

Under Theme 1, the factors affecting the emotional labor behavior of employees were examined in six sub-themes: organizational factors, individual factors, demographic features, passenger type,

4.1.2. Individual Factors

Individual factors refer to the sincere feelings and behaviors of employees when performing emotional labor. Individual factors are generally similar to the sincere behavior dimension of emotional labor.

P2: *"We are actually obliged to do emotional labor, but I have internalized this situation."*

P4: *"We show our emotions as per our nature, not by force, and the emotions we show generally match the expectations of the organization from us."*

P5: *"We cannot convey emotions to the passenger without internalizing them."*

P8: *"We display emotional labor willingly, but sometimes we fake our emotions because the workplace demands it"*.

P9: *"I perform emotional labor for my own personal satisfaction, not because the organization demands it."*

P3: *"If you cannot perform emotional labor, you will be fired or you will have to leave yourself."*

Some participants stated that they exhibited emotional labor willingly, but that the emotional labor they showed coincided with the behaviors that the organization expected from them. In cases where emotions cannot be internalized, it has been observed that emotional labor is performed, even if unintentionally, by the organizational rules. As in P2's statement *"I internalized emotional labor"* participants' working time may be effective in the internalization of emotional labor. As Hochschild (1983) suggests, employees show emotional labor with sincere behavior in some cases. In this context, factors such as employees' feeling of well-being, internalizing emotions, liking their job, personal satisfaction, and the desire to please passengers were evaluated as individual factors affecting emotional labor. However, *"fear of dismissal"* was seen as an exceptional and negative individual factor affecting emotional labor.

4.1.3. Demographic Features

Emotional labor differs according to participants' gender, marital status, age, working time and personality traits; however, it was observed that there was no significant difference according to education level.

4.1.3.1. Gender

P1, P2, P9, P10 and P11: *"Women show more emotional labor than men."*

P10: *"Women are better at emotional labor than men. Men cannot show the kindness that women show. Women are more developed in terms of body language and emotional intelligence. Men are a little more straightforward in this regard."*

P3 and P4: *“Men are more successful in emotional labor than women because they perform more easily due to their nature.”*

P11: *“Being a cabin crew member and doing emotional labor suits women better. However, men are indispensable in the cabin in terms of emotional labor in jobs that require strength or in situations where you need to be stricter (for example, handcuffing an unruly passenger).”*

P6, P7 and P8: *“There is no difference between men and women when it comes to emotional labor.”*

Most participants think that women are more successful than men in emotional labor. However, some participants stated that there was no difference in emotional labor behavior according to gender. When the literature is examined, the concept of emotional labor is associated with feminine behaviors. According to Hochschild (1983), women engage in more emotional labor behavior than men. The friendly attitudes and attractive appearances of female employees who establish close relationships with customers are considered sexy or romantic by men. For this reason, businesses expect their female employees to show more emotional labor (Türkay et al., 2011).

4.1.3.2. Age and Working Time

P2, P4, P5, P6, P7, P8, P9 and P10: *“People gain experience as age and working time increase, and experience positively affects emotional labor.”*

P2: *“Some of our young friends get stressed when they encounter problems and have difficulty communicating. You will not have any difficulties with experience.”*

P8: *“Age affects emotional labor, of course your perspective changes over time. Experienced people are more successful.”*

P11: *“I think age affects emotional labor. In recent teams, young colleagues may experience communication problems with their superiors and may oppose everything. If the employee has gained experience in different sectors, he does his job well, but those whose first job is as a cabin attendant may have difficulty.”*

Participants seem to agree that as employees' age and working time increase, their professional experience also increases, and this reflects positively on their emotional labor behaviors. In the study conducted by Doğan and Sıgır (2017), employees exhibited more superficial behavior in the first years of their career; it has been determined that they display more in-depth behavior in their later years with age and experience. Emotions and behaviors of employees vary according to gender and age, as well as the sector, institution and work experience they work in (Kaya & Özhan, 2012). Similarly, in his study, Çolak (2022) concluded that cabin crew with six years or more of experience are more successful in exhibiting emotional labor.

4.1.3.3. Marital Status

P2: *“Married people are more understanding, and those with children are more sensitive towards passengers with children.”*

P4: *“I can say that married employees tend to find middle ground with passengers.”*

P6: *“I think that married people with children exhibit more emotional labor. They are more helpful and responsive to passengers.”*

P7: *“Marital status affects emotional labor. Because employees who are married and have children are more sensitive to passengers who are mothers and try to help them.”*

It has been observed that the emotional labor behavior of cabin crew varies according to marital status. Compared to single employees, it has been revealed that married employees and especially those with children behave empathetically towards passengers who are like them and, in this context, exhibit more sensitive, helpful and understanding behavior.

4.1.3.4. Personality Traits

P3: *“Most of my friends who resigned were unsocial, introverted and lacking empathy.”*

P6: *“In terms of emotional labor, cold-blooded, sincere and practical personality traits are more suitable for cabin crew.”*

P8: *“Extroverted, attractive, psychologically resilient, prone to team work, social and friendly people are preferred for cabin crew positions.”*

P11: *“As a personality, someone who is talkative, extroverted and perceptive is suitable for a cabin crew position. People with limited perception cannot do this job.”*

It has been observed that especially employees with extroverted and social personality traits are more suitable for performing emotional labor. Extroverts; while exhibiting personality traits such as being friendly, talkative, easy to communicate, sincere, prone to team work, and strong in social aspects; Introverts, on the other hand, are individuals who are calm, shy, live in their own inner world, and have less social interaction with people (Çoban & Deniz, 2021).

4.1.4. Passenger Type

It was seen that passenger type had an important impact on the emotional labor of cabin crew. The sub-theme of passenger type was examined in two categories special and unruly passengers. Passengers with a fear of flying and children/babies, as well as disabled, sick, and elderly passengers, are considered special passengers since they need assistance during air travel. Additionally, passengers of certain destinations (Russian and Indian) were also considered special passengers. Passengers who are drunk, taking pills, stressed, swearing, VIP, business/economy, demanding, famous, government official, tired, and group are considered as unruly passengers. Unruly passengers are passengers who

disturb the peace of other passengers, damage items inside the aircraft, and disrupt the flight order (Schaaf, 2001).

4.1.4.1 Special Passengers

P4: *On flights to Russia, we are tired of Russian passengers asking for more than one drink at the same time. On flights to India, passengers have special requests. For example, they want vegan food."*

P5: *"Mother cabin attendants are emotional and nurturing. She takes better care of the passengers. When she sees a passenger with a baby, she wants to bring him food."*

P8: *"We show more emotional labor to passengers who are afraid of flying or have children."*

P10: *"We touch people's hearts. We are not just service people. We have elderly, sick, children, babies and disabled passengers. We immediately notice these passengers when they enter the plane and help them."*

4.1.4.2 Unruly Passengers

P3: *"The passengers I have difficulty performing emotional labor with are drunk passengers because we cannot communicate with them."*

P5: *"Trying to deal with a unruly passenger makes us tired. For example, drunk and stressed passengers challenge me."*

P7: *"A foreign passenger, who probably took pills and was swearing, started attacking the surroundings and was handed over to the police upon landing."*

P6: *"Groups are becoming more exuberant. They need to be together and talk. Therefore, they disturb other passengers."*

P3: *"Hajj passengers, among the group passengers, may not eat some foods because they are haram. This makes us sad. We also empathize. This can increase our workload and we get stressed. Also, Hajj passengers, create problems in seat selection."*

P10: *"Football player groups are tiring. Their demands never end."*

P8: *"I can say that I have difficulty in performing emotional labor for VIP passengers."*

P11: *"Famous passengers challenge us in terms of emotional labor. Because they act like waiters towards us when communicating. VIP, government officials and business passengers do not want to give up their bags. We tell them the flight rules."*

P6: *"Business passengers are a little more controlled. You make jokes in economy class and they laugh. In business class, you can think twice about whether he will laugh if I tell a joke. So we are more careful business class"*

P8: *“When the economy passenger gets on the plane, he wants something immediately. But he can complain by saying it didn't come right away. For example, he asks for water during boarding. I say I can't give him water right now, but he insistently wants something that doesn't exist.”*

P2: *“When I compare business and economy class, economy class challenges me even though we treat both classes the same.”*

P8: *“I would like to share with you a moment when I had difficulty doing emotional labor. A passenger died on the plane, and while we were upset about it, other passengers asked for food. When I went towards the back, I saw a passenger watching a porn movie. Facing such a situation on an airplane with a funeral, I can say that it forced me in terms of emotional labor by causing me to be confused about which emotion I should feel.”*

Although specific emotional patterns need to be shown to passengers in the aviation industry, it has been observed that the emotional labor behaviors of cabin crew towards special and unruly passengers vary. The cabin crew exhibits more sensitive and helpful behavior towards special passengers. These behaviors stem from the fact that special passengers are more in need of help than other passengers and the cabin crew empathizes with them. However, passengers, who are intoxicated and not conscious as a result of using drugs such as alcohol, medicine, and pills, act outside the rules and force the employees in the context of emotional labor. IATA (2015) grouped unruly passenger behavior into four groups according to their levels. In this context, many unruly passenger behaviors are depending on their level, such as verbal attacks, failure to comply with the flight crew's instructions, discourteous behavior, unreasonable demands, suspicious behavior, physical attack, sexual harassment, threats of violence and damage to flight equipment.

Participants stated that they could not communicate with drunk passengers or that they had difficulty communicating with them due to their excessive behavior. Passengers who try to relax or overcome their fear of flying by drinking alcohol may become drunk after a while and react more emotionally in the challenging flight environment (Fogg, 2001). In addition to drunk passengers, the difficult-to-control behavior of group passengers due to their desire to communicate with each other and the demanding and unethical behavior of the crowded economy class put a strain on the cabin crew. It has been observed that VIP, business, celebrity, and government official passengers do not comply with the rules due to reasons such as their social status, seat class, or ego satisfaction, and cabin crew members act more carefully when communicating with these passengers and are under stress in terms of emotional labor. However, it has been determined that tired passengers, behave sexually, and lack empathy also act unruly.

4.1.5. Physical Work Environment

Since people spend most of their daily lives in the work environment, the physical characteristics of the work environment directly affect employees' behaviors such as job satisfaction, organizational

commitment, and individual performance (Akça & Yurtçu, 2019). In this context, it has been observed that the physical work environment of cabin crew affects emotional labor.

P1: *“The cabin environment affects our emotional labor. A narrow workspace can be uncomfortable. Working under pressure for a long time can trigger migraine pain.”*

P3: *“Physical conditions such as temperature, light, and noise affect our emotional labor. Not feeling comfortable in the physical environment can cause us to experience physical fatigue and decrease our capacity, which in turn can be reflected in our emotions.”*

P4: *“Working on small planes rather than large planes makes us tired. If the plane is small, we have to lie down bent over and can not rest. We do not reflect this situation on the passenger, but it affects us.”*

P8: *“Pressure causes physical fatigue. When you get physically tired, it becomes difficult to perform emotional labor.”*

P9: *“In my opinion, noise and hot weather are important physical factors that affect emotional labor.”*

It was observed that physical factors in the working environment such as narrow space inside the aircraft, temperature, light, noise and pressure affected emotional labor. Since the physical environment in which cabin crew work in aviation industry is different from other aviation employees, the problems they experience are also different. For example, vibrations felt during aircraft takeoffs and landings, confined spaces, and turbulence can lead to hearing, balance, musculoskeletal system problems, and stomach and circulatory problems (Hava & Erol, 2023; Nazlıoğlu, 2014). However, depending on the physical conditions in the cabin, even if cabin crew are unhappy, sick or tired, they are expected to be friendly towards passengers and exert emotional labor (Çolak, 2022).

4.1.6. Content of the Flight Task

According to research findings, it has been observed that the content of the flight task affects the emotional labor behavior of cabin crew. This sub-theme was examined in two categories as task type and critical and urgent phases of the task.

4.1.6.1. Flight Task Type

P3: *“On long-distance and night flights, getting up at certain times (around 3-4 am), getting dressed and starting the service causes fatigue. This negatively affects emotional labor.”*

P4: *“Our successive night flights negatively affect our sense of belonging.”*

P6: *“I have difficulty performing emotional labor during night flights when I am sleepless for more than 24 hours. The reason for this situation is that lack of sleep causes mood disorders and stress in me.”*

P11: *“The number of services is increasing on flights across the ocean. In this case, it is difficult for us to provide continuous service and meet the requests of the passengers. Sometimes we may make a sloppy service due to fatigue.”*

4.2.1. Organizational Results

P1: *“My friendly face will increase passenger satisfaction. This means loyal passenger s and profit for the company.”*

P3: *“If emotional labor is performed well, organizational performance, passenger numbers and satisfaction increase.”*

P5: *“Our behaviors towards passengers is an advertisement for our company”.*

P6: *“We are the showcase of our company. Our good behavior causes passengers to fly with us again and attracts others to our company.*

P9: *“The emotional labor we show becomes an advertisement for the business. Advertising means more passengers and businesses gain.”*

P10: *“Passengers make the company happy, and company makes the employees happy. The passenger you make happy brings new passengers. This is the best advertisement.”*

As participants see themselves as the visible face of the company, they think that positive behaviors in terms of emotional labor will bring new and loyal customers to the company and create a positive organizational impression. Moreover, participants seem that emotional labor will increase organizational profitability, passenger satisfaction, and numbers. Customer satisfaction in the service sector is important for the survival of companies. To ensure customer satisfaction, customers' demands and expectations must be met (Türk, 2005). While human resources can be effective in increasing the competitive advantage and market share of companies, they also provide benefits to customers in terms of their loyalty and satisfaction to the company. In addition, with intense communication in service sectors, people and their emotions become more important (Aslan, 2023; Steinberg & Figart, 1999).

4.2.2. Individual Results

In addition to the organizational results of emotional labor behavior, it has also been observed that it has negative and positive individual results on cabin crew.

4.2.2.1. Negative Results

P1: *“When performing emotional labor, sometimes you need to leave the problems in your private life behind. Suppressing emotions can sometimes be difficult for us and we may experience emotional outbursts.”*

P2: *“Performing emotional labor makes me feel nervous.”*

P3: *“I experience stress along with negative thoughts while performing emotional labor. Especially demanding flights make me tired.”*

P4: *“Working like a robot without rest during busy flights makes me feel worthless and reduces my work motivation. Frequent night flights negatively affect my sense of belonging. Also, when there are*

passenger tensions and we cannot manage this situation, constantly being cheerful creates internal conflict in us.”

P6: *“When passenger criticizes you and goes beyond measure, you normally respond even if you are outside. But you can't say anything because he is a passenger. Then I contradict myself. This situation creates stress for me afterwards. After all, I can't be like myself.”*

P7: *“Negative experiences create mood disorders, stress and burnout.”*

4.2.2.2. Positive Results

P1: *“Your work becomes ingrained in your character after a while. Thanks to my job, I am always smiling.”*

P3: *“I have become more patient thanks to my job.”*

P4: *“Exerting emotional labor as part of our job provides us with conflict management and problem-solving skills.”*

P5: *“This job contributes to my self-efficacy, conflict management and problem-solving skills. These skills contribute to us both in private and business life.”*

P6: *“Emotional labor provides skills such as empathic thinking, practicality, anger management, calmness, being proactive and crisis management over time.”*

It is seen that the inability to show real emotions toward passengers, and the effort to constantly be cheerful and suppress emotions cause many negative situations such as emotional disharmony, internal conflict, burnout, and stress in cabin crew. Although performing emotional labor causes some positive results for companies, deep role behaviors of cabin crew members, compared to their surface role behaviors, may have undesirable consequences such as individual burnout and negative work attitudes (Grandey, 2000). In some studies, it has been observed that surface role behavior increases the intention to quit (Yürür & Ünlü, 2011; Çelik & Atilla, 2019) and emotional exhaustion (Chau et al., 2009; Köse et al., 2011). However, it has been observed that emotional labor does not always cause negative results on cabin crew, but also produces positive results. Basic communication skills such as patience, practical thinking, self-confidence, solution focus, and crisis management gained through emotional labor positively affect the social interactions of employees in their private lives.

5. DISCUSSION AND CONCLUSION

Emotional labor is an important professional employee behavior that must be exhibited to create satisfaction in customers and to create the desired positive organizational impression, especially in the service sector. Organizations expect their employees to exhibit professional behavior according to the rules they set, taking into account their goals and the people they serve. In this study, which was conducted with a qualitative research method on cabin crew in aviation, the factors affecting the

emotional labor behavior of the participants and the results of emotional labor were tried to be examined in depth. As a result of the content analysis, the research findings were collected under two main themes: factors affecting emotional labor and the results of emotional labor.

When the theme of factors affecting emotional labor is examined; it has been observed that organizational factors, individual factors, demographic features, passenger type, physical work environment, and the content of the flight task affect the emotional labor of cabin crew. Organizational factors (%11.4) emerge as a key factor behind cabin attendants' emotional labor. Organizational factors such as organizational rules, passenger satisfaction, and professionalism lead employees to emotional labor behavior, so it is possible to say that employees' surface and deep emotional labor behaviors are greatly affected by organizational factors. According to Seçer (2007), emotional labor in the workplace occurs when employees create some emotions in service recipients through verbal or non-verbal means, as required by an employment contract.

Individual factors (%10.8) refer to the behaviors that cabin crew exhibit willingly and sincerely, regardless of organizational factors, for reasons such as liking their job, internalization, and personal satisfaction. Individual factors can generally be seen as factors that contribute to cabin crew's voluntary display of emotional labor and overlap with the sincere behavior dimension of emotional labor (Hochschild, 1983). However, fear of dismissal has also emerged as a negative individual factor affecting emotional labor.

Participants' gender, age, working time, marital status and personality traits (%13.8) have an impact on emotional labor; However, there was no significant difference in emotional labor according to education level. Most of the participants stated that women show more emotional labor than men because they are more patient, detail-oriented, emotional, kind, and empathetic. The fact that female employees are more successful in showing deep emotional behavior than men causes women to be more preferred in the service sector (Oğuz & Özkul, 2016; Tekin & Akgemci, 2019; Hochschild, 1983). It has been observed that as age and working time increase, employees are more successful in performing emotional labor as their professional experience increases. According to Hochschild (1983), employees can show their emotions more easily in older ages. In addition, it has been observed that married cabin crew members are helpful and friendly towards passengers who are also married and have children, and employees with extroverted, talkative, practical, and perceptive personality traits are more successful in performing emotional labor.

Passenger types (41.5%) were observed to be an important factor affecting the emotional labor behavior of cabin crew due to the continuous social interaction between passengers and cabin crew and the service they provide to passengers. Some passengers are seen as special passengers by the cabin crew because they are afraid of flying, are sick, have children, or are elderly, and the cabin crew acts more understanding and helpful towards these passengers. However, it has been observed that unruly

passengers who are drunk, drugged, dissatisfied, demanding, traveling in groups, and disturbing other passengers, who risk flight safety and security, have an extremely negative impact on the emotional labor behavior of cabin crew. It has been revealed that cabin crew has to perform more emotional labor, especially against drunk and group passengers. Unruly passengers can prevent the flight crew from performing their duties with verbal or physical attacks (Çoban, 2022; Nase & Humphrey, 2014).

According to research findings, physical factors (%6) such as narrow space inside the aircraft, noise, temperature, light, pressure, humidity, cabin air quality, and vibration affect the emotional labor performance of employees. The physical conditions of the working environment have significant effects on the physical and mental health of employees (Sundstrom et al., 1994). Pressure and sunlight exposure during flight may cause concentration and performance problems. Low humidity levels can cause respiratory illnesses. The cabin crew's shift work schedule, uncontrollable situations, conflicts, passenger demands and needs, and constant cheerfulness, when combined with employees' problems in the physical environment, can cause stress and low performance of employees (Schmitz-Felten, 2022; Michie, 2002). Finally, the content of the flight task (%16.5) is another factor that affects emotional labor. In particular, night and long-distance flights cause cabin crew to interact with passengers for longer periods, increase the number of services, and cause physical fatigue. Physical fatigue and long-term interaction with passengers reduce employees' emotional labor performance. In addition, it has been observed that critical and urgent phases of the flight task, such as takeoff, meal service, turbulence, and landing, put a strain on cabin crew in terms of emotional labor.

It has been revealed that emotional labor has organizational (%36.6) and individual (%63.4) results. It has been observed that the emotional labor behavior exhibited by cabin crew, who are seen as the visible face of the organization, within the framework of organizational rules, causes positive organizational results such as an increase in organizational profitability, a positive organizational impression, passenger satisfaction, and an increase in the number of loyal and new passengers. It has been observed that emotional labor has some negative and positive individual results on cabin crew, as well as positive organizational consequences. The fact that cabin crew are always friendly to the passengers and suppress their emotions within the framework of organizational rules causes negative situations such as internal conflict, emotional disharmony, stress, and burnout in the crew. Studies on emotional labor have shown that emotional labor is positively related to variables such as burnout, job dissatisfaction, stress, and intention to quit (Gürel & Bozkurt, 2016; Çelik & Atilla, 2019; Chau et al., 2009). Although emotional labor has negative individual consequences, it has also been observed that it leads to positive results in the communication skills of cabin crew.

When the research findings were examined in general, it was seen that organizational factors were the main factors that directed the emotional labor behavior of cabin crew. Although this finding appears to be compatible with the relevant literature (Hochschild, 1983; Ashforth & Humphrey, 1993; Grandey, 2000), the emotional labor behavior of cabin crew is also directly affected by individual

factors, demographic features, passenger type, physical work environment and the content of the flight task has been seen. In this context, apart from organizational expectations, different factors in the workplace also affect the emotional labor behavior of employees. These findings add unique value to the study, unlike the literature. Looking at the literature, it is seen that emotional labor has positive organizational consequences and negative individual consequences on employees (Gürel & Bozkurt, 2016; Çelik & Atilla, 2019; Chau et al., 2009). These results were also obtained in this study. However, the positive contribution of emotional labor to the communication skills and personal development of flight attendants over time is thought to increase the unique value of the study, as a different finding emerges from the research.

Within the scope of the research findings, some suggestions can be made to managers and employees. First of all, it should not be forgotten that emotional labor is a concept that has bright and dark sides both organizationally and individually. Since the research shows that employees internalize emotional labor behaviors as their age and working time increase and they can regulate their emotions more easily, organizations can develop and apply methods to measure the emotional labor ability of new personnel to join the organization during the recruitment processes. In addition, the unwritten rules for emotional labor behavior that should be exhibited in line with organizational expectations can be conveyed to employees more clearly, specifically, and concretely through organizational training. Organizational and psychological support can be provided to employees through arrangements to reduce the adverse effects of emotional labor on workers.

The fact that this study was conducted in aviation by sampling only a certain number of cabin attendants and using a qualitative research method may pose a limitation in terms of the generalization of the research results. Therefore, to overcome these limitations, the concept of emotional labor can be studied with different variables and with qualitative, quantitative or mixed methods on other employee groups of the service sector that communicate intensively with customers. The relationships between job insecurity, fear of dismissal, and emotional labor can be investigated in this context. It is thought that the research results will contribute to the literature on the concept of emotional labor and shed light on future studies on this concept.

Ethics committee approval for the study was obtained from the İstanbul Gelişim University Ethics Committee on October 20, 2023, with document number 2023-08.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that they all equally contributed to all processes of the research.

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Accessibility of COVID-19 Vaccines in African Countries: A System Dynamics Model Examining Income, Logistics, and Governance

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Abstract

To combat the COVID-19 pandemic, pharmaceutical companies, biotech companies, national governments, and universities have jointly developed a variety of vaccines. After this stage, widespread and effective vaccination on a global scale has become the most crucial aspect in the fight against the pandemic. The discovery of vaccines has brought up the issue of how to deliver them quickly and fairly to those living in underdeveloped countries. Vaccination encompasses not only the medical aspect but also the concepts of accessibility, availability, equitable, fair, and rapid distribution as a whole. The main theme of our study is to comparatively highlight the impact of factors other than the medical aspect of vaccination on vaccination, specifically within the context of the African continent. African countries particularly have faced the most problems in accessing and distributing vaccines. This study aims to identify the barriers to the delivery of the Covid-19 vaccine to African countries. In this study, we analyzed the vaccine supply, governance index, and logistics infrastructure factors affecting access to vaccines in the context of various scenarios, using the system dynamics method. The findings of this study show that income level is the most significant variable. Additionally, improving logistics performance and infrastructure and governance index increase more equitable access to vaccines in African countries.

Keywords: Covid-19, Vaccine, Africa, System Dynamics, Logistics Infrastructure, Governance Index.



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Article Type	Application Date	Admission Date
Research Article	January 17, 2024	December 14, 2024

1. INTRODUCTION

Vaccination stands as one of the most crucial tools in the battle against the COVID-19 virus. Some biotechnology companies, national governments, and universities have jointly developed various vaccines against the ongoing COVID-19 pandemic since December 2019. After the confirmation of the safety of the COVID-19 vaccine through research findings, two primary challenges were encountered. Firstly, there was the issue of gaining public acceptance of the vaccine and addressing potential concerns. In order to address the first challenge, studies utilizing a behavioral approach were published (Saleska and Choi, 2021). Subsequent to the approval of COVID-19 vaccines, vaccine logistics emerged as a universal problem. Global demand existed in the face of limited supply (Yamey et al., 2020). The limited vaccine supply brings about new challenges both between countries and within a country (Roope et al., 2020). It has been demonstrated that making swift political decisions is beneficial for the fair and egalitarian distribution of the COVID-19 vaccine, which proves to be a significant obstacle against the epidemic (Bollyky TJ et al., 2020). Governments without a clear plan may be compelled to make rapid decisions favoring groups with strong political connections instead of creating open, consistent, evidence-based guidelines for the fair and egalitarian distribution of the COVID-19 vaccine. Those at "personal risk" are prioritized in vaccine distribution, for example, frontline healthcare personnel. Additionally, among individuals at risk, such as bus drivers, they may be included in the priority group (Bonaccorsi et al., 2020).

After the vaccine development studies were completed, discussions began on how to deliver the vaccine to people quickly and fairly. While 65.4% of the world's population received at least one dose of the COVID-19 vaccine, only 15.7% of people in low-income countries received at least one dose (Ourworldindata, 2022). The World Health Assembly announced that 10% of each country's population vaccinated by the end of September 2021. Additionally, they aimed that 40% of each country's population will vaccinate by end of 2021. Although almost 90% of high-income countries achieved the goal, many African countries still did not reach the target. By the end of December 2021, 7 African countries with relatively smaller populations (Seychelles, Mauritius, Morocco, Tunisia, Comoros, Botswana, and Cape Verde) had met the 40% target. According to the new target set by WHO, 70% of the population of all countries is targeted to be vaccinated by June 2022, but this target may not be reached in African countries (BBC, 2021; Idris et al., 2022; Lucero-Prisno et al., 2021; WHO, 2022a). In September 2021, the World Health Organization (WHO) set an ambitious global target. The UN health agency has called for 70 percent of the global population to be vaccinated by mid-2022. At this point, just over 3% of people in low-income countries have been vaccinated with at least one dose, compared to 60.18% in high-income countries. Six months later, the world hasn't even come close to achieving that goal. The total number of vaccines administered has increased dramatically, but so has the inequality in distribution: of the more than 10 billion doses given worldwide, only one percent are administered in low-income countries.

Although vaccination is a medical intervention, without effective logistical planning, a successful vaccination campaign is impossible (Duijzer et al, 2018). Evelot Duijzer and colleagues, in their study, focus on the following three priorities of the World Health Organization as an operations research for a successful vaccination campaign related to Operations Research/Operations Management (OR/OM); 1-Products and packaging, 2-Immunization supply system efficiency, 3-Environmental impact of immunization supply system. In this context, vaccine packaging and products should be designed with suitable specifications, taking into account the needs and constraints of countries. The efficiency and agility of the vaccine supply system should be maximized by integrating it with other supply systems. This way, leveraging the synergy of other systems and supporting continuous improvement should be aimed at minimizing environmental side effects.

The developed vaccines were first distributed to healthcare workers in hospitals and then to people in the high-risk group. However, vaccination of all citizens will take a long time. It should not be forgotten that many factors such as technical, political, and ethical are taken into account, especially in making such national and international decisions regarding health. In addition, it is possible to say that other parameters such as uncertainties, safety, and effectiveness are effective both in the short term and in the long term in the logistics planning of the developed vaccine. However, the success of a global vaccine campaign depends on the rapid production and fair distribution of pandemic-specific vaccines worldwide. The logistical requirements for the delivery of the vaccine are outlined below (Supply Chain 247, 2021):

The most important factor in vaccine distribution is cold chain capacity. For example, the Pfizer vaccine needs to be stored below -70°C . However, the logistics system is not ready to fulfill this condition. In addition, there is a lack of infrastructure suitable for both hot climate and cold storage in some parts of South America, Asia, and Africa. This brings along the problem of a cold supply chain. For example, vaccines will likely become unusable if cooling is not available due to a power outage. Vaccine storage volumes are insufficient in parts of South America, Asia, and Africa, with a total population of more than six billion people. One of the biggest challenges in vaccine logistics is expressed as the "last mile delivery" concept. Specially trained personnel are required for the distribution and delivery of vaccines to the final delivery address after they reach the destination country. Therefore, access to rural health centers is extremely difficult.

COVID-19 cases and vaccine figures for the African continent as of May 2022 are (WHO, 2022b; Worldometer, 2022): According to the latest United Nations estimates, the population of Africa is 1,402,414,173, the total number of deaths from COVID-19 is 170,709. The total number of COVID-19 cases is 8.390.054. Eleven percent of adults living in Africa are vaccinated.

If the necessary interventions and aid are not started for the continent regarding vaccines, Africa's disease burden will last longer than expected (Lucero-Prisno et al., 2021). It is possible to

indicate the reasons for the lack of vaccine supply and the effective distribution of vaccines inefficiently, especially in sub-Saharan African countries, as follows (Brookings, 2021; Economist, 2020; Idris et al., 2022; Lucero-Prisno, Ogunkola, Esu, et al., 2021; Lucero-Prisno, Ogunkola, Imo, et al., 2021; Mataba and Ismail, 2021; Ogunkola et al., 2020). Poverty has multiple and complex causes (Addae-Korankye, 2014). According to some politicians, it is poor because the former colonial powers want to keep it that way, not because of the choices made by African leaders. Others state that the cause of poverty is corruption or mismanagement. Besides that, Africa's infrastructure paradox and the lack of adequate financial resources for health infrastructure are among the causes of poverty. The private healthcare system is not developed, as financially advantaged people living in Africa prefer to travel abroad for health-related matters. 80 percent of infrastructure projects fail during feasibility and business planning. Foreign trade protective measures applied in many African countries, high customs taxes increase the cost of medical products and equipment. In addition, non-tariff barriers such as import procedures and customs procedures delay the delivery of critical medical supplies and equipment. Finally, border conflicts, civil wars, violence, corruption, lack of good governance, democracy, and an insufficiently trained workforce and practices related to patent rights are among the hidden factors that hinder vaccine access in Africa.

Research Question: To what extent and in what direction do income level, logistics performance, and governance index affect people's vaccine accessibility in global pandemics?

Numerous interconnected factors are crucial in effective and widespread response to global disasters. We believe that income level, logistics infrastructure, and governance index play highly significant roles in the battle against COVID-19, which forms the central theme of our study. Especially considering the income levels and vaccination statuses of African countries, it is anticipated that the income level of countries will have a more significant positive impact on vaccine supply compared to other factors. Income level is expected to be effective in vaccine accessibility through its role in vaccine distribution, whereas the level of development of logistics infrastructure is expected to influence vaccine access. It is also believed that a high governance index will be highly effective in ensuring fair and equitable vaccine distribution, which is crucial in disaster response in general.

This article focuses on vaccine supply, governance index, and logistics infrastructure affecting vaccine access in African countries. This study evaluates vaccine access, population vaccinated in 24 months, vaccine demand, and loss of life in Africa in the light of scenarios. By simulating the system dynamics model, the impact of vaccine supply, governance index, and logistics infrastructure on vaccine access in African countries will be estimated.

2. LITERATURE REVIEW

Numerous studies have been conducted on the effective implementation and widespread distribution of vaccination across society. Our study's main focus is on vaccination, and it categorizes

and elaborates on research concerning the impact of national income, governance index, and logistic performance and infrastructure on vaccination. The literature review section is organized into three main sections as follows:

2.1. The Relationship Between Vaccination and Income Level

One of the most significant factors affecting global vaccination is income level. An increase in national income will lead to higher healthcare expenditures. Consequently, an increase in the budget allocated to healthcare will have a positive impact on vaccination. Globally, it is observed that individuals living in high-income countries have easier access to vaccines compared to those in other countries. It has been observed that higher income is associated with better healthcare and better vaccination.

There are numerous studies that examine and investigate the impact of national income levels on vaccine accessibility. For instance, Masiva et al. (2018) adapted the standard conditional convergence model to incorporate variations in vaccination rates over time and across countries. They employed this modified model to project the macroeconomic gains derived from enhanced vaccination rates. Their findings revealed that increased investments in vaccination triggered by income growth yielded concrete economic benefits, which were linked to ongoing improvements. Basak et al. (2022), aiming to investigate the relationship between the GDP of various countries and vaccination rates, sought to explore how the model they developed operates at the continental level and examine the spatial distribution of progress in COVID-19 vaccination for all countries. They identified a strong linear relationship between per capita income and the proportion of vaccinated individuals in countries with a population of one million or more. Per capita GDP is responsible for a 50% variation in vaccination rates across countries. Furthermore, the global model was found to be applicable on every continent. It was observed that Rich Europe and North America were the most protected against COVID-19, while less developed African countries struggled with limited vaccination coverage. In a study conducted using the least squares method with data from 118 countries (Ngo et al., 2022), it was initially noted that authoritarian countries were slow in the vaccination process. However, their economic size facilitated vaccine supplies and directed them toward higher vaccination rates.

In a study examining vaccine hesitancy in China, conducted by Wang et al. (2021), a semi-structured face-to-face interview technique was employed with 92 Chinese individuals in 10 provinces following a predefined survey framework. It was suggested that trust, price, and recommendations influenced vaccination decisions. Additionally, it was observed that regions with higher per capita GDP had a higher belief in the benefits of vaccination.

MPhil et al. (2015), in their study examining the impact of vaccination on economic development, have argued that economic growth emerges only through the contribution of healthy individuals to the economy. Vaccination is considered a crucial factor in maintaining a healthy and

productive labor force. It extends individuals' working lives, thus increasing their productivity over a longer period. Therefore, it has the potential to directly influence economic growth.

2.2. The Relationship Between Vaccination, Logistic Performance, and Infrastructure

At the onset of the COVID-19 pandemic, many governments were initially unsure about how to proceed. They encountered numerous challenges, from the procurement of protective equipment to issues of equitable, fair, and rapid distribution. The logistical and infrastructure problems in the distribution of essential pandemic-fighting products were evident, and it was clear that similar challenges would arise in the vaccination process where the target population is the entire populace. Additionally, countries with strong logistics performance and infrastructure were better equipped to overcome these challenges early on.

It is expected that countries with strong logistics performance and infrastructure will demonstrate a highly successful performance in achieving widespread vaccination. In their study examining the factors to consider when preparing a successful COVID-19 vaccination program in African countries, Williams et al. (2021) focus on lessons drawn from solutions proposed for the challenges encountered in previous vaccination efforts. These considerations range from improving weak infrastructure for data management and identifying adverse events post-vaccination to addressing logistical challenges in vaccination campaigns and assessing financing options to generate demand for vaccine supply. In conclusion, the COVID-19 pandemic, despite causing disruptions in global life and destabilizing economies, has also provided global leaders with an opportunity to reassess the fundamental healthcare infrastructure, preparedness, and response capacity for health emergencies in their respective countries.

Examining the correct delivery of COVID-19 vaccines to the entire global population, Shretta et al. (2021) in their articles, highlight that the existing vaccine supply chains are meticulously coordinated arrangements involving numerous stakeholders and components. They have stated that to ensure global coverage for an estimated 15 billion doses, it would require up to 200,000 pallet shipments and 15 million deliveries across various supply chains, in addition to 15,000 cargo aircraft flights. Developing a specific supply chain for COVID-19 vaccines could potentially have adverse effects on other supply chains.

2.3. The Relationship Between Vaccination and Governance Index

Democratic countries, under the condition of controlling other factors, tend to carry out vaccinations more rapidly compared to authoritarian countries. While democratic countries also grapple with vaccine hesitancy within their own borders, they have been observed to be more successful in vaccinating large segments of their populations compared to authoritarian nations (Ngo et al. 2022). However, there are studies that argue the opposite. Takshi Aida and Masahiro Shoji have proposed that there is no data to support the impact of the national governance index on the delivery of vaccines to

citizens in developing countries. They have created a model to examine the relationship between the national governance index and vaccination in developing countries. This model, encompassing all countries, was compared with a model comprising non-OECD countries. As a result, contrary to their claims, it was found that the relationship between the governance index and vaccination is stronger in the non-OECD sample (Shoji and Aida, 2021). Baghbanzadeh et al. (2022) conducted a global analysis with the aim of examining the relationship between COVID-19 country-level morbidity and mortality data, vaccination, and the national-level governance index. They attempted to predict the morbidity and mortality of COVID-19 based on national governance index indicators (corruption index, transparency and accountability, political stability, and absence of violence and terrorism) and officially reported COVID-19 national data (cases and deaths per capita, and testing), as well as vaccination coverage. As a result, a strong relationship was observed between the national governance index and COVID-19 data. Countries were divided into three categories: politically stable countries, average countries, and less stable countries. According to the multivariate regression, politically stable countries reported more cases, more deaths, more testing, and more vaccination data compared to the other country groups. Politically less stable countries reported less data in all categories compared to countries in the other group.

Benati and Coccia (2022) conducted a global analysis by applying Independent Samples T-Test to examine the relationship between COVID-19 vaccinations and public governance. Analyzing over 110 countries worldwide, they provided evidence of a relationship between high and low levels of vaccination and indicators of public governance. The findings suggest that high-level governance can support the better functioning of the healthcare system.

3. MATERIALS AND METHODOLOGY

3.1. Model and Data Set

We analyze vaccine access in African countries with a system dynamics modeling approach. The system dynamics modeling helps to understand the behavior of complex systems over time. It observes the movement of complex problems in time by using the mathematical modeling method. Mathematical models are the core of system dynamics. This method was developed by Jay W. Forrester at MIT in the 1950s for understanding the behavior of industrial systems. This method represents the behavior of the system with various symbols within the framework of certain principles (Forrester, 1961). It contributes to understanding the complex relations not only in engineering but also in the social sciences, education, and communication to understand complex relationships.

The system dynamics method includes the simulation approach, cause-effect relationships, feedback loops, stock and flow diagrams, equations, and continuous simulation. It depends on 'information feedback theory' (Saysel et al., 2002).

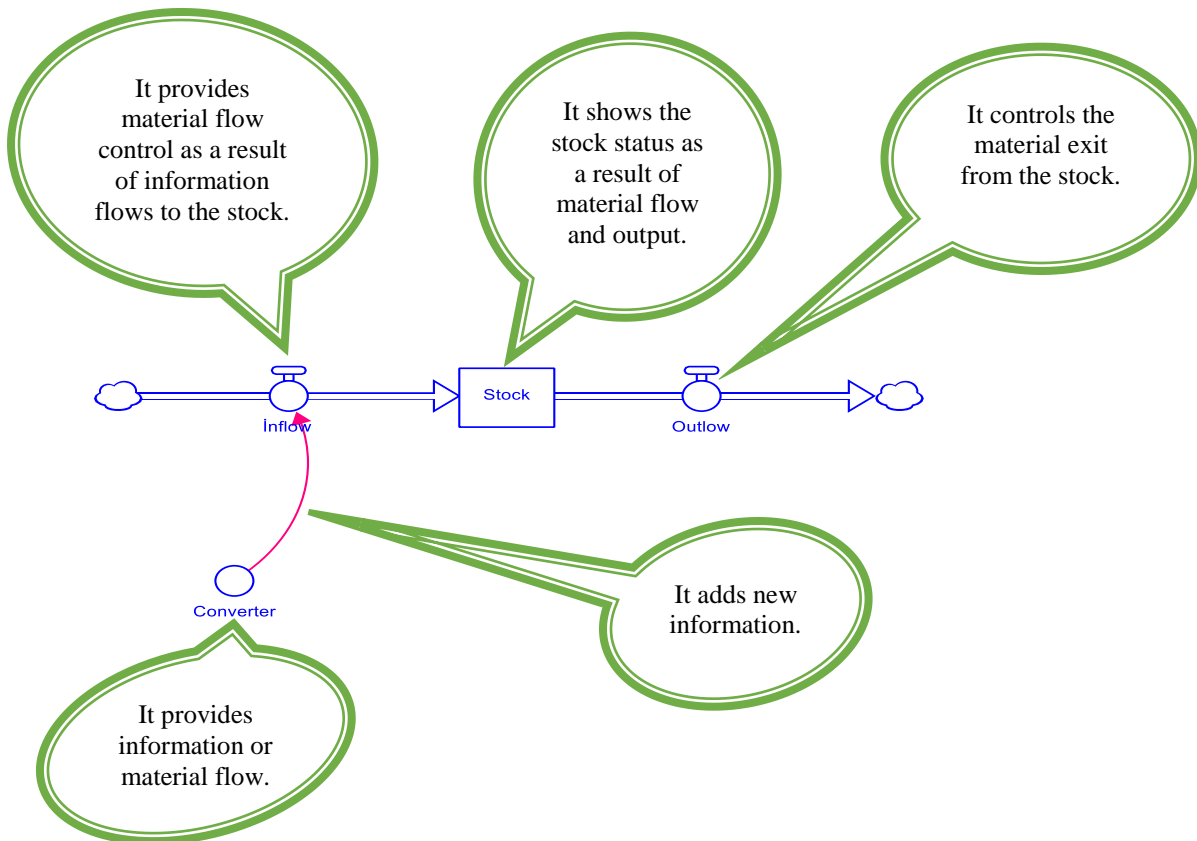
Cause and Effect Relationship: It provides understanding of cause-and-effect relationships between variables by modeling.

Feedback Loops: One-way causality between variables is insufficient to explain dynamic relationships. Circular causality with feedback is the main element that gives dynamism to the system.

Stock and Flow Diagrams: System dynamics modeling also illustrates the mutual and complex connections and feedback loops in the system by showing the accumulations in the system and the effects that cause these accumulations to decrease and increase over certain periods of time.

Equations and continuous simulation: In system dynamics, mathematical equations determine interrelated behavior measures of system variables. It provides a continuous simulation by repeating these behavior patterns at certain time intervals. Continuous simulation also helps to understand the movement of the system and to develop policy.

Figure 1. System Dynamics Modeling Approach Working Chart and Elements



In Figure 1, a system with all its elements is modeled and simulated with the system dynamics approach. To understand the vaccine access problem in African countries, a simulation model was created with the system dynamics approach to propose solutions to the vaccine access problem in African countries by using the system dynamics approach. The data used in the model are taken from databank.org, World Bank, ourworldindata.org, freetradezone.africa.org and WHO data. In the light of

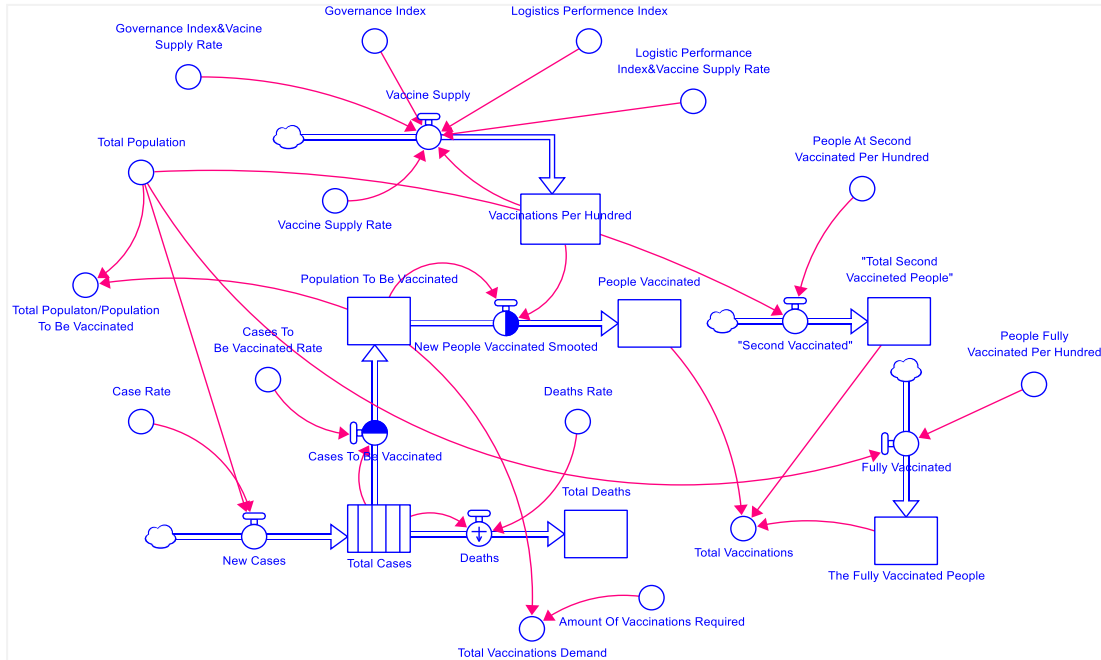
the data obtained from these sources, the initial data for the stock variables and other necessary ratios were calculated and used in the model.

3.2. Methodology

In this study, the system dynamics simulation model, which was created to examine the effects of different variables on the access problem of COVID-19 vaccines in the African continent, was created with the help of the Stella computer-based package program. Stella consists of three main layers: the high-level map layer, the model building layer, and the equation building layer. First, the main system and subsystems were created in the top-level map layer. Then, feedback loops where stock and flow variables are placed are created in the model building layer. This layer is essentially the layer where the skeleton of the system is created and the direction of the relationship of the variables with each other is determined. Finally, with the help of mathematical equations, the degree, amount, and ratio of the relationship between the system variables were determined in the equation layer. Thanks to the equations created in this layer, the model gained vitality and dynamism.

In this study, the main system was created by considering the vaccination sub-model, population sub-model, governance index, vaccine supply and logistics performance sub-model and Covid-related loss of life sub-models in a holistic framework.

Figure 2. Availability Model of COVID-19 Vaccines in African Countries



The Figure 2 displays the model of the vaccine distribution system in African countries using the dynamic systems approach. As seen in the diagram, the population of Africa, logistical infrastructure, countries' income levels, and the governance index are depicted as stocks and flow variables to create the model illustrating the connection between vaccination and stock and flow variables in African

countries. There are many factors that affect COVID-19 vaccine access, such as communication, culture, geographical structure, local and national dynamics, and beliefs. However, to determine the limits of the model we created, the model was created by taking the variables of governance index, logistics index and vaccine supply into the main axis, among the other factors affecting vaccine access. The governance index is an index that considers peace/security, democracy/laws, human rights/participation, sustainable development, and human development as a whole. The effect of this index on the vaccine; The average of the world governance index was calculated, then the average of vaccination in the world was calculated and the rate of vaccination per governance index was used in the model. Logistics performance index is calculated by calculating the world average from the World Bank data with the same method; The effect of average availability of vaccines on the average worldwide vaccine access was found and used in the model. Vaccine supply was also calculated using the same method.

Table 1 presents the calibration results of the model we created. The calibration of the model was performed using the optimization tool integrated into the package program we employed.

Table 1. Calibration Results

Method	recombine_type	f	crossover_type	tolerance	generations	pop_size	cr	k	seed
Differential Evolution	rand	0.6	bin	0.001	10	20	0.2	1	0
Payoff:	Payoff								
Action	minimize								
Element	Case Rate	Governance Index & Vaccine Supply Rate		Logistic Performance Index & Vaccine Supply Rate			Vaccine Supply Rate		
Weight	auto	auto		auto			auto		
Comparison Variable	Case Rate	Governance Index & Vaccine Supply Rate		Logistic Performance Index & Vaccine Supply Rate			Vaccine Supply Rate		
Comparison Run	Run 1	Run 1		Run 1			Run 1		
Comparison Type	Squared Error	Squared Error		Squared Error			Squared Error		
Comparison Tolerance	0	0		0			0		
Parameter:	Governance Index & Vaccine Supply Rate		Logistic Performance Index & Vaccine Supply Rate			Case Rate	Vaccine Supply Rate		
min_value	0		0			0	0		
max_value	1		1			1	1		
Payoff									
	min		max						
Initialization	614.4399357		58200.02012						
Generation 1 of 10	526.603966		44104.35083						
Generation 2 of 10	526.603966		44104.35083						
Generation 3 of 10	263.3132138		44104.35083						
Generation 4 of 10	263.3132138		44104.35083						
Generation 5 of 10	255.1793516		25243.30048						
Generation 6 of 10	255.1793516		25234.09927						
Generation 7 of 10	255.1793516		25216.66545						
Generation 8 of 10	255.1793516		25204.54352						
Generation 9 of 10	255.1793516		25204.54352						
Generation 10 of 10	236.938059		4592.107466						
	Governance Index & Vaccine Supply Rate	Logistic Performance Index & Vaccine Supply Rate		Case Rate	Vaccine Supply Rate		Payoff		
After 10 generations	0.900225786	0.000456622		0.03030966	0.030928398		236.9		

As shown in Table 1, the calibration of the model was conducted by us using the differential evolution method.

The model, which was created on the axis of the problem of accessing COVID-19 vaccines in African countries, was calibrated through the optimization added to the Stella program, since calibration is a type of optimization. Then, the values calibrated in the model were used. Then, various scenario trials were conducted on the system dynamics simulation model, which was created and calibrated to find a solution to the problem of accessing COVID-19 vaccines in African countries.

3.3. Limitations of the Model

The model for the availability of COVID-19 vaccines in Africa has been developed by considering the continent as a whole. However, the national income, logistical infrastructure, and governance indices of the countries vary significantly. Therefore, the data used in the model and the results obtained do not reflect all African countries in a homogeneous manner.

Many variables influence COVID-19 vaccination, such as traditions, religion, healthcare infrastructure, cultural structure, geographical features, physical infrastructure, and human resources. However, our study examined the impact of only three variables on vaccination, thus ignoring the effects of other factors.

In African countries, lifestyle, cultural structure, geographical barriers, and governance gaps make it challenging to accurately record data on population, births, deaths, and vaccinations. Consequently, the continent-wide average data was used in the COVID-19 vaccine availability model for Africa.

3.4. Scenario Trials

In this study, which is based on examining the access to COVID-19 vaccines in African countries in the main axis of governance index, logistics performance and vaccine supply, scenario trials are also built on these three variables. Here, three different sub-scenario experiments for each variable will be made and in the light of the findings obtained, which variable will be examined to what extent and how it affects vaccine access.

To examine the factors influencing vaccine distribution in African countries, scenarios depicted in Table 2 have been created.

Table 2. Scenario Table

Scenarios	a-Status Quo	b-World	c-South Africa
Scenario-1 (Governance Index)	Scenario-1/a	Scenario-1/b	Scenario-1/c
Scenario-2 (Logistics Performance Index)	Scenario-2/a	Scenario-2/b	Scenario-2/c
Scenario-3 (Vaccine Supply)	Scenario-3/a	Scenario-3/b	Scenario-3/c

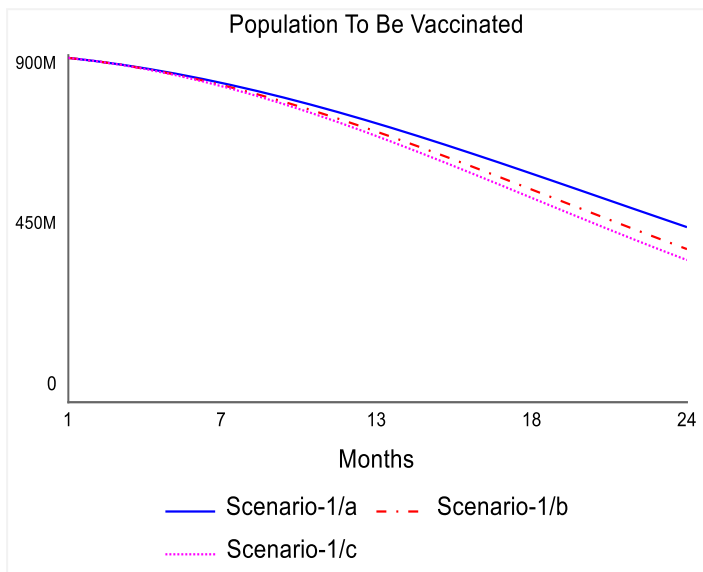
As shown in Table 2, three scenarios are formulated based on the Governance Index, Logistic Performance Index, and Vaccine Supply. For each scenario we created, three different situations are considered: Status Quo, World, and South Africa examples.

Script trials; Separately for each of the Governance Index, Logistic Performance Index and Vaccine Supply variables; If the current status quo, which we call the usual situation, continues, it has been simulated how the vaccine access situation in the African continent, the vaccine access situation in the South African example and how the vaccine access situation is affected based on the world averages. In terms of time, vaccine access status was observed in the light of scenarios within a period of 24 months.

In addition, a different scenario has been added in which the best case and the usual case, which consists of the most positive results obtained from the three scenarios and sub-scenarios, are compared. To put it more clearly; For the Governance Index (Scenario-1), the scenario with the best results was taken from the current status quo (a), South Africa (c) and World (b) sub-scenarios. Likewise, for the logistics performance index and vaccine supply, a scenario was created that compares with the usual situation, considering the values from which the best results are obtained from the a, b and c sub-scenarios.

Finally, a scenario was implemented in which the effectiveness of the governance index, logistics performance index and vaccine supply variables on vaccine access was compared among themselves. The purpose of applying this scenario is to reveal the variable that most affects vaccine access among these three variables.

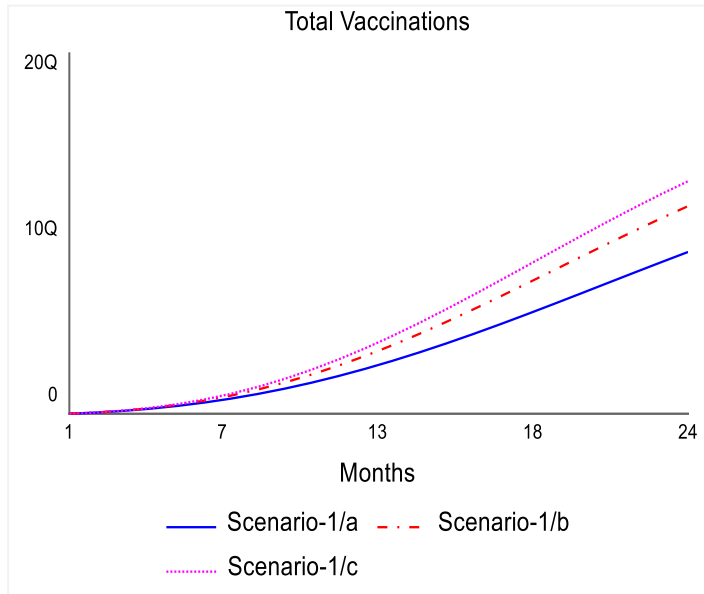
Figure 3. Scenario One: Population to be Vaccinated



From Figure 3, it is understood from the first scenario governance index variable (a, b, c) that the population to be vaccinated has decreased at the end of 24 months in any case, but nearly half of the

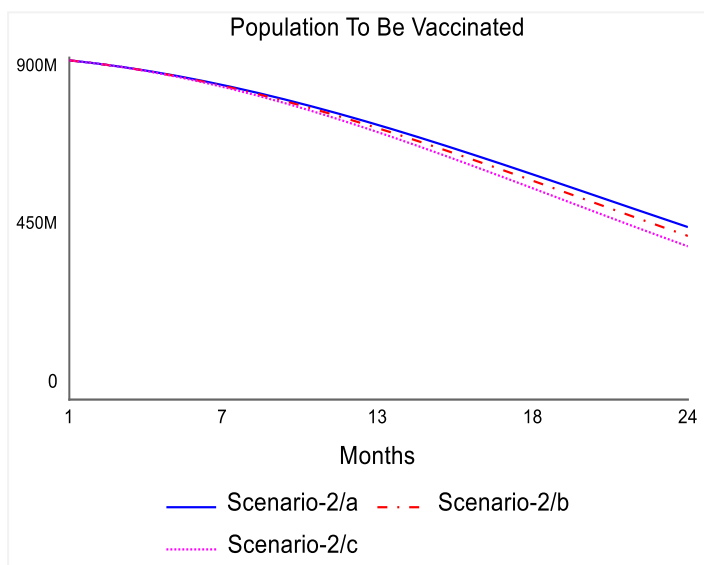
population to be vaccinated is still waiting for vaccination. Despite this, it is seen that the best results are obtained when the South African average governance index is achieved in vaccination rates in African countries.

Figure 4. Scenario One: Vaccine Access



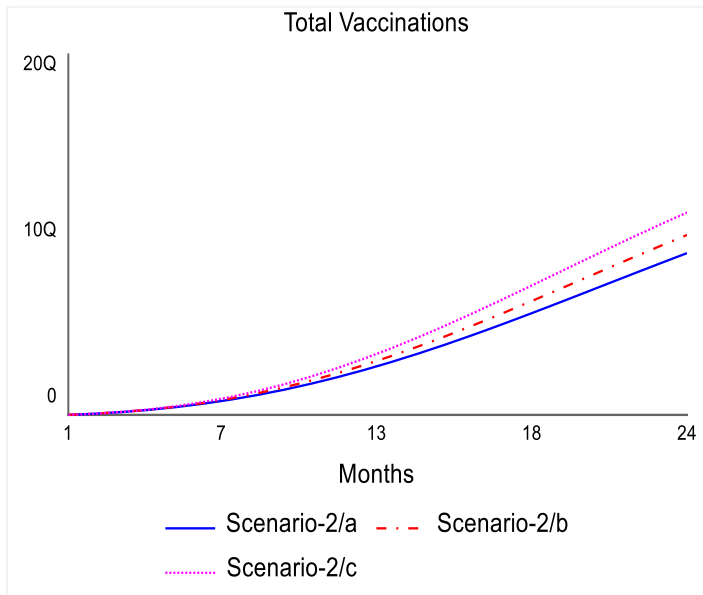
It is seen from Figure 4 that there is a clear difference between the world average and the South African average in the governance index variable in vaccine access compared to the African continent average, and that the goal of catching the South African average in vaccine access is the most real target.

Figure 5. Second Scenario: Population to be Vaccinated



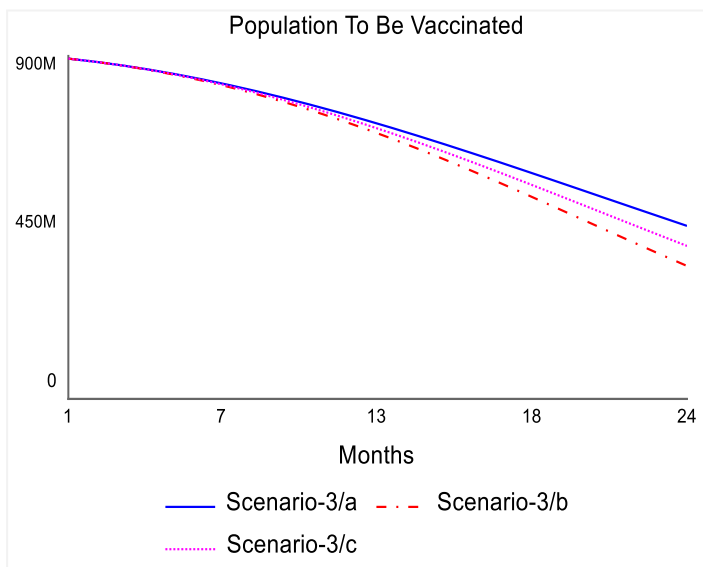
In the logistics performance index main scenario, it is seen in Figure 5 that the African continent average, the world average, and the South African average are all effective on the population that needs to be vaccinated, but they cannot reveal a serious vaccination difference between each other.

Figure 6. Scenario Two: Vaccine Access



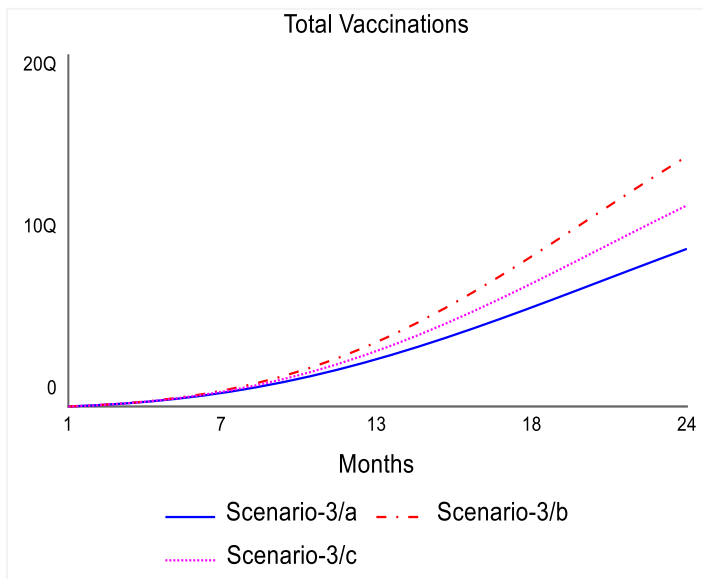
It is observed that the world average gives the best vaccine access result as a logistics performance index on vaccine range. Again, it is seen in Figure 6 that the African continent average has the least effect on vaccine access in its current state.

Figure 7: Scenario Three: Population to be vaccinate



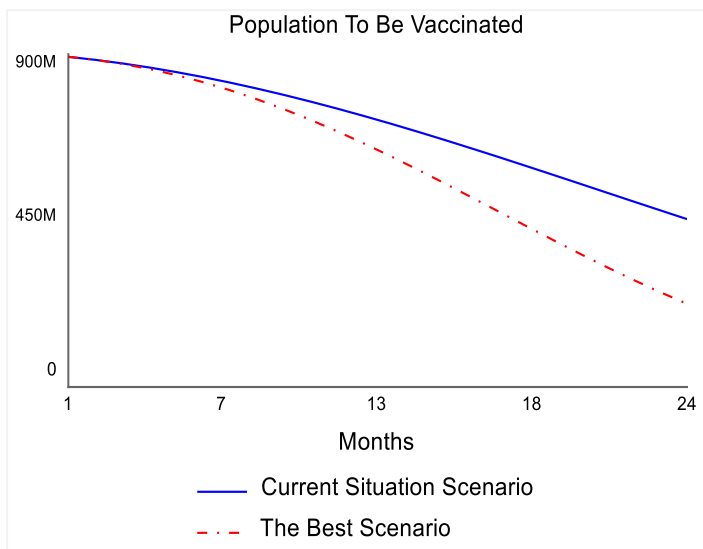
In this scenario, in which the African continent average, world average and South African average vaccine access impact of vaccine supply is examined as scenario 3, it is observed in Figure 7 and Figure 8 that the world average in vaccine supply gives the best results.

Figure 8. Vaccine Access



The catch of the world average in vaccine supply is seen in Figure 8, where it gives the best result in terms of vaccine access in the African continent. From this figure, it is clearly observed that there is a clear difference between the world average, the South African average, and the African continental average in vaccine supply.

Figure 9: Best Scenario: Population to be Vaccinated

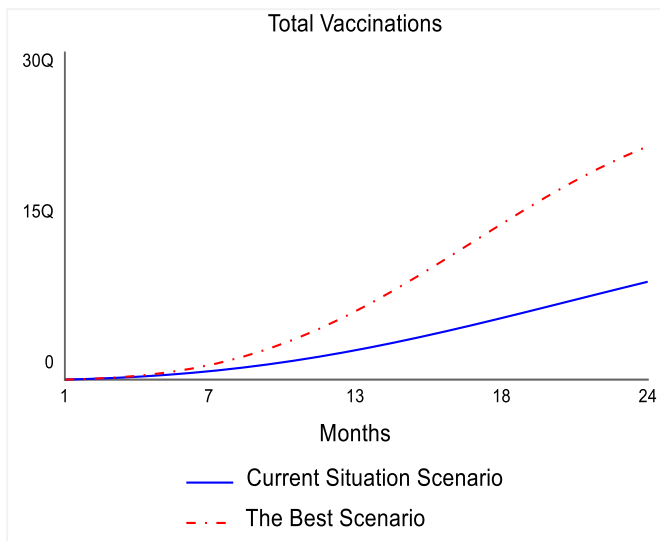


In the light of the data obtained as a result of the application of the first three scenarios, the scenario we created by taking the data with the best results among the variables and the scenario of the usual situation were compared in Figure 9. As the best data, the average of South Africa as the governance index and logistics performance index in the first and second scenarios, and the world average where the best result is obtained in the supply of vaccines in the third index, the best scenario is created and compared with the usual case scenario.

As seen in Figure 9, in the comparison between the usual situation scenario where the current situation is maintained and the best scenario with the best results, it is seen that there is a clear difference between the amount of population to be vaccinated at the end of 24 months. As a result of the best-case scenario, vaccine access appears to be more controlled.

The best-case scenario has been created by considering situations where optimal results are obtained from all applied scenarios. Figure 10 illustrates the total vaccination situation if the current situation continues in the best-case scenario.

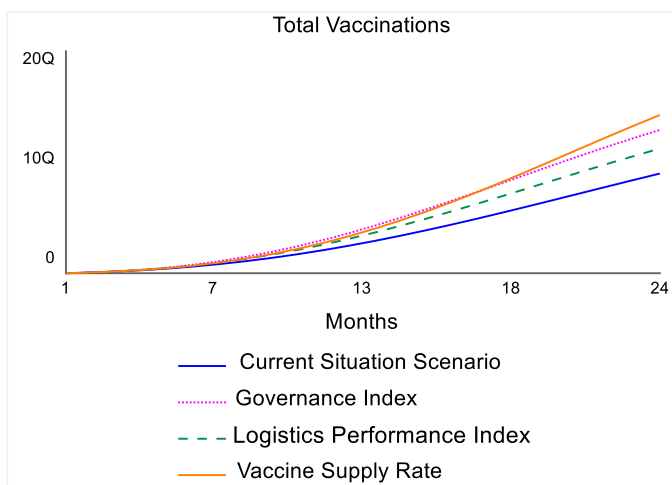
Figure 10. The Best Scenario: Vaccine Access



As seen in Figure 10, in the best-case scenario, there is a significant increase in total vaccination.

When the scenario created by considering the best results from all variables is applied; It is seen that the African continent, which is far below the world in terms of vaccine access, has reached a very good point in vaccine access at the end of 24 months. However, a one hundred percent point in vaccine access cannot be achieved. It is thought that other factors affecting vaccine access have an impact here.

Figure 11. Comparison of Variables Scenario: Vaccine Access



In this study, in which the variables of governance index, logistics performance index and vaccine supply, which are among the factors affecting vaccine access in the African continent, are examined, we have finally created a scenario that comparatively examines the effects of these variables on vaccine access. According to this scenario, the averages that most positively affect vaccine access were taken from these variables, and these variables were compared within themselves.

Accordingly, vaccine supply is the most important factor affecting vaccine access. No matter how good the governance index or logistics performance is, ensuring vaccine supply is the most important factor for vaccine access. Next comes the governance index. Considering these two situations, we can cite countries such as Israel and the United Arab Emirates as examples. Although both countries are low in the governance index, all their populations were vaccinated at the time of our study. Here, the importance of vaccine supply in vaccine access is demonstrated. Among all three variables, the logistic performance index has the least effect on vaccine access. However, it has a significant impact on vaccine access. We can clearly see this in Figure 11 when comparing the preservation of the current situation and the improvement in the logistics performance index.

4. FINDINGS

Nine scenario experiments have been conducted to examine how governance index, logistics infrastructure, and national income variables affect vaccination rates through the model of COVID-19 vaccine availability in the African continent. Several findings have been obtained as a result of these scenario experiments. Some of the findings are listed below:

-If the governance index catches the world average, at the end of 24 months, nearly 60% of the population cannot access the vaccine.

-When the governance index catches the South African average, the vaccination rate reaches 70%.

-When logistics performance and infrastructure improvement catch the world average, vaccination rates are close to 60%.

-When the logistics performance and infrastructure improvement catch the S. Africa average, a vaccination rate of up to 70% is achieved.

-Improvement in vaccine supply When the S. Africa average is achieved, 68% vaccination is achieved at the end of 24 months.

-When the world average is caught in vaccine supply, a vaccination rate of 74% is achieved at the end of 24 months.

-If the current status quo is maintained, vaccination rates remain below 50% at the end of 24 months. On the other hand, when the situations where the best result is obtained as a result of scenarios for each variable are considered together, a rate of 83% is achieved in vaccination rates.

5. CONCLUSION AND RECOMMENDATIONS

The findings show that vaccine availability, good governance index, and logistics factor are crucial factors in front of vaccination. Firstly, we indicated that vaccine availability is the most significant factor in front of vaccination. Secondly the governance index of states increases, people's access to vaccines increases. Therefore, in countries where political stability is ensured, violence is prevented, terrorism is minimized, corruption can be prevented, governments' effectiveness is increased, legal rules can be applied, responsibility and transparency are ensured, it is seen that access to the vaccine has a positive effect.

Finally, logistics performance and infrastructure strengthen, vaccine access increases. Here, the power of the logistics infrastructure makes it easier for people to access the vaccine. Logistics infrastructure has the effect of facilitating the supply of vaccines to the farthest corners of the country. This situation positively affects citizens' access to vaccines.

The variable that most impacts people's access to vaccines is the provision of vaccines. The most important factor here is related to the economic wealth of the country. Countries with high economic power are more advantageous in the supply of vaccines, and therefore they are more advanced than other countries in terms of their citizens' access to vaccines. Here, it is seen that the most effective variable in terms of citizens' access to vaccines is vaccine supply. It has been observed that the most important power affecting the vaccine supply is economic wealth. As an example, to this situation, it has been observed that although half of the people in the world have not been vaccinated yet, almost all citizens of the rich gulf countries and Israel have access to the vaccine. Although these countries are quite low in the governance index rankings and are in the middle ranks in the logistics performance index, they are at the forefront in the world in terms of vaccine access for all their citizens. Therefore, while the effect of other variables is not ignored, it is seen that the citizens of economically strong countries are more advantageous in accessing the vaccine.

The fact that healthy individuals contribute to the economy is a paramount indicator emphasizing that vaccination should not be viewed solely through the lens of public health. Vaccination, due to its role in fostering a healthy and productive population, also wields significant potential for boosting economic growth. Additionally, income levels emerge as the foremost factor influencing the achievement of widespread vaccination. It is observed that the rising economic prosperity of nations positively impacts both vaccine supply and the development of necessary logistics infrastructure essential for ensuring widespread vaccination. This is underscored by the ability of economically advanced nations to efficiently reach their citizens with vaccines, extending their vaccination efforts even into rural areas. This phenomenon underscores the close relationship between economic development and a well-established logistics infrastructure, demonstrating a mutually reinforcing causal relationship between vaccination and economic progress.

In an era where global trade and population mobility have advanced significantly, it is not an effective strategy for each country to rely solely on its own defense mechanisms and resources, limiting its efforts to within its borders, in the face of global pandemics. Prolonged isolationist approaches are nearly impossible in this interconnected world. Such a stance would disrupt international trade, supply chains, and international relations mechanisms, rendering a country economically paralyzed. Consequently, the economic impact on individuals would outweigh the consequences of pandemic disasters. Therefore, international organizations like the World Health Organization (WHO) should play a more effective and proactive role in combating such disasters. They should approach the issue comprehensively and coordinate infrastructure improvements that ensure access to healthcare services for all. Simultaneously, the establishment of a fund should provide financing for underdeveloped countries, without leaving this critical task to the discretion of individual governments.

As a result, the improvement of the logistics performance and infrastructure and the governance index, where other variables are not ignored and there is no shortage of supply, increases access to the vaccine in an equal and fair manner.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that they all equally contributed to all processes of the research.

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APPENDIX:

INITIALIZATION EQUATIONS

```

: I Total_Cases = 9353563
TRANSIT TIME = 6
INFLOW LIMIT = INF
CAPACITY = INF
: c Deaths_Rate = 226,960/9353563*1/24
: s "\"Total_Second_Vaccinated_People\""" = 4,98/100/12*1275920972
: s People_Vaccinated = 9,03/100*1275920972
: s Population_To_Be_Vaccinated = 1275920972*7/10
: s The_Fully_Vaccinated_People = 0,06/100*1275920972
: s Total_Deaths = 226960
: s Vaccinations_Per_Hundred = 11/100*1/12
: c People_At_Second_Vaccinated_Per_Hundred = 5,2/100*1/12
: c Total_Population = 1275920972
: f "\"Second_Vaccinated\""" = People_At_Second_Vaccinated_Per_Hundred*Total_Population
: c People_Fully_Vaccinated_Per_Hundred = 0,06/100*1/12
: f Fully_Vaccinated = People_Fully_Vaccinated_Per_Hundred*Total_Population
: c Case_Rate = 9353563/1275920972*1/24
: f New_Cases = Total_Population*Case_Rate
: f Deaths = LEAKAGE OUTFLOW
: c Cases_To_Be_Vaccinated_Rate = 70/100
: f Cases_To_Be_Vaccinated = CONVEYOR OUTFLOW
: f New_People_Vaccinated_Smoothed = Population_To_Be_Vaccinated*Vaccinations_Per_Hundred
: c Vaccine_Supply_Rate = 11/100*1/12
: c Governance_Index&Vaccine_Supply_Rate = 30,425
: c Governance_Index = 0,0000274
: c Logistics_Performance_Index = 2,245
: c Logistic_Performance_Index&Vaccine_Supply_Rate = 0,034/100
: f Vaccine_Supply =
Vaccine_Supply_Rate*Vaccinations_Per_Hundred+Governance_Index&Vaccine_Supply_Rate*Governance_Ind
ex+Logistics_Performance_Index*Logistic_Performance_Index&Vaccine_Supply_Rate
: c Amount_Of_Vaccinations_Required = 2
: c "\"Total_Population/Population_To_Be_Vaccinated\""" =
Population_To_Be_Vaccinated/Total_Population
: c Total_Vaccinations =
302590+The_Fully_Vaccinated_People+People_Vaccinated+ "\"Total_Second_Vaccinated_People\"""
: c Total_Vaccinations_Demand = Population_To_Be_Vaccinated*Amount_Of_Vaccinations_Required

```

```

{ RUNTIME EQUATIONS }
: s "\Total_Second_Vaccineted_People\"(t) = "\Total_Second_Vaccineted_People\"(t - dt) +
("\Second_Vaccinated\") * dt {NON-NEGATIVE}
: s People_Vaccinated(t) = People_Vaccinated(t - dt) + (New_People_Vaccinated_Smooted) * dt
{NON-NEGATIVE}
: s Population_To_Be_Vaccinated(t) = Population_To_Be_Vaccinated(t - dt) +
(Cases_To_Be_Vaccinated - New_People_Vaccinated_Smooted) * dt {NON-NEGATIVE}
: s The_Fully_Vaccinated_People(t) = The_Fully_Vaccinated_People(t - dt) + (Fully_Vaccinated) * dt
{NON-NEGATIVE}
: s Total_Deaths(t) = Total_Deaths(t - dt) + (Deaths) * dt {NON-NEGATIVE}
: s Vaccinations_Per_Hundred(t) = Vaccinations_Per_Hundred(t - dt) + (Vaccine_Supply) * dt {NON-
NEGATIVE}
: l Total_Cases(t) = Total_Cases(t - dt) + (New_Cases - Cases_To_Be_Vaccinated - Deaths) * dt
{CONVEYOR}
CONTINUOUS
ACCEPT MULTIPLE BATCHES
: c Deaths_Rate = 226,960/9353563*1/24
: c People_At_Second_Vaccinated_Per_Hundred = 5,2/100*1/12
: f "\Second_Vaccinated\" = People_At_Second_Vaccinated_Per_Hundred*Total_Population
{UNIFLOW}
: c People_Fully_Vaccinated_Per_Hundred = 0,06/100*1/12
: f Fully_Vaccinated = People_Fully_Vaccinated_Per_Hundred*Total_Population {UNIFLOW}
: c Case_Rate = 9353563/1275920972*1/24
: f New_Cases = Total_Population*Case_Rate {UNIFLOW}
: f Deaths = LEAKAGE OUTFLOW
LEAKAGE FRACTION = Total_Cases*Deaths_Rate
LINEAR LEAKAGE
LEAK_ZONE = 0% to 100%
: c Cases_To_Be_Vaccinated_Rate = 70/100
: f Cases_To_Be_Vaccinated = CONVEYOR OUTFLOW
INFLOW MULTIPLIER = Cases_To_Be_Vaccinated_Rate*Total_Cases
: f New_People_Vaccinated_Smooted = Population_To_Be_Vaccinated*Vaccinations_Per_Hundred
{UNIFLOW}
INFLOW MULTIPLIER = Population_To_Be_Vaccinated*Vaccinations_Per_Hundred
: c Vaccine_Supply_Rate = 11/100*1/12
: c Logistic_Performance_Index&Vaccine_Supply_Rate = 0,034/100
: f Vaccine_Supply =
Vaccine_Supply_Rate*Vaccinations_Per_Hundred+Governance_Index&Vaccine_Supply_Rate*Governance_Ind
ex+Logistics_Performance_Index*Logistic_Performance_Index&Vaccine_Supply_Rate {UNIFLOW}
: c "\Total_Populaton/Population_To_Be_Vaccinated" =
Population_To_Be_Vaccinated/Total_Population
: c Total_Vaccinations =
302590+The_Fully_Vaccinated_People+People_Vaccinated+"\Total_Second_Vaccineted_People\"
: c Total_Vaccinations_Demand = Population_To_Be_Vaccinated*Amount_Of_Vaccinations_Required

{ TIME SPECS }
STARTTIME=1
STOPTIME=24
DT=1
INTEGRATION=EULER
RUNMODE=NORMAL
PAUSEINTERVAL=0

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Energy Transition in Azerbaijan: Advantages of System Value Analysis and Strategic Role of the Global Climate Actors

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Abstract

Azerbaijan, a country with hydrocarbon resources, seeks to restructure its economy and energy system to become more resilient to climate change. The European Union's call for international climate action offers opportunities for a green energy transition in Azerbaijan. However, the economic, social, climatic, and environmental elements driving this transition are understudied. This article follows the example of the World Economic Forum's System Value Analysis to study how complementary the impact of policies and solutions targeting sustainable development, the environment, climate action, and the green energy transition is in Azerbaijan. For this purpose, we analyze the energy market in Azerbaijan and the potential of renewable energy resources. The main aim is to reveal not only the economic advantages of the energy transition but also its political and strategic contribution to Azerbaijan. We argue that Azerbaijan's strategic engagement with the EU is crucial, as it serves as a means for Europe to bolster energy security and assist Azerbaijan in its political drive and strategy for transitioning to green energy. Additionally, it fulfills Azerbaijan's commitments to global climate initiatives.

Keywords: *Azerbaijan, Energy Transition, System Value Analysis, European Union, International Climate Action, Renewable Energy.*

Article Type	Application Date	Admission Date
Research Article	March 11, 2024	December 17, 2024

1. INTRODUCTION

Azerbaijan has followed an oil strategy for economic growth through the process of post-Soviet liberalization since independence in 1991. The oil industry has provided the necessary financial resources to support the newly declared economic and political independence of Azerbaijan through extreme macroeconomic growth. However, Azerbaijan's post-Soviet development, which has prioritized the extractive industry over the real economy, has left the state vulnerable to fluctuating oil prices and led to an imbalance in the state's production capacity. Energy sector preserves its significance for Azerbaijan's national security, yet climate change and the European Green Deal -as Azerbaijan is a trade partner of the EU- need to adapt to the new circumstances. Azerbaijan's dedication to addressing climate change is of utmost importance as it prepares to host the UN Climate Change Conference (COP) in Baku in 2024. Azerbaijan has the capacity to exemplify the feasibility and influence of the European Green Deal framework, thereby implementing its governmental pledge. Once again, Azerbaijan needs to adopt a strategy that will transform the economy and the supporting energy system. The European Union's (EU) call for an energy transition comes with both attractive opportunities and enforcement. This study looks at the economic, social, environmental, and industrial necessities and possibilities for Azerbaijan to make a green transition. The potential green transition in Azerbaijan offers a chance to demonstrate that geopolitics, economic policies, and climate action should not diverge, but rather complement each other.

Climate change is increasing environmental, social, and economic vulnerabilities in Azerbaijan, requiring strategies to build resilience and capacity to adapt. Extreme weather events, such as floods, landslides, mudslides, droughts, and forest fires, harm populations, infrastructure, and the economy. The highest emissions pathway expects Azerbaijan to warm by 4.7°C by the 2090s, faster than the global average. Some regions will become drought-prone, and crop management may worsen precipitation deficits and river surface and subsurface flow deficits (Asian Development Bank [ADB], 2021). Azerbaijan may soon be desertified, and extreme temperatures will significantly impact crop yield, labor productivity, health, and ecological survival (Ministry of Ecology and Natural Resources, Republic of Azerbaijan 2015). To improve resilience and food security, the agricultural sector must adapt, invest in infrastructure, and adopt new and green technology. Farzalieva (2021) states that Azerbaijan's food security depends on agro-food policy and macroeconomic development. In 2014, droughts caused 59 hectares of forest fires, harming Azerbaijan's unique fauna and vegetation (Global Forest Watch [GFW], n.d.). Azerbaijan has successfully eradicated malaria, but climate change and urban heat island effects increase its risk of recurrence (Mammadov et al., 2016). Seasonal migration of agricultural laborers, internally displaced persons, and refugees requires vigilant measures. Public policies must address climate change adaptation for sustainable development and energy transition.

If Azerbaijan makes the right political decisions, it can enhance climate resilience, speed up economic growth, and make clean energy the engine of its economy at the same time. This article aims

to reveal Azerbaijan's strengths and vulnerabilities in the face of climate change and on the path to greening and diversifying the economy. It follows the example of the World Economic Forum's (WEF) System Value Analysis and the call to consider not only the levelized cost of energy but also the broader impact of related policies and solutions on sustainable development, the environment, climate, and humans (Aldersey-Williams & Rubert, 2019; Astariz et al., 2015). Azerbaijan can successfully transition into an energy system based on renewables and storage, following the lead of oil-rich countries such as Norway (Simpson, 2023) and Saudi Arabia (Al-Saidi, 2022). Azerbaijan also needs to put in place effective and targeted policies to reduce emissions. This will give the country a better chance of connecting with the economies of Europe that are changing, creating a more diverse economy, and keeping the country self-sufficient. This study uses the System Value Framework from the WEF to figure out why energy transition is essential and what would happen to the economy, environment, and people if Azerbaijan chose clean energy instead of fossil fuels.

This article argues that it is important for Azerbaijan to achieve a green energy transition for economic diversification and comply with the EU's neighborhood policy and international climate action. In the second part, the study introduces the System Value Framework developed by the WEF as an alternative to cost-benefit analysis, presents a literature review on Azerbaijan, mostly studied as a significant hydrocarbon energy producer, and gives examples of the country analyses by the WEF. Then the article analyzes the Azerbaijani energy market with reference to the system value framework. The study also evaluates the country's renewable energy resource potential. In the third section, the article examines the significance and advancement of Azerbaijan's energy transition policies, taking into account the country's clean energy market potential. This is done in tandem with the country's strategic relationships with the EU and its national commitments to international climate action. The study ends with an evaluation of Azerbaijan's overall situation in terms of green energy transition and presents concluding reflections on its strengths and weaknesses. Hence, this study aims to contribute to revealing how an oil-producing country might transform its economically profitable sector through a comprehensive transition process that also provides an advantageous position in its international relations.

2. LITERATURE REVIEW

Although Azerbaijan has rich oil and natural gas resources, the country has also faced the severe impacts of the climate crisis and its social and economic consequences. Additionally, the phase-down and out processes discussed in global climate negotiations challenge Azerbaijan as an oil-producing country. By considering other oil-rich countries' energy transition plans, such as Norway (Simpson, 2023) or Saudi Arabia (Al-Saidi, 2022), Azerbaijan could also launch a transition process for energy systems based on renewables and storage. In this context, Azerbaijan also needs to put in place effective and targeted policies to reduce emissions. This will give the country a better chance of connecting with

the economies of Europe that are changing, creating a more diverse economy, and keeping the country self-sufficient.

The performance of the current energy systems and the favorable environment for the energy transition are the components of the energy transition index framework. A country's system performance reveals the ability of a country's energy system to promote economic development and growth, ensure that everyone has access to a safe and reliable energy supply, and maintain environmental sustainability along the energy value chain. The goal of a nation's energy transition should be to simultaneously address these three issues and maintain a balanced "energy triangle". The energy transition is a planned shift to a broader, sustainable, economical, and secure energy system that addresses global energy concerns while adding value to business and society without undermining the energy triangle's balance. How far a nation's energy transition can advance depends on its ability to build a robust and enabling environment. The transition readiness score of a country evaluates the following enabling dimensions: energy system structure, capital and investment, regulation and political commitment, human capital and consumer participation, infrastructure and innovative business environment, and institutions and governance (WEF, 2020a). 40 indicators make up the composite score of the energy transition index. The indicators are standardized, grouped, and assigned equal weight to generate scores for higher-order dimensions. These are then used to calculate scores for the system performance and transition readiness subindices. These two sub-indices are added together to create the composite energy transition index score. With a transition readiness score of 49%, a system performance score of 67%, and an energy transition index value of 58%, Azerbaijan ranks 44th out of 115 nations in 2020 (WEF, 2020a). This section focuses on the literature on clean energy transitions. First, the advantages of System Value Analysis rather than Cost & Benefit Approach are examined; then the literature on Azerbaijan's transition is assessed.

2.1. Looking Beyond Cost & Benefit Analysis in Clean Energy Transition

Cost & benefit analysis is a widely used method for organizations to determine the best projects or programs to conduct and allocate investable funds. It considers net benefits rather than business improvements. (Mishan & Quah, 2021). This technique simplifies public policy decisions by identifying the differences in net benefits between two scenarios based on economic and environmental forecasting. The choice rests mainly on monetized benefits and costs, "consisting largely of well-defined monetary expenditures on facilities, collection vehicles, and labor" (Ackerman, 2008, p. 25). However, this approach omits environmental impacts, which do not have market prices.

In the past, the cost of a project or an investment has been an important factor, today -in the age of climate change- it is crucial that we assess the energy system to achieve economic success and limit global temperature increases to 1.5 degrees that is targeted through the Paris Agreement. Therefore, a new perspective that places an emphasis on a range of benefits and wider value is required to accelerate

activities and investments toward a future with net zero carbon emissions. We refer to this new framework for decision-making as System Value (WEF, n.d.). System Value is a comprehensive framework for assessing the technical, social, economic, and environmental effects of proposed energy solutions. The framework aspires to broaden the political and economic discussion beyond price to cover value. It is possible to examine policies, investments, and solutions to determine how they will affect various outcomes (WEF, n.d.). The WEF uses the System Value framework to direct discussions and initiatives that aim to promote the clean energy transition. The framework assists in concentrating on such solutions and actions that help lower emissions, besides bringing economic advantages like job creation and improving health due to better air quality (WEF, n.d.).

The System Value framework examines possible energy solutions across markets more comprehensively by considering their technological, social, economic, and environmental effects. The WEF, with the cooperation of Accenture, carried out a study across numerous geographies as part of market evaluations that looked at recovery potential to speed up economic growth and the clean energy transition. The framework's adaptability allows for the inclusion of both quantitative and qualitative analysis.

System Value analysis considers twelve economic, environmental, societal, and energy value dimensions (WEF, 2020b): carbon dioxide emissions, job creation, water footprint, air quality, electricity availability, energy productivity, resilience, security, foreign direct investment, service quality, flexibility, improved system adaptation, and cost and investment competitiveness. The System Value dimensions differ by geography and time frame (WEF, 2020b). These dimensions help determine the benefits of energy transition, renewables, and sustainable development. By focusing on these dimensions, organizations can enhance their overall value and contribute to a more sustainable future.

Expanding renewables, improving efficiency, upgrading the grid, and enhancing interconnection are essential components; the electricity transition contributes 20-30% of annual renewable energy to the generation mix. Power market reform, smart flexibility solutions, demand optimization, and electrification for end users are the transformational elements. Enhancing systemic effectiveness through solutions, partner cooperation, and digitalization provides a net-zero integrated energy system (WEF, 2020b).

2.2. Limits of Literature on Azerbaijan's Energy Transition

The WEF and Accenture have conducted research on recovery prospects for economic growth and clean energy transition using the System Value framework in selected countries, except Azerbaijan, a major hydrocarbon resource exporter. Through system value analysis, the WEF proposes solutions for countries and regions such as Brazil, the United States, India, and Europe. Potential solutions recommended for Brazil, include focusing on developing non-hydro renewable energy sources, digitalizing transmission and distribution systems, and energy-efficient urbanization. The United States

is advised to invest in renewable capacity, smart buildings, and energy infrastructure to enhance system durability. India's investments in renewable resources will benefit from renewable energy zones, distributed solar systems, and the shutdown of coal power plants. Solutions for Europe to achieve the 2030 target include a green hydrogen market, renewable energy use, and a digital energy ecosystem. China's distributed energy will almost triple by 2030, if it achieves increased solar and wind power capacity, digital grid transformation, smart grid technologies, and electric charging infrastructure. Denmark and Europe are advised to accelerate their transition to a low-carbon economy through smart digital technologies, supply-demand equilibrium, renewable energy sources, decarbonization, sustainable practices, and green fuel for transportation and aviation (WEF, n.d.).

Literature on the economic, social, climatic, and environmental factors pushing for Azerbaijan's transition to clean and green energy systems is limited. The existing literature primarily focuses on Azerbaijan's role as a significant oil and gas producer (Hoffman, 1999; Ciarreta & Nasirov, 2012; Bayulgen, 2005), the existing and prospective pipeline projects that extend from Baku to Europe over Turkey (Najman et al., 2007), Azerbaijan's oil politics, energy diplomacy, and the geopolitics of energy (Ipek, 2009; Kubicek, 2013; Yesevi & Tiftikcigil, 2015; Aydin, 2019; Sanili Aydin & Uste, 2022). Few studies have examined the socioeconomic effects of declining oil and gas demand and prices on the sustainable energy transition in the Eurasian petrostates, as noted by Skalamera (2022). He argues that the clean energy transition in the EU will cause distress, particularly in Azerbaijan, as it remains committed to westbound energy markets rather than China (pp. 1645-1646). Additionally, the impacts of climate change on an oil-dependent state exacerbate its political, socioeconomic, and environmental vulnerabilities. Therefore, it becomes crucial for Azerbaijan to seek out alternative economic sectors and energy resources.

However, Azerbaijan's renewable potential is understudied. Azerbaijan National Academy of Sciences, Mustafayev et al. (2022), Karimov (2015), and others have conducted a few studies in this area. These studies confine the issue to technicalities or economics (Vidadili et al., 2017). Few studies have examined the impact of renewable energy on social, environmental, and economic vulnerabilities in the country. Guliyev (2021) indicates that Azerbaijan has progressed in enacting laws to support the transition to renewable energy. Rasoulinezhad and Taghizadeh-Hesary (2022) confirm that affordable, clean energy is essential for poverty reduction and equitable growth in the Commonwealth of Independent States (CIS). Once again, this study does not incorporate environmental and climate-related impacts on various sectors in its analysis. Cholewa et al. (2022) reveal the obstacles to the energy transition in Azerbaijan. Hasanov et al. (2023) examine the role of renewable energy in reducing GHG emissions and reveal that its utilization in Azerbaijan has been limited compared to the available sources. Thus, the study of reports, decrees, statements, and policy papers related to the governance of the energy transition in Azerbaijan makes a useful contribution to filling a gap in the literature and provides valuable insight to analyze the country's transition to renewables.

3. AZERBAIJAN'S ENERGY MARKET ANALYSIS

The energy sector has strategic importance for the national economy and the formation of GDP. Almost 90% of the nation's exports come from the oil and gas sector, which supplies one-third of the GDP of the nation (The State Statistical Committee of the Republic of Azerbaijan, 2023; Central Bank of the Republic of Azerbaijan, n.d.). The rich energy resources of Azerbaijan, especially oil and natural gas, made a significant contribution to the economic development of the country after gaining its independence in 1991 and the signing of the “Contract of the Century” in 1994 (Huseynli, 2023). Azerbaijan signed this contract with 13 world-renowned oil companies in 1994 and then signed 27 more contracts with 41 oil companies from 19 countries. These agreements have been effective in increasing the growth performance of the Azerbaijani economy since 2006. The GDP has grown from around 3 billion USD (1995) to 75 billion USD (2014) thanks to the Contract of the Century, which created new opportunities for the country to export its natural resources to the global market (World Bank, 2021). With the completion of the Baku-Tbilisi-Ceyhan pipeline in 2005, the country's oil was eventually able to reach world markets (Grant Thornton, 2019).

According to BP, the country's total proved oil reserves account for 7 trillion barrels, and its natural gas reserves are 46.6 trillion cubic feet (British Petroleum, 2018). Azerbaijan has one of the highest levels of energy self-sufficiency in the world, producing around four times as much energy as it uses. In recent years, Azerbaijan has exported around 40% of natural gas and over 90% of oil (International Energy Agency [IEA], 2022). The country's leadership acknowledges the fact that it can continue to rely on natural resources. However, this also implies that Azerbaijan will remain vulnerable to fluctuations in the global energy market, similar to what happened in 2014-2015, when the country faced two consecutive devaluations due to a decline in oil prices, and experienced its first economic recession in 20 years (CESD, 2015). The volatile oil prices in 2020 and 2021 have once again demonstrated the necessity of promoting productive, private sector-led development and diversification in Azerbaijan. The newly declared decarbonization goals in an increasing number of nations that import oil and gas support this idea. However, economic diversification remains a significant challenge, and the country's dependence on the oil and gas sector is likely to persist for some time (IEA, 2022). Reducing the share of the oil industry both in public revenues and in the country's GDP is the only way to reduce the country's reliance on oil and natural gas export revenues. Another problem is the high share of the energy sector in the country's GHG emissions. The energy sector is responsible for approximately 80% of the country's total emissions in 2020 (The State Statistical Committee of the Republic of Azerbaijan, 2022). Although Azerbaijan has an insignificant share in global warming (only 0.15% of the estimated emissions worldwide in 2016), the country's physical and geographical characteristics make it highly vulnerable to the effects of climate change, so a long-term strategic approach is crucial for Azerbaijan.

Azerbaijan's total export of goods in 2021 is worth 21 billion dollars, of which 19 billion dollars belong to the oil and gas sector. In the first three quarters of 2022, goods exports reached 30 billion dollars; 28.6 billion dollars covered the oil and gas sector exports, and the exports of this sector corresponded to 93% of the total goods exports. The export of the oil and gas sector has significant importance as it provides Azerbaijan's foreign trade surplus (Central Bank of the Republic of Azerbaijan, n.d.). Undoubtedly, oil and gas have an important share in Azerbaijan's economy in terms of exports and public revenues, but considering the targets of major importing countries to achieve zero greenhouse gas emissions by 2050, Azerbaijan's need for a long-term energy transition plan becomes important. Additionally, the fluctuation in oil prices seen in 2020-2021 made it more important than ever for the private sector to lead product diversification, which would boost productivity (IEA, 2022).

State-owned monopoly companies predominate and manage Azerbaijan's energy sector. The State Oil Company of Azerbaijan Republic (SOCAR) and its subsidiaries control the production, storage, transmission, distribution, and supply of oil and gas. Azerenergy and its subsidiaries provide electricity generation and transmission, heat power generation, and sales; Azerishiq provides electricity distribution, supply, and small-scale electricity generation; Azeristiklihzat provides heat power generation, transmission, distribution, and supply; and heated water production, distribution, and supply (IEA, 2022).

In 2021, Azerbaijan achieved a total energy production of 66,202 thousand TOE, of which 35,583.1 thousand TOE came from crude oil, 30,395.6 thousand TOE from natural gas, and 223.3 thousand TOE from renewables and waste. The country exported 48,552 thousand TOE of its production, resulting in a total energy supply of 17,556.6 thousand TOE. Additionally, 59.5% of total exports, which were 48,552 thousand TOE in 2021, consist of crude oil, 36.7% of natural gas, 3.5% of petroleum products, and 0.3% of electricity (The State Statistical Committee of the Republic of Azerbaijan, 2022). While fuel sources -particularly natural gas, which is the main source of domestic total energy supply- provide almost all the energy supply, renewable energy only accounts for 1.3% of the total energy supply, as can be seen in Table 1.

Table 1. Total Energy Supply in 2021

	Thousand TOE	Share in total energy consumption%
Gaseous fuels	12,115.6	69
Liquid fuels	5,222.1	29.7
Solid fuels	3.8	0
Renewable energy	225.1	1.3
Total energy supply	17,566.6	

Source: The State Statistical Committee of the Republic of Azerbaijan, 2022

Table 2 displays the allocation of Azerbaijan’s renewable energy supply based on generation resources in 2021. While the use of wind and solar energy among renewable energy sources remains at a very low level, the share of hydropower, biomass, and waste usage is around 95%. The share of total renewable energy supply in total energy use is only 1.3%.

Table 2. Renewable Energy Sources in 2021

	Thousand TOE	Share in total renewable energy supply%	Share in total energy consumption %
Hydropower	109.8	48.7	0.6
Biomass and waste	102.6	45.5	0.6
Wind power	7.9	3.5	0.1
Solar power	4.8	2.1	0.0
Total renewable energy supply	225.1		1.3

Source: The State Statistical Committee of the Republic of Azerbaijan, 2022

To secure an energy transition, it is crucial for Azerbaijan to reduce greenhouse gas emissions by lowering the use of fossil fuels in the production of electricity and restricting freshwater use in hydropower plants to reduce water scarcity. The distribution of electricity generation in Azerbaijan over time is shown in Table 3, along with the various types of power plants. Most of the electricity is produced in thermal power plants, where natural gas consumption has climbed and oil use has dropped since 2001. Thermal power plants produce more than 90% of their electricity using natural gas (IEA 2022). While biomass, wind, and solar power plants have significantly increased their electricity production since 2016, only 5.8% of 2021's electricity came from renewable sources, including hydropower.

Table 3. Production of Electricity by Type of Power Plant (Million Kwh)

	Thermal	Hydro	Biomass	Wind	Solar
2010	15,263	3,446	-	0.5	-
2015	22,859	1,638	181	0.4	4
2020	24,398	1,069	200	95	47
2021	26,238	1,277	193	91	55

Source: The Ministry of Energy of the Republic of Azerbaijan, n.d.

Utilizing renewable energy sources for electricity generation can help diversify the energy mix and free up natural gas for export and other lucrative uses. According to the State Statistical Committee’s 2022 data, Azerbaijan is a country with a very high renewable energy potential, and there have been significant increases in wind and solar power plant capacities in recent years, as can be seen in Table 4, but these capacities are far below their potential.

Table 4. Plant Capacity at the End of the Year (Mw)

	Electric and CHP plants working with fuel	Hydroelectric	Wind	Solar	Solid domestic waste	Biogas
2010	5,401	995	1.7	-	-	-
2015	6,652	1,103	7.7	4.8	37	1
2020	6,326	1,149	66	35	44	1
2021	6,649	1,157	66	47	44	0.7

Source: The State Statistical Committee of the Republic of Azerbaijan, 2022

Table 5 shows the shares of renewable energy sources in electricity production and capacity over the last ten years based on the 2022 data retrieved from the International Renewable Energy Agency and the State Statistical Committee of Azerbaijan. Whereas the share of renewable energy sources in electricity production was approximately 8%, it fell over the last three years to 5.8% in 2021. The share of renewable energy sources in electricity capacity was between 15 and 17%.

Table 5. Share of Renewable Energy in Electricity Capacity (%Mw) and Production (%Gwh)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Capacity	16	15	15.2	14.8	15	15	16.3	16.9	17	17.1
Production	7.9	7	6	7.4	8.8	8.1	8.1	7.3	5.5	5.8

Source: International Renewable Energy Agency, 2022; The State Statistical Committee of the Republic of Azerbaijan, 2022

In 2021, the electricity industry used 14% of the supplied electricity to the market, exported 6% of the produced electricity, and lost 8% of the overall supply due to network transmission and distribution losses, with network distribution accounting for roughly 7% of these losses. While households use 34% of the electricity, 32% of the commerce and public services sector, 20% of the industry sector, and 8% of the agriculture sector, other sectors account for only about 6% of total energy consumption (The State Statistical Committee of the Republic of Azerbaijan, 2022).

Table 6. Greenhouse Gas Emissions by Sectors (CO₂ Equivalent Million Tons)

	Energy	Industry	Agriculture	Waste	Land use and forestry	Total land use	Total land use (except forestry)
2005	40.9	1.9	6.5	1	-5.3	50.2	44.9
2010	41	2	7.2	1.2	-5.4	51.4	46
2015	47.7	3.7	8.6	1.3	-7.1	61.3	54.2
2018	47.5	3.4	8.7	1.3	-7.2	60.8	53.6
2019	49	3.3	8	1.4	-7.5	61.6	54.1
2020	49.8	3.2	8	1.4	-8.5	62.4	53.9

Source: The State Statistical Committee of the Republic of Azerbaijan, 2022

Statistics on greenhouse gas emissions reflected on Table 6 demonstrate that the energy sector is primarily responsible for Azerbaijan's emissions (The State Statistical Committee, 2022). With a value

of 49.8 million tons in 2020, the energy sector's greenhouse gas emissions account for 80% of all; when forestry -as a carbon sink- is taken out of the equation, they rise to 92%.

4. THE POTENTIAL OF RENEWABLE ENERGY RESOURCES IN AZERBAIJAN

Azerbaijan's share of global greenhouse gas emissions is merely 0.15%, but by 2030 and 2050, it hopes to have cut those emissions by 35% and 40%, respectively, compared to 1990 levels, and it aims to create a zero-emission zone in the liberated areas (The Republic of Azerbaijan, 2023). Azerbaijan also wants to increase the proportion of renewable energy sources in all installed power capacity from 17% to 30% by 2030 (UN Climate Change, 2021). The government signed contracts for the construction of wind and solar power in early 2020 in addition to enacting legislation to promote the use of renewable energy to meet this goal (IEA, 2022). In addition, precautions such as energy efficiency measures, low-emission solutions in the urban transportation system, the use of technologies that will create low carbon emissions in the industrial sector, the development of the waste management system, and the expansion of forests and green areas are also on Azerbaijan's political agenda. Accordingly, Azerbaijan claims that establishing green energy zones, green agriculture, and green transportation practices, increasing afforestation activities, and building smart cities and smart villages will serve to achieve the goal of "Net Zero Emissions" by 2050 (UN Climate Change, 2022). Furthermore, the government also attaches importance to the goal of accessing affordable, reliable, sustainable, and modern energy sources, which is among the Sustainable Development Goals of the United Nations (IEA, 2022).

To realize the goal of increasing the use of renewable energy in the generation of electricity, it is planned to create a total of 1,500 MW of new generation capacity - 440 MW in 2023, 460 MW in 2023-2025, and 600 MW in 2026-2030. Given Azerbaijan's high potential for renewable energy resources, experts estimate its economically and technically feasible renewable energy resource potential to be 27,000 MW. This potential comes from 23,000 MW of solar power, 3,000 MW of wind power, 380 MW of biopower, and 520 MW of mountain rivers (The Ministry of Energy of the Republic of Azerbaijan, 2022). Further, significant potential for renewable energy is also thought to exist in Azerbaijan's liberated areas. In these regions, it is estimated that there is a potential of over 7,200 MW for solar energy and over 2,000 MW for wind energy, while water resources are also estimated to have significant hydroelectric potential (Azerbaijan Renewable Energy Agency under the Ministry of Energy of the Republic of Azerbaijan, n.d.).

In the strategic roadmap of Azerbaijan, renewable energy capacity and the share of renewable energy in total capacity targets for the years 2020, 2025, and 2030 have been determined and shown in Table 7. Renewable energy plant capacity and the share of renewable energy in total capacity data for 2020 and 2021 show that the target is falling behind (Yusifov, 2018).

Table 7. Planned Power Installation (Mw)

	Wind	Solar	Hydro	Bioenergy	Total	Share in total capacity%
2020	350	50	10	20	430	20
2025	440	150	220	30	840	25-30
2030	465	190	220	50	925	35-40

Source: Yusifov, 2018

The World Bank research on the offshore wind potential of Azerbaijan estimates that there is a total of 157 GW of offshore wind potential, of which 35 GW is in shallow waters and 122 GW in deep waters. Natural gas primarily provides electricity production in Azerbaijan, a country with a high renewable energy potential. We expect the utilization of offshore wind potential to present opportunities like decarbonization, increased export potential, workforce transition to clean energy, and competitive pricing. The decrease in the use of natural gas in the electricity generation system and the increase in the use of renewable resources are important for the country to reach its decarbonization targets. By using offshore wind for electricity generation, Azerbaijan can export the gas it no longer uses for electricity generation. In the long run, shifting the workforce from the oil and gas sector to wind farms will create qualified jobs. Although the use of offshore wind creates a higher levelized cost of energy than current costs in the early stages of production, experiences from other countries indicate that the cost will decrease over time with the right policies (The World Bank, 2022).

The World Bank analyzed the effects of the use of offshore winds with two different growth probabilities. In the case of moderate growth, it will be possible to meet 7% of the country's electricity needs in 2040 with a foundation capacity of 1.5 GW. Despite achieving the 2030 renewable energy installation targets, the small scale of offshore winds limits their contribution to job creation, economic value creation, cost reduction, and decarbonization in comparison to the high growth model. The World Bank (2022) estimates that in the scenario of high growth, a foundation capacity of 7.2 GW will meet 37% of the country's electricity needs in 2040.

Interest in the use of renewable energy in Azerbaijan has started to increase in recent years, and it is accepted that the use of renewable resources in electricity production will contribute to the diversification of energy sources and that directing natural gas to more profitable export and use in petrochemicals instead of energy production will contribute to meeting the climate policy objectives. Despite Azerbaijan's strong potential for solar and wind resources, as well as prospects for biomass, geothermal, and hydroelectric resources, achieving economic diversification in terms of realized production and long-term goals will take time, and the economy will remain dependent on oil and gas for a while (IEA, 2022).

5. THE ROLE OF GLOBAL ACTORS IN GREEN ENERGY TRANSITION

Azerbaijan's strategic partnership with the EU is significant because it is both a tool for Europe to enhance energy security and support Azerbaijan's political motivation and planning for green energy transition. It also serves Azerbaijan's national pledges for international climate action. The political commitment and institutional readiness to undertake the green energy transition alone will enable Azerbaijan to take concrete steps towards achieving a more resilient and sustainable economy in the face of climate change, ensuring human and ecological security and the stability of the country. Azerbaijan's progress in terms of political will and practice to comply with the EU and international climate action is one of the complementary variables of the green energy transition and shows how to add tangible detail to otherwise ambitious climate targets at the national level.

5.1. Azerbaijan's Strategic Partnership with the EU

The EU-Azerbaijan Strategic Partnership aims to modernize energy, transportation, and logistics infrastructure, modernize oil and gas extraction, and build an environmentally friendly manufacturing sector. The European Green Deal prioritizes energy efficiency, reliability, and a fully integrated, networked, and digitalized energy market. Azerbaijan contributes strategically with its natural gas, safeguarding EU energy supplies. The partnership focuses on strengthening institutions, governance, economic development, connectivity, energy efficiency, environment, climate action, mobility, and people-to-people relations (European Commission, 2018). Van Gils (2018, p. 1581) states that the bargaining power in EU-Azerbaijan relations indicates "a more symmetrical relationship or at least a less asymmetrical mode than in relations with other states in the Eastern Partnership (EaP)". In van Gils' words (2018, p. 1581) this power rests on several factors, such as Azerbaijan's economic boom due to high oil prices between 2010 and 2015, Azerbaijan's skillful diplomacy demanding "cooperation to take place on a more inclusive, dialogical basis" and domestic expectations for the negotiation process. Today, plummeting oil prices, the demand for dialogical policymaking, and the need for diversification of the economy are the factors driving Azerbaijan to engage in cooperation with the EU. Yet, they herald the potential to extend closer cooperation and dialogue into the field of clean energy transition as well.

The European Commission's Eastern Partnership policy beyond 2020 aims for resilient, sustainable, and integrated economies, accountable institutions, rule of law, environmental and climate resilience, digital transformation, and fair and inclusive societies (European Council, 2022a). The European Commission considers extending the Southern Gas Corridor to Azerbaijan, a country that produces 5% of the EU's energy, to assist neighboring countries in diversifying their economies and temporarily reducing their carbon emissions (European Commission, 2021). The EU gains economically, politically, and strategically from Azerbaijan's involvement in the European Neighborhood Policy and the Eastern Partnership. The Eastern Partnership's core programs include green connectivity, digital connectivity, sustainable, innovative, green, competitive economies,

innovative rural development, and smarter cities, which will benefit Azerbaijan the most through its energy system reforms (European Commission, 2021, p. 24).

In 2019, the European Council defined achieving climate neutrality as a major opportunity for the EU. For this purpose, the European Council targets carbon leakage from imports and aims to prevent rising emissions outside the EU from undermining the EU's greenhouse gas reduction efforts (Council of the EU, 2022). Moreover, the EU is expanding its energy acquis to “neighborhood” partners and implementing regional and bilateral programs to simplify environmental and climatic cooperation (European Council, 2022b). EU4Climate and EU4Environment projects aim to integrate low-emissions and climate resilience objectives into development policies and plans in six Eastern Partnership countries.

EU4Climate supports greener decision-making, circular economy, smart environmental legislation, ecosystem protection, and information sharing (UNDP, 2023). It also helps Azerbaijan develop green investment strategies, finalize the Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) laws, reform regulatory regimes, promote compliance assurance, reinforce policy dialogues, support public environmental expenditure management, assess and strengthen administrative capacity, and develop Green Growth Indicators (EU4Climate, 2023).

EU4Environment focuses on environmental, health, and climate aspects in spatial planning (EU4Environment, 2022), protecting Azerbaijan's forests and wildlife. The organization's World Bank-supported guidelines safeguard fragile habitats. Community-driven ecotourism, ecosystem services evaluation, and natural capital conservation will improve policies. EU4Environment-Green Economy aims to improve water resource management, stakeholder involvement, and economic soundness of policies, inspiring eastern partner countries to balance economic development with environmental protection and green transition (EU4Environment, 2022).

Azerbaijan and the EU share environmental, energy, and climate goals. Azerbaijan, a member of the Eastern Europe Energy Efficiency and Environment Partnership (E5P) since 2019, established a new law on energy efficiency and a roadmap for accelerating eco-design and labeling requirements for energy-using products (EU4Climate, n.d.). Azerbaijan also plans to increase energy efficiency in all sectors between 2021 and 2025, resulting in natural gas savings of 3.5-4.2 bcm, improved export revenues of \$667-787 million, decreased budgetary subsidies of \$491-981 million, new investments of \$2.5-3.4 million, and 118,000-123,000 new jobs (EU Neighbours East, 2021).

In 2022, the EU signed a Memorandum on Strategic Partnership in Energy with Azerbaijan, a significant partner in the EU's transition away from Russian fossil fuels (European Commission, 2022), establishing a long-term energy efficiency and clean energy partnership. The policy prioritizes renewable energy development, energy technology cooperation, knowledge sharing, and cross-investment. The partners aim to harmonize Azerbaijani energy legislation, improve energy demand

management, including concrete energy-saving measures, introduce measures to tackle climate change, benefit from relevant mechanisms under the Kyoto Protocol (European Commission, 2022, p. 25), such as carbon trade and converge electricity and gas markets (European Parliament, n.d.). The European Commission (2022) highlights the importance of renewable energy development “to fully reap the synergies between the EU’s clean energy transition and Azerbaijan’s strong untapped renewable energy potential, in particular in the offshore energy sector”.

In conclusion, the EU-Azerbaijan Strategic Partnership provides normative leadership and a plan for developing the country's energy, transportation, transit, and logistics infrastructure. The European Green Deal anchors the Europeanization of external energy policy and extends the EU’s acquis for greener and cleaner energy to its eastern neighbors.

5.2. Azerbaijan’s National Pledges for Accordance with International Climate Action

Azerbaijan ratified the UN Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol in 1995 and 2000, joining the Non-Annex I Group of countries “especially vulnerable to the adverse impacts of climate change, including countries with low-lying coastal areas and those prone to desertification and drought” and “that rely heavily on fossil income from fossil fuel production and commerce” (UNFCCC, n.d.-a). The country supports a climate change deal and aims to reduce greenhouse gas emissions by 35% by 2030 (UNFCCC, n.d.-b). Azerbaijan has implemented measures like low-carbon, energy-efficient, renewable energy, waste management, and forest growth.

The Deputy Prime Minister leads the State Commission on Climate Change, a technical working group that improves agency relations, encourages participation, and helps achieve UNFCCC commitments (UNFCCC, 2014). It also develops inventory systems and evaluates emission reduction options with an action plan. To meet revised NDC emission goals, Azerbaijan ensures an open climate policy and pledges a 40% GHG emission reduction by 2050 (The Republic of Azerbaijan, 2023).

Azerbaijan has implemented climate change policies, programs, and regulations since 1998, focusing on pollution from industrial production (oil exploration and production, energy, transport, and other sources), the Caspian Sea, forestry, land biodiversity, and institutional development. Azerbaijan is committed to enhancing its water resources, land, forests, and the Caspian Sea, recognizing environmental conditions as both a contributing factor to poverty and a means to mitigate it (Organization for European Cooperation and Development [OECD], 2007, p. 104). Azerbaijan aims to respond to environmentally sustainable energy development concerns with a growing use of renewable energy (Climate Change Laws of the World [CCLW], 2003; ADB, 2005). Hence Azerbaijan neatly links the goals of increasing energy security, attracting investment in renewable energy resources, improving energy efficiency, and creating new sector jobs (IEA, 2021).

The Azerbaijan State Program on Poverty Reduction and Sustainable Development aims to reduce energy sector emissions by 20%, increase renewable and alternative energy sources, reduce fuel-

energy complex environmental impact, create an action plan, and establish a carbon fund for mitigation efforts (CCLW, 2008). Azerbaijan plans to respond to the social and economic needs of Baku and its settlements by developing new power plants, improving infrastructure, and renovating heating facilities (UNECE, n.d.).

Azerbaijan established the State Agency for Alternative and Renewable Energy Sources (SAARES) in 2009 to combat climate change and improve energy management. The 2012-2020 National Strategy aims to boost energy efficiency and use alternative and renewable energy sources for electricity and heat generation. Decree No. 1159 established the Azerbaijan Renewable Energy Agency in September 2020 to manage and implement policy.

Since 2009, Azerbaijan has set goals to diversify its economy, connect to the global market, develop infrastructure, and improve living standards (Azerbaijan Portal, n.d.). Azerbaijan's key policy goal is diversification; therefore, growing the non-oil sector, particularly the green economy, is a priority and an opportunity. Azerbaijan's 2015-2020 State Program for the Development of Industry promotes eco-friendly energy technologies, alternative energy installation and equipment manufacturing, improves existing industrial plants, and launches new ones (Food and Agriculture Organization [FAO], 2014).

Industrial parks like Balakhani promote green growth, job creation, and environmental improvement in Baku. Western countries supply energy-efficient and low-carbon technologies, while EU-funded industrial zones strengthen non-oil sectors and support economic diversification (EU-Azerbaijan Business Forum, 2021). Azerbaijan prioritizes agriculture, food production, tourism, logistics, information and communication technologies, and other light industries for economic diversification (EU4Business, 2021).

Launched in 2015, the Azerbaijan 2020 Outlook for Future Development Concept aims to reduce energy use and carbon dioxide emissions to OECD levels (ADB, n.d.). It also seeks sustained economic growth, social welfare, effective state administration, human rights protection, civil society participation, and food security. Azerbaijan's development goals include bringing environmental protection to European standards, improving energy, transportation, and residents' skills in the countryside, and creating new competitive non-oil industries.

This process will strengthen Azerbaijan's susceptible sectors, help the country combat climate change, and include the country in large-scale EU economic and market developments (FAO, 2023). Azerbaijan's energy transition will take time, but a robust roadmap and normative leadership will help. Thus, promoting a green economy will help Azerbaijan achieve its fundamental goal of a strong, well-functioning economy that can compete globally and develop new partnerships through a transforming energy sector.

6. CONCLUSION

The availability of data limits Azerbaijan's systemic value analysis. The most important factors determining the accessibility of data are the data collection practices of government agencies, transparency and data sharing, or the existence of observable/measurable impacts of a policy since its introduction. Still, the effects of climate change and environmental degradation, market analysis and an assessment of Azerbaijan's renewables potential, the political orientation of the Azerbaijan government, its national pledges for climate action, and the progress to comply with the EU's neighborhood policy allow us to make predictions about the challenges Azerbaijan will face and the benefits it will reap from the green energy transition.

For Azerbaijan to diversify its economy and increase resilience against the global volatility of oil prices, it must increase its energy mix with renewables, encourage private sector-led development, and promote productivity. Diversification of production through renewables will contribute to stable economic growth. Investment in new and green technology will both attract foreign investors and create new jobs. Increasing use of clean energy will motivate adoption of sustainable and green practices in agricultural and industrial sectors, which will increase the resilience of communities and create new jobs.

To achieve this goal, Azerbaijan needs to reduce its reliance on natural gas for electricity production and boost its use of renewable energy sources, thereby increasing its share of natural gas exports abroad. Thus, Azerbaijan will achieve both the greening of its energy sector and economy and save an essential source of income. The more surplus natural gas Azerbaijan has, the better its relations with the EU, which has been shifting toward relatively less polluting energy alternatives as part of climate action. Azerbaijan's partnership with the EU has several benefits, including R&D and technology transfer, foreign investment, trade, and international recognition of political discourse.

Infrastructure upgrades to increase energy efficiency will prevent transmission and distribution losses in Azerbaijan. Legislative and regulatory changes are improving the efficiency of energy production and supply chain. These processes include developing new production capabilities that suit modern energy system requirements, reducing losses in transmission and distribution systems, and restoring and reconstructing current energy production capacities to increase efficiency. However, Azerbaijan must develop energy efficiency at the consumer, industry, and transport levels. For this purpose, Azerbaijan established a Green Energy Zone in the liberated territories, which will be the base for the future application of environmentally friendly and efficient green technologies. Azerbaijan recognizes renewables as an alternative to hydrocarbons, encourages private actors to engage, and provides mechanisms to increase them. However, only a few small private players operate in the energy market due to the incomplete implementation of the regulations.

The ambitious climate action plans of the EU would likely require hefty tariffs on CO₂-containing goods and services. If Azerbaijan doesn't improve its exports of CO₂-free products, its global exports may drop. Thus, the EU provides both motivation and guidance toward green energy transition through its neighborhood policy and strategic partnership with Azerbaijan.

Although Azerbaijan displays a governmental focus on green energy transition and climate action, society and local communities need to understand and embrace an integrated approach to sustainable development, clean energy use, and the well-being of the ecosystems, including soil, water, air, vegetation, and biodiversity. If Azerbaijan achieves to transform its fossil-fuel-dependent economy into a greener and carbon-neutral one, it will be a good example for other countries and may contribute to expanding the scope of the green transition.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that they all equally contributed to all processes of the research.

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Transition from Hydrocarbon Geopolitics to Critical Mineral Geopolitics

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Abstract

Geopolitical analysis considers factors beyond a state's geographical location, such as climate, topography, demographic structure, natural resources, country size, and technological advancement. In the 20th century, natural resource ownership and control became crucial to geopolitical analysis and policymaking. In recent years, the need for clean energy has become more prominent due to the negative effects of climate change. Developing technology and increasing populations have led to a greater demand for energy. Transformation is necessary to differentiate between energy systems that rely on clean technologies and hydro-carbon energy sources. This study will discuss the transition process from hydro-carbon energy to geopolitics based on critical minerals required for sustainable climate and clean energy, its reasons, and the current reflections of the future geopolitical struggle. Descriptive and historical research methods were used in this study. As a result of the study, it was determined that there may be changes in the geopolitical struggle depending on energy.



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<https://doi.org/10.30798/makuiibf.1452392>

Keywords: *Geopolitics, Critical Mineral, Hydrocarbon.*

Article Type	Application Date	Admission Date
Research Article	March 13, 2024	December 11, 2024

1. INTRODUCTION

When formulating policies, nations and powers with ambitions of global dominance prioritize economic advantages and their sustainability. This approach is rooted in imperialistic ideology and seeks to satisfy the raw material needs of the imperialist state. The economic goal is to access cost-effective labor, energy, and underground and surface resources to sustain industry and ensure long-term security.

Imperialist countries implement extensive policies spanning over 40 or 50 years to achieve their goals, prioritizing research and development activities.

The utilization of developing technology and information systems is imperative in this process.

At this point, the question becomes essential: "Can there be a change in the field of geopolitical struggle with the developing technology?" In order to answer this question, it is necessary to examine developments in energy fields and technology. Currently, countries and regions that have affordable labor, abundant natural resources, and energy have become significant. Once these locations are identified, efforts are made to establish political connections with them.

Various methods may be employed when political relations cannot be developed through cooperation and mutual agreement. These methods can include using force, such as overthrowing the political power through a coup or applying economic and political sanctions. Another approach is supporting the opposition in changing the ruling power democratically. Additionally, some may attempt to exploit ethnic and religious differences in the target country to create chaos and make it vulnerable to international intervention.

It is essential to recognize that each region has unique characteristics that affect its geopolitical value. Factors such as geographical location, natural resources, and workforce contribute to this value. However, the significance of each region is not fixed and may change with the development of new technologies. Imperialist countries adapted their policies accordingly to capitalize on these changes.

Historically, countries and cities connected by trade routes on land and sea held significant geopolitical importance. However, as industrialization relied heavily on hydro-carbon energy, countries with abundant energy resources became politically significant. In recent years, the focus has shifted towards climate and energy security, emphasizing the need for clean energy transformations. As a result, the minerals required for clean energy technologies and the locations that possess them are now part of a new geopolitical equation. Unfortunately, imperialist nations have already begun developing policies for extracting, processing, acquiring, and maintaining these crucial minerals.

This study seeks to explore whether geopolitical equations and policies change based on technological development and the need for raw materials. The primary issue is that with technological advancements, the demand for resources increases, leading to imperialist states devising their geopolitical strategies based on the underground resources of other countries. In certain cases, this approach has negative consequences for the countries that possess these resources.

The aim of this study is to examine the efforts of imperialist countries to shape their geopolitical plans through critical minerals. Specifically, we will explore the transition from current hydro-carbon energy-based policies to those based on critical minerals required for sustainable climate and access to clean energy in the 2040-2050s. We will discuss the reasons for this shift and potential geopolitical implications.

The study is expected to contribute to science by showing how developing technologies change the fields of geopolitical struggle.

Descriptive and historical research methods were used in this study. Firstly, the theoretical part and definitions will be explained. After introducing the study's theoretical framework, this analysis will investigate the 2022 National Security Strategy Document of the United States and the International Energy Agency's (IEA) report from March 2022. The relationship between these reports and contemporary international relations regarding cause and effect will be discussed.

2. CONCEPTS: GEOPOLITICS, GEOSTRATEGY, NATIONAL POWER AND ITS ELEMENTS

Geopolitics was first introduced in the 19th century by Rudolf Kjellen, a Swedish political scientist (Aron, 2003, p. 191). However, its roots can be traced back to ancient Greek philosophers such as Herodotus (485-425), Platon (427-347), Aristotle (384-322), and Strabo (B.C.63-B.C.24). Aristotle argued that climatic conditions influenced the political landscape of Greek city-states and empires, this was also emphasized by Immanuel Kant during the Renaissance in France (Scholvin, 2016, p. 8). Although scientific geography was incorporated into political and international relations since the 15th century, Kjellen's use of the term "geopolitics" in an article about Switzerland's borders and the relationship between diplomacy and military service popularized the term (Yılmaz, 2015, pp. 201-248).

The concept of geopolitics originates from the Greek words "geo" and "politeia," which mean land and politics, respectively (Evan and Newnham, 1998, p.2). While there is no universally agreed definition, it refers to the branch of science that examines the relationship between a state's geographical location and political situation. Geopolitics considers factors such as a country's climate structure, proximity to seas and oceans, access to transportation routes and important junctions, distance to significant power centers, and conflict zones in world politics (Doster, 2017, pp. 83-110). Additionally, the concept evaluates a country's geographical structure regarding military operations. However, a country's geographical location alone cannot ensure foreign policy success. National power elements are also considered when forming policy alongside the country's geography. Geography is a crucial component of federal power. To better understand this, examining the various elements of national power and the corresponding approaches is essential.

According to Bayat (1986, pp. 61-86), The elements of national power are “military power, economic power, demographic power, scientific and technological power, and psycho-social and

cultural power. There are different approaches to the elements of national power. While the General Staff of the Republic of Turkey stated that the elements of national power consist of "political, military, economic and socio-cultural" issues, the United States International Relations Commission stated that it consists of "Diplomacy, natural resources, armed forces, population, geography, technology, national unity."

In his book "The Relations of Nations," Frederick H. Hartman (1983, p. 26) identified various aspects contributing to a nation's power, including demography, geography, economy, science and technology, history, psychological and sociological situation, administration and organization, and military strength.

Similarly, in his book "Politics Among Nations," Hans J. Morgenthau (1967, p. 33) listed the elements of national power: geography, industrial capacity, natural resources, military preparedness, population, national character, national morale, diplomacy, and government effectiveness.

Numerous examples of the elements of national power can be provided. However, they all cover similar subjects under different categories. As a result, it is appropriate to analyze the factors of national power through the concepts of "Force" and "Power."

When referring to national power, every component that contributes to it must possess the qualities of being a "power." Along with having a powerful attribute, each component must be actively engaged, not in a passive or potential state.

Based on the explanations provided, we can identify various types of power, such as geographical power for a country, democratic power for a nation, and political power for an administration. Additionally, we can consider military, economic, science and technology, psychosocial, and cultural power, which reflect the state's ability to fulfill essential functions and uphold the nation's spiritual values.

Various theories throughout history have influenced geopolitics. Mackinder and Spykman are two significant figures who made statements and developed theories regarding geopolitics during World War II and the Cold War (Fettweis, 2015, p. 235). British scholar Mackinder focused on heartland theory. According to Mackinder, whoever conquers Eastern Europe gains control of the Heartland - the central region of the Eurasian continent. The one who dominates the Heartland then gains control of the entire World Island and, ultimately, the world. According to Mackinder's theory, some countries and regions have undergone significant industrialization and development. This region possesses an extensive array of natural resources, particularly hydrocarbon energy, which unequivocally and substantially contribute to the global economy (Clover, 1999, pp. 8-10).

Nicholas Spykman's "Rimland Theory" (1942, p. 43) emphasizes that the security of the USA should be prioritized over geographical factors. The most effective way to control Mackinder's Central region, according to Spykman, is by holding rimland." Spykman emphasizes the concept of a rimland

consisting of three sections: the European Coastland, the Arab-Middle Eastern Desert land, and the Asiatic Monsoon Land. Spykman's theory solely emphasizes a nation's security and vital geographical positions to uphold it. This encompasses the domination of the essential raw materials required for an imperial state, mainly the natural resources in these areas.

American Admiral Alfred Thayer Mahan developed the "Naval Power" theory in his book, "The Influence of Sea Power." It posits that whoever dominates the seas will achieve global dominance. Mahan believed that naval power was superior to land power. With strong naval capabilities, nations like the USA, England, and Japan would have an advantage over nations like the Soviet Union and China, which were more focused on land power (Mahan, 1987, pp.1-23).

Geostrategy is critical to any country's political interests, particularly its foreign policy, as it is determined based on geographical conditions. The primary objective of geostrategy is to safeguard the country's interests in specific trade routes, strategic nodes, rivers, islands, and seas. Frederick L. Schuman first introduced this concept in his article "Let Us Learn Our Geopolitics" in 1942 (Schuman, 1942, pp.348-360). When deciding on their geostrategy, countries must consider the current state of their national power elements. Specific strategies may not be feasible if there are any shortcomings or weaknesses in some of these elements. On the other hand, in line with the state's geostrategic policies, military, political, and economic power elements must be re-planned and put into action. Military power must be tailored to the current geopolitical and geostrategic situation, while financial activities and trade should be determined based on the geopolitical situation.

It is crucial to acknowledge that every state has a geostrategy. However, military power alone is inadequate for achieving strategic goals. One cannot become a great power without it. Nations must develop their geopolitical approaches to be global actors. After the Cold War, the United States employed Spykman's "Rimland Theory" to form alliances and encircle the Soviet Union while simultaneously building up significant naval forces by Mahan's "Sea Domination" theory. Germany and Russia, being land states, focused on developing robust land armies and strategies based on MacKinder's "Heartland Theory". Meanwhile, England strengthened its naval forces to maintain its dominance in colonial areas.

In addition to military power, it is imperative to have economic, social, cultural, demographic, and technological power. Such capabilities enable states to impose their desired policies. However, the adoption of any policy is a controversial issue. Although the dominant global powers do not always do what they want, they prevent any action that does not suit their interests. This issue ultimately determines whether a state will become a global or regional power (Keegan, 1993, pp. 341-345).

States typically resort to military force only as a last option. Military power is commonly utilized as a means of deterrence. As global powers exert their geostrategic policies on other nations, they also employ tactics such as soft power elements, perception management, proxy wars, psychological warfare,

and asymmetric warfare methods, in addition to their military forces. All these efforts aim to establish hegemony on the other side and obtain the necessary aspects for the state's survival. These include energy resources, rich raw materials, and consensual seizure and retention of markets. Access to and control of energy, raw materials, and markets is insufficient. Inspection and safety of transport routes are also essential components to be considered (Keegan, 1993, pp. 352-357).

States must collectively consider geostrategy, geopolitics, and geoeconomics to achieve their global interests. The primary concern is safeguarding economic interests and implementing policies to achieve this. Therefore, while developing appropriate policies within their geography, states must also devise policies in other regions to ensure a sustainable economy. The availability of raw materials influences states' policies on industry, technology, and energy. Countries may use their resources and establish diplomatic relations with nations with the required materials (Collins, 1998, pp. 60-75).

Sometimes, acquiring the necessary raw materials and maintaining good relations with the source country isn't enough to solve the problem. The safety of the raw materials during shipment and the chosen shipping route also become crucial factors to consider. More is needed to make agreements with the source country to ensure the safe and sustainable flow of goods. It's also important to consider the safety of the goods and the route they will take. To achieve this, states can develop policies alone. To handle such a situation, the state must harmonize strong economic, military, and political power. Additionally, there must be no interruptions in the supply of necessary raw materials for the elements of national power to be effective (Keegan, 1993, pp. 355-362).

In the current landscape of international relations, it appears challenging for a country to establish comprehensive global policies that safeguard its interests. This can be attributed to various factors, such as the evolution of global strategies, advancements in technology and cognition, and the abundance of information available. States often need to form alliances to achieve things they cannot accomplish independently. For instance, the USA's policies towards the Soviet Union emphasized the importance of containment, which involved creating comprehensive alliances based on the Border Belt theory. Similarly, the Soviet Union (and now Russia) has pursued policies to secure access to warm seas and maintain a robust naval presence in the Baltic and Mediterranean regions. Today, one of the most significant developments is the establishment of trade routes under China's "One Belt One Road" initiative, which highlights the importance of ensuring the safety and security of these routes.

3. CHANGES IN GEOPOLITICS

Geopolitics is constantly changing, affected by population movements, demographic shifts, and technological advancements. As a result, states must adapt their geostrategic approach to meet their evolving needs. States are adopting new policies and collaborating with others to ensure their national survival and effectively address defense issues. Economic factors will heavily influence the world in the future, and geopolitics will be crucial. Geopolitical changes are inevitable, including the shift from a

unipolar to a multipolar world, the rise of regional powers, terrorist threats, climate change and sustainable policies, regional dominance, and the resurgence of past conflicts. Technological advancements and their demands will also force changes in geopolitics.

Geopolitical theories differ according to the objectives that change among themselves in the process. In forming this difference, economic policies have been the primary decisive factor in the transition to the nation-state order. The hegemony of the states, which had strong land armies (Mongol, Russian, and Chinese Empire, Ottoman Empire, Austro-Hungarian Empire) until the 1600s before the nation-state, was influential in geopolitics. The discovery and development of sea routes have changed the power dynamic from land-based territories to the open ocean. This has led to a new aspect of colonialism, where economic dominance is more important than traditional land conquest and occupation. Hegemonic powers are exploiting the country's resources by collaborating with local powers. During colonial times, sea routes were primarily used to access raw materials. Using sea routes and maritime trade allowed access to distant areas. Mahan was inspired by the UK's maritime control and proposed the Rimland theory (Mahan, 1987, pp.1-23).

Since the beginning of the 20th century, ideological approaches have played a role in determining geopolitics and geoeconomic policies. The rise of industrialization and capitalism led to the emergence of workers' movements and socialist ideology. The Bolshevik Revolution in 1917 marked a significant shift in prioritizing ideology in state affairs. In response, capitalist nations began implementing measures to restrict the socialist world's reach and influence. Concurrently, the Heartland Theory emerged, emphasizing the territories formerly governed by traditional land-based states (Mackinder, 1962, p. 241).

Since the Cold War, the world has been split into two distinct ideological spheres: the bipolar world. This division has had lasting and irreversible effects on global politics and international relations. The USA's focus in the Middle East during the Cold War was primarily on oil and containing the Soviet Union. Today, it has come to the fore to prevent Russia from re-emerging as a hegemonic power in Europe. The USA's priority in the Middle East was controlling the oil, regardless of whether the countries in the region were democratic. The authoritarian or totalitarian regime type in power was insignificant as long as the existing regimes cooperated with the USA. The events in Afghanistan since the 1980s, as well as Middle Eastern countries' relations with the Soviet Union, led the USA to alter its strategy. As a result, the USA introduced the "Greater Middle East Project," intending to implement a policy called moderate Islam under the banner of democratization. However, the September 11, 2001, Twin Tower Attack gave the United States the opportunity it sought. The US claimed that it aimed to neutralize terrorist organizations in their locations, leading to an invasion of Iraq (Ari, 2006, pp.57-87).

Although Russia is the largest country in the world geographically, it does not have secure borders and exit corridors to ensure its strategic depth and global interests. However, with its oil and

incredible natural gas, it has succeeded in creating energy dependence on these countries with its agreements with the surrounding countries, especially the European countries. Russia's strategic approach of expanding its influence in warmer regions and energy policies have strengthened ties with Turkey. President Putin's proposal to transport natural gas to markets via Turkey, establishing it as a natural gas trade hub and key transit point, holds significant geopolitical importance for Russia. Installing nuclear power plants in Turkey and commercial and tourism agreements have brought the countries closer politically, but it has also made them economically interdependent. Russia's decision to access warm seas through the Baltic Sea led to the U.S. persuading Sweden and Finland to join NATO despite their long-standing neutrality policy.

China has become a major global player alongside the US and Russia. China prioritized its economy after gaining independence following two destructive wars in the 20th century. It utilized its population and abundant natural resources to rapidly develop while also pursuing a policy of exerting its influence through soft power and economic means in other regions (Van Beek, 2011, 390).

Thanks to the constructive policies it has pursued in Africa, China has accessed raw materials that are unavailable within its borders. The relationship between China and African countries is based on friendship, equality, mutual benefit, and shared prosperity, as well as mutual learning, support, and close coordination in political, economic, cultural, and international relations (Van Dijk, 2009, p.31).

4. FUTURE OF GEOPOLITICS

Changes in the global economy lead to shifts in geopolitical and geostrategic conditions. The economy's contraction or expansion impacts this change. With the world population rapidly increasing, there is a greater demand for resources such as food and energy. Additionally, population growth has led to an acceleration of urbanization. Urbanization rose from 15% in 1900 to 45% in 1990, then to 50% in 2000 (Yılmaz, 2017, pp. 163-188). Urbanization and increasing population have caused rapid consumption, especially in developed countries, and Western countries, which have about 20 percent of the world's population, have consumed 70 percent of their energy resources. Western countries unwilling to consume their energy resources have sought energy and raw materials in other geographies and have started using violence to reach them. Imperialist states have made the Middle East and Caucasus regions a focal point due to their abundance of oil and natural gas deposits. Additionally, the diverse demographic makeup of the regions, including various cultures, religions, and sects, and their location on migration routes have further facilitated these policies.

Over the past two centuries, humanity has experienced a significant transformation. As the global population continues to grow at an unprecedented rate, technological advancements have also changed how people think and behave as individuals and as a society. Nowadays, long-term strategies and policies have replaced the short-sighted ones that were once prevalent. While planning their futures, they have begun considering the issues that technology affects and contributes to. Many societies and

countries have started to formulate and implement long-term policies to ensure that their citizens' future is secured in terms of peace and prosperity. While technological advancements and industrialization have brought about numerous positive changes to human life, they have also had adverse effects on various aspects (Özer, 2016, pp. 137-157).

It is predicted that there will be unpredictable changes in human life in the next thirty or forty years. Three issues come to the fore in this change. These include climate change, globalization, and global inequality. Although it is impossible to address globalization and global inequality in terms of the subject and scope of the study, it can be examined from various dimensions. Climate change is emphasized as the first step in this study's geopolitical changes. Many factors cause climate change, but human activity is the primary cause. Climate change is caused by uncontrolled human activities, rapid population growth, and the measures taken to meet human needs and consumption (Kahraman and Şenol 2018, 353-370). Technological studies relieve people's basic needs, such as heating, nutrition, and shelter, and confront nature and people. The excessive consumption of natural resources and human activity have led to ecological crises, particularly global warming and climate change (Özer, 2016, pp. 137-157).

According to Taylor, Wiesenthal, and Aphrodite (2005, pp. 360-376), The initial effects of climate change are manifested through global warming. Human activities, mainly using hydrocarbon energy sources such as coal, increase greenhouse gas emissions, which in turn cause global warming. Carbon dioxide emissions are primarily responsible for this phenomenon. Although hydrocarbon energy sources are essential, they negatively affect the climate, ecosystems, and human health.

It is imperative to acknowledge that hydrocarbon energy production is a significant source of pollution and has contributed to ecological crises. Accordingly, environmentalist movements have raised concerns and scrutinized its impacts. The sustainable development movement aims to ensure that the environment is not negatively impacted during the developmental process and that natural resources are utilized responsibly. Unfortunately, the escalating demand for energy brought about by population growth, accidental consumption, and technological progress is hindering our progress toward this objective.

According to Özer (2016, p. 142), Energy consumption depends on each nation's development status and population size. Developing countries necessitate more power as they progress industrially, unlike developed nations. Additionally, energy costs rise in developing countries due to the inefficient utilization of energy compared to their developed counterparts and a limited energy supply. This ultimately places developing countries at a disadvantage in the global market due to the escalating energy expenses. It is crucial to address foreign dependency in energy policies for developing countries. Developing nations must actively pursue more substantial relationships with hydrocarbon energy-rich

countries to decrease this dependency. However, they must also be aware that this can have geopolitical implications and proceed cautiously.

It's imperative to acknowledge that developed countries have vastly different approaches to their energy resources. They refuse to use them and instead take control and use energy resources in other regions. This creates geopolitical equations and policies that often lead to domination and hegemony.

While hydrocarbon energy has caused global problems and conflicts, it has also contributed to global warming and climate change. According to Michael Klare, (2002, p. 304) "in the past, many wars were fought to possess natural resources. In the future, wars will be fought to possess hydrocarbon energy and water." Klare's statement indicates that the wars fought so far have been waged to secure access to hydrocarbon energy resources. The struggle for hydrocarbon energy is the primary cause of geopolitical conflicts in the hydrocarbon-rich regions of the Middle East, Africa, and South America. The Great Middle East Project aims to destabilize Arab countries such as Libya, Egypt, Iraq, and Syria. Similarly, global powers are struggling for control over hydrocarbon energy-rich South American countries, notably Venezuela. Additionally, colonial policies have been implemented in African countries with abundant natural resources, especially in the Sahel region. All of these actions are intended to eliminate energy dependence. Although policies are designed to meet the needs of developed countries' increasing population in connection with technology, excessive consumption causes ecological problems.

The impact of hydrocarbon energy on climate change and the threats to international security have compelled countries to look for alternative energy sources. However, it is essential to note that these two issues are not the only driving factors behind the search for different energy sources. Technological developments have led countries to explore other energy sources. As a result, sustainable and clean energy, energy security, and technological advancements have become critical factors in determining a country's energy mix. The effects of global crises on national economies and the growing concern over global warming, which is increasingly being felt, have compelled governments to take measures to reduce their reliance on hydrocarbon energy and instead shift towards more cost-effective, safer, cleaner, and eco-friendly sources of energy such as wind, solar, and geothermal power (Kakışım, 2022, p. 104).

Power plants and their capacity increase annually in countries that invest in renewable energy production and technology. Modern technologies related to renewable energy are rapidly becoming widespread. Electric vehicles have become a popular choice for public and urban transportation, in addition to personal vehicles.

The International Renewable Energy Agency's 2020 report on Global Energy Transformation predicts that by 2050, renewable energy sources such as wind and solar power will account for 66% of the world's total energy consumption and 86% of global electrical energy production. According to the

report, the transportation industry is projected to have 965 million electric vehicles, 57 million public vehicles, and 2.16 billion two and three-wheeled individual vehicles. In addition, the International Renewable Energy Agency (IRENA) has stated that the countries expected to have the most significant increase in renewable energy consumption include the People's Republic of China (67%), India (73%), the USA (63%), and the EU (73%), which consists of 27 member states (International Renewable Energy Agency Report, 2020)

According to BloombergNEF's New Energy Outlook 2020 report, investments in the energy sector are now primarily focusing on renewable energy and related technologies, The report states that by 2050, approximately USD 15.1 trillion will be invested in new power capacity, with USD 5.9 trillion of this investment being made in wind energy and USD 4.2 trillion in solar energy. Asia-Pacific countries, especially China and India, are expected to account for 45% of this capital investment, with America and Europe following in their footsteps.

Developments in energy transformation cause geopolitical effects apart from their economic and technological dimensions. The transition from one energy source to another reveals new geopolitical equations covering the geographies of these energy sources (Carley et al., 2018, p. 138). Energy transformation relies on underground resources that are concentrated in a few countries. A handful of nations often control these resources' extraction, separation, and export. This creates new geopolitical tensions around energy security, which must be addressed through sustainable climate, energy, and technology policies.

The discovery and utilization of coal, oil, and natural gas marked a significant turning point in the energy geopolitics of the world. These resources had critical beginnings, both in terms of geography and national origin, over the last two centuries. The extraction and use of these resources brought about significant changes in the global economy, politics, and the environment. Coal was the first important energy source, followed by oil and natural gas, which have since become the world's primary energy sources. The discovery and exploration of these resources have led to the development of new technologies, industries, and markets that have transformed the global energy landscape. The transition between different energy sources has resulted in many economic, logistical, and technical infrastructural problems. Shifting from one energy source to another has also created significant political and geopolitical tensions. Extracting these resources requires a substantial investment, and as a result, countries that lack the necessary economic power often become vulnerable to foreign intervention. Having the technology to extract resources is as important as investing in them. There is a need for laying oil and natural gas pipelines across seas and continents, pumping stations, refinery facilities, and sea and land vehicles with a carrying capacity of thousands of tons. When oil and natural gas pipelines pass through multiple countries' sea and land borders, it becomes necessary for those countries to reach agreements. In cases where no agreements or bilateral or tripartite contracts are based on international law and fairness, it can lead to issues with other nations and even the possibility of conflict.

Industrialized countries have a high demand for energy to maintain their industries. The need for energy to continue industry operations, the geopolitical considerations that come with meeting this need, and the measures required to ensure the sustainability and security of these considerations are interconnected issues that impact each other. It is imperative to allocate military funds toward securing our energy supplies. This requires the construction of combat vehicles for land, sea, and air, along with the acquisition of energy resources like oil, which are critical for these vehicles. These factors must become the primary focus of attention for both regional and global security and global geopolitics. The unequal distribution of the world's natural resources has led to developed countries exerting control over oil and gas reserves in underdeveloped countries. This control has enabled developed countries to establish hegemony over these regions, leading to political and economic destabilization and, in some cases, civil wars and chaos (Kakışım, 2022, p. 108).

The discovery, supply, storage, and security of different energy resources can rebuild the geopolitical equations that arose from coal, oil, and natural gas energy sources. It is possible to state these various energy sources as "Critical Minerals." The minerals mentioned below are essential in constructing power plants, wind turbines, solar panels, electric vehicles, and energy storage units (batteries). These minerals include rare earth elements such as lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium; and other minerals such as lithium, cobalt, copper, nickel, germanium, graphite, beryllium, and tellurium (Kakışım, 2022, p. 108).

Critical minerals were evaluated in the "The Role of Critical Minerals in Clean Energy Transitions" report published by the International Energy Agency (IEA) in March 2022. (International Renewable Energy Agency Report, 2022). This report states that the mineral requirements of the energy system working with clean energy technology and those working with hydrocarbon energy are different. The expansion of the electricity grid necessitates substantial quantities of copper and aluminum. Copper, silicon, and silver are required for clean energy production via solar panels. Minerals like lithium, nickel, cobalt, manganese, and graphite are essential to guarantee optimal performance and energy density of electric car batteries. Moreover, rare earth elements are critical in wind turbines and electric vehicle engines. According to the report, the demand for critical minerals is expected to increase six times in 2040 compared to 2020. Precisely, the need for lithium is predicted to increase by 42 times, graphite by 25 times, cobalt by 21 times, nickel by 19 times, and rare earth elements by seven times compared to the demand in 2020 (Gökçe, 2023).

Based on the data provided by the International Energy Agency, the top three countries with the highest capacity for oil extraction are the USA, Saudi Arabia, and Russia. Meanwhile, the USA, Russia, and Iran are the top three countries with the highest capacity for natural gas extraction. Regarding oil processing, the USA, the People's Republic of China, and Russia are the top three countries. At the same

time, Qatar, Saudi Arabia, and the USA are the top three countries in natural gas processing (International Renewable Energy Agency Report, 2022).

The extraction and processing of critical minerals differs significantly among countries. Chile, Peru, and the People's Republic of China are the top three countries in copper extraction capacity. Similarly, the top three countries in copper processing capacity are the People's Republic of China, Chile, and Japan. The countries with the highest rare earth extraction capacity are the People's Republic of China, the USA, and Myanmar. Meanwhile, the countries with the highest rare earth processing capacity are the People's Republic of China, Malaysia, and Indonesia. Australia, Chile, and the People's Republic of China are the top three countries in lithium extraction capacity for electric vehicle batteries. Meanwhile, the People's Republic of China, Chile, and Argentina are the top three countries in lithium processing capacity. Democratic Republic of Congo, Russia, and Australia in terms of cobalt extraction capacity; In terms of cobalt processing capacity, the People's Republic of China, Finland, and Indonesia take the top three places (International Renewable Energy Agency Report, 2022).

More than 75 % of the global production of Lithium, Cobalt, and Rare Earth elements is controlled by the three largest producing countries in the world. Based on the 2019 data, the Democratic Republic of Congo and the People's Republic of China jointly produce 70 % of Cobalt and Rare Earth Elements. The People's Republic of China holds a significant share in the processing of Nickel, accounting for 35 percent. China's share in Cobalt and Lithium processing is even higher, ranging between 50-70 percent. Additionally, Chinese energy companies invest in countries such as Australia, Chile, the Democratic Republic of Congo, and Indonesia (International Renewable Energy Agency Report, 2022).

The People's Republic of China has the world's largest proven reserves of rare earth elements and is the country that consumes and exports these elements the most (Körst 2020, p. 28). It controls 90 % of the rare earth's production in the processing and separation processes (Schmid, 2019, p. 380).

Half of the world's proven cobalt reserves are in the Democratic Republic of Congo (DRC). It is expected to supply around 70% of the global cobalt supply by 2020, making it the country with the largest cobalt reserves (Körst, 2020, p. 32).

34% of lithium reserves are in Bolivia, 31% in Chile, 13% in China, 8% in the USA, 6% in Argentina, and 3% in Australia. Australia and Chile are the leading producers and exporters of lithium (Swain, 2017, pp. 388-403).

When assessing the distribution of mineral reserves globally, it is revealed that only six countries - Australia, the Democratic Republic of Congo, Brazil, China, Chile, and Russia - hold 66% of cobalt, 52% of nickel, 33% of copper, 84% of lithium, and 100% of silver. These countries also possess 33% and 70% of other rare earth elements, respectively (Månberger & Johansson, 2019, pp. 1-10).

According to Table 1, the People's Republic of China is a major player in producing and using critical minerals. They have a high capacity for extraction, storage, and processing of minerals such as Cobalt, Copper, Lithium, and Nickel, as well as energy resources. Although this situation contributes to China's transition to clean energy and economic development, it also makes it a target for countries needing these resources. Minerals and rare earth elements have become the source of trade wars, international tensions, and diplomatic crises between China and the US, EU, Japan, and Australia. In 2010, China imposed a limit of 40% on the export quota of rare earth elements. This decision created diplomatic tensions because it indicated China's desire to retain these raw materials for its economy instead of exporting them (Kalantzakos, 2020, p. 8).

It is important to note that countries rich in critical minerals have become areas of power struggles for imperialist countries. The Democratic Republic of Congo, which is rich in cobalt reserves, is in heavy corruption and economic fragility, and the control of the cobalt reserves is in the hands of separatist groups and armed groups.

Table 1: Usage Areas of Critical Minerals and the Most Producing Countries

Beryllium	Wind Power	Brazil, China, Madagascar, Mozambique, Portugal
Cobalt	Batteries, Energy Storage and Electric Vehicles	Democratic Republic of Congo, China (Largest decomposer)
Gallium	Solar Energy	China (Largest decomposer)
Germanium	Solar Energy Systems, Fiber Cables	Canada, China, Finland, Democratic Republic of Congo
Indium	Solar Energy Systems	China (50%), Belgium, Canada, Japan, South Korea
Graphite	Battery Technologies, Electric Vehicles	China (67%), India, Brazil
Lithium	Battery Technologies	China, Australia
Niobium and Tantalum	Energy Storage	Brazil (90%), Canada
Rare Earth Elements	Clean Energy Applications	China (90%), Australia
Selenium	Solar Energy Systems	Japan (51%), Belgium, Canada and USA
Tellurium	Solar Energy Systems	China, Sweden
Vanadium	Battery Technologies	China, Russia, South America

Source: (Kakışım 2022, p. 102).

In South America, Chile, Argentina, and Bolivia have the world's richest lithium reserves and are fragile and unstable countries. The political upheaval in Bolivia in 2019 had a detrimental impact on

the land. Meanwhile, in Chile, indigenous communities are taking a stand against the extraction of minerals due to the social inequality and environmental destruction caused by mining activities. Conversely, Argentina faces severe economic turmoil (Kalantzakos, 2020, p. 10).

The final declaration of the G20 Leaders' Summit held in India between 9-11 September 2023 emphasized that "pursue and encourage efforts to triple renewable energy capacity globally through existing targets and policies" (G20 New Delhi Leaders' Declaration, 2023).

Another decision taken at the G20 Leaders' Summit was the establishment of the IMEC Line. In his statement, the US President announced the "India-Middle East-Europe Economic Corridor" (IMEC) to connect India to the Middle East and Europe. He called this corridor "a big deal." This corridor has become an alternative route to the "One Belt, One Road" project of the People's Republic of China. The geopolitical struggle between India, China, and Pakistan in Asia also directly impacts trade routes. The "One Belt One Road" initiative's southern trade route to Pakistan's Gwadar port and India's Mumbai route highlights the competing interests of nations with rich mineral resources and nations vying for influence in the geopolitical arena.

Countries with critical minerals, such as the People's Republic of China, are of interest to developed countries seeking to acquire these minerals. Many countries implement policies to enhance their relations with countries that possess critical minerals in terms of military, economic, and political power. Although these policies must be implemented based on the principle of mutual gain in dialogue and peace between countries, they are also likely to lead to conflicts and wars. Imperialist countries, including the USA, are ready to try all methods to secure their needs for critical minerals. While the USA is attempting to mobilize diplomacy, it is also working to improve its readiness and alliances in preparation for potential conflict or war. In the "National Security Strategy Document" published annually by the United States of America, critical minerals are highlighted in the section titled "Climate and Energy Security In the "Our Global Priorities" section of the document, it outlines how to shape the relationship with China and Russia.

The US National Security Strategy Document emphasizes that the Russia- Ukraine war and climate changes have made clear the urgent need to accelerate the transition from hydrocarbon energy. In the Security Strategy document, it is stated that long-term energy security depends on clean energy. The document also emphasizes the need for energy security, affordable costs, and access to critical mineral supply chains. It is stated that the USA should work together with its partners and allies when implementing this policy. The USA collaborates with partners such as the International Energy Agency, USA-EU, European Energy Security Task Force, Clean Energy Ministerial Meeting, Strengthen Africa, Eastern Mediterranean Gas Forum, and others. However, the USA's allies are countries it cooperates with, particularly in the Indo-Pacific region and Western countries (National Security Strategy, 2022, p. 22).

The US National Security Strategy Document's "Overview of Our Strategic Approach" section emphasizes strengthening relationships with democratic allies and partners in the Indo-Pacific and Europe in technology, trade, and security. The section also highlights that the People's Republic of China is the most significant challenge for the USA under the same heading (National Security Strategy, 2022, pp. 11-14).

While it is emphasized that the general strategy of the USA is primarily cooperation, it is stated that if cooperation is not possible, they will not hesitate to use force for America's interests (National Security Strategy 2022, p. 22).

Information the USA sees as a threat to the People's Republic of China is included in various National Security Strategy Document articles. It is noted that the People's Republic of China stands out as the only competitor possessing the requisite will and the economic, diplomatic, military, and technological capabilities to reform the global system. The document further acknowledges China's significant impact on climate change and global public health. It has been stated that the coming decade will hold great significance in the competition with the People's Republic of China. However, the United States will always be open to working with China and engaging in dialogue wherever their interests coincide (National Security Strategy, 2022, pp. 23-26).

The ten-year target of the USA in China competition and the need for critical minerals in 2030-2040, as stated in the International Energy Agency's report, are compatible with each other. The United States is already crafting its Indo-Pacific strategy, emphasizing clean energy derived from critical minerals. The National Security Strategy Document highlights the importance of improving cooperation and creating strong and durable relationships with various countries and groups. These include the Indo-Pacific Quartet (Australia, India, Japan, and USA), I2-U2 (India, Israel, UAE, and USA), AUKUS (Australia, United Kingdom, and USA), and USA-EU, as well as the Trade and Technology Council (National Security Strategy 2022, 13).

To create a bloc against China in the region, the USA is developing policies together with countries such as Taiwan, South Korea, and Japan, which have problems with the People's Republic of China, or Australia and New Zealand, which are sociologically similar to itself. When examining countries with which the USA has diplomatic relations, it becomes apparent that certain nations, such as Australia and Indonesia, possess significant deposits of critical minerals. In addition, the USA is also cooperating with countries such as India, whose critical mineral needs will increase in the next decade. In addition to economic benefits, India-US cooperation can leverage the current geopolitical tensions between India and China to strengthen their strategic partnership. India and the US can collaborate to counterbalance China's influence, maintain regional stability, and promote peace. Furthermore, the two countries can collaborate on various security and defense initiatives to enhance their military capabilities and ensure the region's security. The India-Middle East-Europe Economic Corridor (IMEC) was adopted

at the G20 India Leaders' Summit. The rivalry between China, India, and the US shapes its geopolitical implications. The USA's invitation to Japan, South Korea, Australia, and New Zealand from the Pacific region to attend the NATO Leaders Summit held in Madrid from 28-30 July 2022 is significant in terms of the future of alliances in the region. The United States is actively shaping its Indo-Pacific policy, as demonstrated by the participation of these countries in the NATO meeting of the Atlantic Defense Organization.

US support for Taiwan contradicts the United Nations' decision in the relationship between China and Taiwan. The United Nations General Assembly passed Resolution 2758 on October 25th, 1971, acknowledging the People's Republic of China as the only lawful representative of the Chinese people in the UN. The USA's support for Taiwan in the relationship between the People's Republic of China and Taiwan means it does not comply with the United Nations (UN) decision.

To confront China alone in the Pacific region, the USA limits potential supporters of China in different areas of conflict. One of them is Russia. Federation. During the Russia-Ukraine War, Russia's military, economic, and political energy concentrated on the Ukraine conflict. At the same time, the USA prevented Russia from supporting China in a hypothetical US-China conflict.

The USA does not only develop hegemonic policies over countries with critical minerals in the Pacific region. The USA and other Western imperialist countries pursue colonial and hegemonic policies on critical mineral-rich African countries such as Mozambique, Democratic Congo, and Niger. This can be observed from recent developments in these countries.

5. CONCLUSION

With the emergence of capitalism, developed countries began searching for raw materials and energy to increase capital, make investments, and ensure the sustainability of their economy. Rapid technological development has increased the demand for cheap energy and raw materials to sustain industry. All regions with hydrocarbon energy resources, particularly the Middle East and Caucasus, are areas of imperialist competition and struggle. This competition and struggle has gone beyond the legal and humanitarian dimensions and has reached the level of conflicts between countries. In these conflicts, the local people and advanced weapon technologies are utilized. Today, geographies rich in hydrocarbon energy struggle with civil war and terrorism. Places such as Iraq, Syria, Libya, Ethiopia, Sudan, Egypt, the Caucasus, Iran, and the Eastern Mediterranean are the battlefields of imperialist countries.

While the reduction in hydrocarbon energy and the impact on climate change emphasize the need for clean energy, technological advancements have also increased the demand for certain elements. The developed imperialist countries, which feel this need the most, want to invade the geographies rich in these critical minerals. It is important to establish cooperative relationships with countries that possess critical minerals. This cooperation should be based on goodwill and trade. If such cooperation does not

exist, particularly if countries rich in critical minerals compete with imperialist nations globally, it can create conflicting policies and even conflicts.

The US National Security Strategy document emphasizes the importance of critical minerals and considers the relationships with the regions where these minerals are found. This focus is reflected in the policies developed to ensure their supply and sustainability. The Pacific region is at the top of these geographies. Also, in the report published by the International Energy Agency, it is seen that most of the critical minerals are in China. Therefore, relations with China are emphasized in the "China" section of the US National Security Document. It is stated that relations with China should be maintained on their normal course or that one should be prepared for the conflict dimension of competition with China. These issues are particularly prominent in the Pacific region, which is a crucial area in the struggle to secure the energy necessary for the United States to maintain its hegemony as the world transitions from a unipolar to a multipolar structure. In this struggle, the USA may exploit the Taiwan issue, which is China's sensitive side. At the same time, it is attempting to unite other economically and demographically strong countries in the Pacific region around itself.

In the International Energy Agency report, the amount of critical minerals generally needed in 2030-2040 is directly proportional to the critical minerals needed by the USA to maintain its hegemonic policies based on technology production. The USA is preparing to meet this need either in a peaceful environment or by considering the possibility of conflict.

While the USA focuses on the Pacific region to supply critical minerals, other countries will compete with the USA to meet their critical mineral needs. Countries with critical minerals will also try to maintain their current situation and develop policies in line with their own interests. In this case, it increases the risks of conflict in the region.

In the upcoming years, the Pacific region, particularly the People's Republic of China, will be the center of global conflict due to its possessing critical minerals significant in global politics. Imperialist countries, particularly the United States, aim to destabilize regions rich in hydrocarbons and gain control by supporting proxy terrorist organizations such as DAESH, PKK/PYD, and Al Qaeda or hiring mercenaries. At the same time, these countries establish new geopolitical arrangements in areas where critical minerals are found through the collaboration of nation-states and supranational organizations.

The demand for critical minerals has skyrocketed as the world increasingly relies on technology. The Indo-Pacific region, spanning from the eastern shores of Africa to the western coast of the United States, is home to a vast array of these valuable resources. As a result, the Indo-Pacific region will become the new geopolitical struggle land with countries vying for control over these precious resources vital to the global economy.

This research does not need the approval of Ethics Committee.

The study has been crafted in adherence to the principles of research and publication ethics.

The author declares that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article.

The entire work was carried out by its only, stated author.

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Sectoral Concentration in Loans and Credit Risk: An Examination by Company Accounts in Turkey

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Abstract

This study examines the impact of sectoral concentration on credit default risk, drawing from economic theory and portfolio management principles, utilizing the Turkish aggregated sector-level data and banking data from 2009 to 2022. The study employs a panel data analysis framework to investigate the relationship between sectoral diversification in loans and credit risk, controlling for sector-specific variables. Unlike previous studies primarily reliant on banking system data, this research broadens the scope by incorporating the real sector credit usage data for the measurement of concentration. Additionally, instead of the commonly used Herfindahl-Hirschman Index, the study employs the Sector Concentration Index as a measure of concentration, allowing for a comparison of sector distribution with an ideal market sector distribution. The analysis considers not only the widely used indicator of credit risk, non-performing loans ratio in the banking system but also bad debt ratios in the real sector, thereby enhancing the understanding of credit risk dynamics. The analysis results, which show a significant positive relationship between sectoral concentration indices and non-performing ratios employed, reveal that sectoral credit concentration has an increasing effect on the credit risk level and offers insights into the optimal diversification strategies for mitigating credit risk in the banking sector.

Keywords: *Sectoral Loan Concentration, Sectoral Loan Diversification, Credit Default Risk, Turkish Company Accounts, Turkish Banking Sector, Panel Data Analysis.*



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<https://doi.org/10.30798/makuiibf.1464022>

Article Type	Application Date	Admission Date
Research Article	April 3, 2024	October 18, 2024

1. INTRODUCTION

As economic theory suggests, increased diversity tends to reduce volatility, a principle most notably observed in portfolio theory. According to portfolio theory, diversification minimizes the overall risk of a portfolio through strategic asset allocation, maintaining expected returns as long as assets are not perfectly correlated (Markowitz, 1952). Conroy (1974) extended portfolio theory to regional and economic growth and instability, suggesting that sectoral diversification would enhance a region's overall economic stability and efficiency and thus serving as insurance against volatility in various industries. The impact of sectoral diversification on economic and financial instability has been the subject of recent research (Kluge, 2018, pp. 205-206).

In banking, credit risk concentration arises when loans are extended to counterparties within the same economic sector or geographic region (Banking Regulation and Supervision Agency [BRSA], 2016). Given that lending is a core function of banks and key intermediaries in financial markets, the level, causes, and effects of sectoral diversification on credit risk merit thorough investigation.

Financial intermediation theories highlight intermediaries' cost advantages offer in resolving agency problems between borrowers and lenders. A financial intermediary, such as a bank, collects funds from depositors (lenders) and lends them to entrepreneurs (borrowers), taking on the crucial task of monitoring these loans and assessing borrower credibility on behalf of depositors (Winton, 1999). Diversifying a loan portfolio provides essential cost advantages for intermediaries in their delegated monitoring roles, as it allows for a higher risk tolerance toward individual loans, ultimately reducing the cost of risk-bearing incentives (Diamond, 1984). This conventional view suggests that well-diversified financial intermediaries minimize default probabilities and enhance loan returns by lowering the need for costly equity capital (Diamond, 1984; Winton, 1999).

However, while diversification across multiple sectors and regions may lower asset risk by improving monitoring incentives, it does not guarantee low risk. Expanding into new sectors, geographies, and loan types can dilute expertise, potentially weakening monitoring effectiveness and making diversification costly. Studies advocating for concentration in bank lending cite benefits such as enhanced screening and monitoring efficiency (Beck & De Jonghe, 2013; Winton, 1999). Concentration can mitigate asymmetric information problems by allowing banks to specialize in familiar areas (Anastasi et al., 2009; Sarı & Konukman, 2021; Sarı & Konukman, 2023; Winton, 1999).

While competitive pressures may make diversification appealing, they can also compel banks to venture into sectors lacking expertise (Winton, 1999). Although sectoral concentration can improve a bank's performance during specific economic conditions, it may simultaneously elevate systemic risk and the fragility of financial institutions (BRSA, 2016; Demirbaş Özbekler, 2019; Yalçın & Tunay, 2020), thereby threatening overall financial stability. Furthermore, the reliance on wholesale funding and interbank market activities, exacerbated by complex financial products and globalization, has

intensified banks' sensitivity to credit volatility and market fluctuations, introducing additional contagion risks (BRSA, 2016). It is crucial for banks to adopt contemporary portfolio management strategies that align credit portfolios with the market's optimal structure to mitigate these risks, thereby shielding against systemic risks (Yalçın & Tunay, 2020; Gönenç & Kılıçhan, 2004).

This study investigates the impact of sectoral concentration in credits given to the Turkish real sector and its 17 sub-sectors on credit default risk during the period 2009-2022. Our research is distinguished by two key features: applying a concentration measure that aligns credit portfolios with the market's ideal portfolio and using aggregated sector-level data rather than solely relying on bank-level data.

In the literature, the Herfindahl-Hirschman Index (HHI), developed by Herfindahl (1959) and Hirschman (1964), has been widely used to measure sectoral concentration levels. The HHI is calculated as the sum of the squared relative credit risk positions, but it does not account for comparisons with an ideal portfolio distribution. However, portfolio management theory suggests that aligning credit portfolios with optimal sector distributions can mitigate systemic risk (Gönenç & Kılıçhan, 2004; Hazar et al., 2017). Notably, all ten studies (Gönenç & Kılıçhan, 2004; Türkmen & Yiğit 2012; Tunay, 2015; Demirbaş Özbekler, 2019; Sarı 2019; Sarı, 2020; Yalçın & Tunay, 2020; Sarı & Konukman 2021; Sarı, 2022; Sarı & Konukman, 2023) examining Turkey's economy included in this research have employed the HHI, with only Gönenç and Kılıçhan (2004) additionally using standard deviation as suggested by the ideal credit volume model.

This study employs the Sector Concentration Index (SCI), a corrected version of HHI according to the market (Kacperczyk et al., 2005, p. 1987) that facilitates comparisons of sector distribution with optimal allocations. In this study, the relative asset size, number of firms, and GDP contribution of sectors have been used as three different ideal credit distribution portfolios.

These ten studies for the Turkish economy utilized bank-level data in concentration measurements and other variable constructions and did not consider borrower-side (firm or sector side) factors. Unlike previous studies primarily reliant on banking system data, this research broadens the scope by incorporating real sector credit usage data. Real sector data has been employed in measuring sectoral loan concentration indices and used as an alternative to bank-level data in assessing credit risk, and as a control variable for sector risk, thereby accounting for the characteristics of the real sector as the borrower of loans. This comprehensive data, which combines bank data with real sector dynamics, contributes to the existing literature by providing insights into the nuanced relationships between sectoral factors and credit risk.

Following theoretical background, the subsequent sections will delve into the methodology employed, including sample selection, variable definitions, dataset development, and the econometric framework utilized in the analysis.

2. THEORETICAL GROUNDING

Some studies on concentration in bank lending and their effects have yielded results in favor of diversification, while others have supported concentration.

Among the studies supporting sectoral diversification, Kluge (2018) focused on the positive effect of sectoral diversification on economic stability and growth in regions of Germany, while Morgan and Stolyk (2003) emphasized that geographic diversification among U.S. holding banks increased the banking system's lending capacity. Using international data, Beck and De Jonghe (2013) found that sectoral diversification in bank lending had a positive impact on bank performance, increasing returns or reducing risk. Bebczuk and Galindo (2008) reached similar conclusions with data from Argentina, while Chen et al. (2013) noted that although sectoral diversification reduced bank risk, it also decreased returns. The findings of Bebczuk and Galindo (2008) were particularly pronounced during downturns in the business cycle and in larger banks.

On the other hand, among the studies that present findings in favor of specialization, Winton (1999) demonstrated that sectoral or regional diversification in bank lending, under certain conditions, such as moderate risk, can reduce the probability of bank failure. However, when loans have either low or high downside risk, diversification adds little value or may even increase the odds of bank failure. Acharya, Hasan, and Saunders (2006) concluded that sectoral diversification in high-risk or new/competitive industries diminishes the monitoring effectiveness of Italian banks. Conversely, Böve, Düllmann, and Pfingsten (2010) found that the monitoring quality of German cooperative and savings banks improved with sectoral specialization. Similarly, Anastasi et al. (2009) for Argentine financial institutions and Tabak, Fazio, and Cajueiro (2011) for Brazilian banks related loan portfolio concentration to reduced default risk, while Goetz (2012) highlighted the increased risk associated with diversification among international markets.

Studies on Turkish data also tend to yield mixed results either in favor of diversification and/or concentration. Among studies examining the effect of sectoral concentration on bank profitability, Türkmen and Yiğit (2012) found that sectoral concentration had a decreasing effect on bank profitability (ROA and ROE), Gönenç and Kılıçhan (2004) and Sarı (2020) demonstrated that sectoral and geographical loan concentration increase banks profitability.

We have identified five studies directly examining the relationship between diversification and credit risk with Turkish data. Among them, while three studies (Tunay, 2015; Sarı, 2019; Yalçın & Tunay, 2020) concluded that diversification reduces credit risk, only one accessible study (Sarı & Konukman, 2021) obtained a negative relationship between that sectoral diversification and credit risk in the Turkish banking system. However, Demirbaş Özbekler (2019) suggests that the direction of the relationship varies depending on the method used. The last two studies presented in this section focus on the effect of geographical diversification (Sarı, 2022) and the relationship between sectoral

concentration and GDP growth (Sarı and Konukman, 2023). Sarı (2022) gathered a negative relationship between geographical concentration and credit risk in the long run. Sarı and Konukman (2023) showed a bidirectional positive relationship between sectoral loan concentration and economic growth.

In the ten studies this research summarized and conducted using data from the Turkish banking system, the level of sector concentration in loans was calculated using the Herfindahl-Hirschman Index (HHI). The HHI ($HHI_t = \sum_{i=1}^n (W_{i,t})^2$) is derived from the sum of the squares of the relative shares of loans provided to specific sectors by the banks or bank groups in the sample. The HHI, which takes values between 0 and 1, indicates that as it approaches 1, the loans of the examined bank or banking group are concentrated in specific sectors, suggesting a lack of diversification. As inferred from its formula, the HHI does not account for an ideal sectoral loan distribution. However, in portfolio theory, the effectiveness of diversification is achieved by the portfolio's convergence towards an optimal market portfolio. In the study by Gönenç and Kılıçhan (2004), in addition to the HHI, the level of diversification was measured by standard deviation that indicates how much the bank deviates from the market portfolio, which is considered the ideal distribution on a sectoral basis (Gönenç & Kılıçhan, 2004, p. 60).

In this study, the Sector Concentration Index (SCI), originally introduced by Kacperczyk et al. (2005) to assess the industry concentration of mutual funds, was utilized. The SCI serves as a modified version of the Herfindahl-Hirschman Index (HHI), tailored to reflect market conditions, and is employed to evaluate concentration in relation to the ideal sector distribution. The SCI measures the deviation from the market portfolio, with higher index values indicating a greater concentration in a limited number of industries (Kacperczyk et al., 2005, p. 1987).

Besides utilizing a different measure of concentration, this study also contributes to the previous research conducted in Turkey by employing a more comprehensive dataset. The ten studies mentioned calculated the concentration of loans provided to various sectors using data from the Turkish banking system. Similarly, the relationship between loan concentration and bank performance was analyzed exclusively using bank-level data. Therefore, factors related to firms or sectors as recipients of credit were not considered in these studies. In this research, however, data specific to the real sector, which is the borrower of bank loans, was utilized both for measuring sectoral concentration indices and for determining other relevant variables.

3. DATA AND METHODOLOGY

This section details the sample selection, dataset development, and the econometric framework employed in the analysis.

3.1. Sample and Variables

The study employs panel data analysis using information from the Central Bank of the Republic of Turkey (CBRT), the Banking Regulation and Supervision Agency (BRSA), and the Turkish Statistical Institute (TSI). The data were collected from various sources, including CBRT statistics (CBRT, 2023), BRSA statistics (BRSA, 2023), and TSI data (TSI, 2023). Sector data are aggregated and included in the CBRT sector balance sheets. The data for all sectors combined is referred to as 'all companies' (hereinafter referred to as the real sector). Annual balance sheets, income statements, and sector risk data for the real sector and 17 main sectors for the period 2009-2022 were compiled. The analysis covers 17 sectors over 14 years, yielding 238 observations. After 2008, the sector distribution in the CBRT matches that of the TSI's Gross Domestic Product (GDP). Three of the 20 sectors reported by TSI are not included in the CBRT data, so the analysis was conducted with the 17 sectors reported by the CBRT.

In the previous literature, credit risk is typically proxied by non-performing loans (NPL) rate or bad debt rate (Anastasi et al., 2009; Tunay, 2015; Demirbaş & Özbekler, 2019; Yalçın & Tunay, 2020) or NPL amounts (Sarı, 2019; Sarı & Koruman, 2021; Sarı, 2022). In this study, three alternative NPL ratios representing the real sector were used as time-variant but sector-invariant variables:

$NPL_{t,1}$: Ratio of "Banking Sector Non-Performing Loans / Total Cash Loans (%)" for the Turkish banking sector (Total loans and non-performing loan amounts are gathered from BRSA balance sheet information and monthly banking sector data).

$NPL_{t,2}$: "Banking Sector Non-Performing Loans (Gross) / Total Cash Loans (%)" ratio (Directly obtained from BRSA's monthly banking sector ratio information).

$NPL_{t,3}$: "Real Sector Bad Debts / Cash and Non-Cash Credits" ratio (Calculated using data from the CBRT's company accounts statistics).

According to BRSA (2016), the types of loans that lead to credit risk concentration are as follows: i. Large amounts loans extended to the same counterparties or ii. Groups consisting of counterparties with risk relationships among them. iii. Loans extended to counterparties located in the same economic sector or geographical region. iv. Loans extended to groups of counterparties engaged in the same service or goods production or utilizing the same credit risk mitigation methods, and v. Credit risks indirectly exposed due to the use of only one type of collateral or credit protection. This study focuses more on diversification in the third group.

In this study, the concentration measurement, referred to as standard deviation in the study by Gönenç and Kılıçhan (2004) and modeled as the Sector Concentration Index (SCI) in the study by Kacperczyk et al. (2005), was used. SCI (Kacperczyk et al., 2005, p. 1987) is the adjusted form of the Herfindahl-Hirschman Index (HHI) according to an optimal sector distribution criterion.

SCI is calculated using Equation (1):

$$\text{Sector Concentration Index} = \text{SCI}_t = \sum_{i=1}^{17} (W_{i,t} - \bar{W}_{i,t})^2 \quad (1)$$

Sector Concentration Index (SCI) is represented by Equation (1), where it $W_{i,t}$ denotes the share of the respective sector's credit risk (credit utilization) within the real sector's credit risk for the given year. Risk statistics of CBRT company accounts report the sector credits under categories of cash, non-cash credits, bad debts, bonds, commercial papers, and funds used for leasing. $\bar{W}_{i,t}$ represents the optimal or required share for the sector's credit share ($W_{i,t}$). $\bar{W}_{i,t}$ is determined based on three different assumptions regarding the sector's characteristics: asset size (AS), firm number (FN), and value-added (VA). Data for variables other than sectoral value added were obtained from the CBRT database.

Under the asset volume criterion, the Sector Concentration Index_AS (SCI_t_AS) is constructed to ensure that credit allocation to each sector is aligned with its relative asset size within the real sector. The firm number assumption requires that credit be allocated based on the relative number of firms within each sector, forming an alternative Sector Concentration Index_FN (SCI_t_FN). The third Sector Concentration Index_VA (SCI_t_VA) is derived from the sector's relative value added (gross domestic product) within Turkey's gross domestic product, as reported by TSI. The most commonly applied diversification measures are the sectoral distribution of employment or gross value added in a specific region (Kluge, 2018, p. 206). Value added share is obtained from the TSI database reported in the table of "Gross domestic product at current prices by kind of economic activity A21 level value, share, percentage change, at current prices, 1998-2022." (TSI, 2023). SCIs are specified annually and represent time-variant but sector-invariant variables.

As summarized in the literature review presented in Section 2, studies have not reached a consensus on whether sectoral diversification or concentration in bank loans reduces credit risk. However, in line with the majority of studies focusing on the relationship between credit risk and diversification using Turkish data (Tunay, 2015; Sarı, 2019; Yalçın & Tunay, 2020), it is hypothesized that there is a positive relationship between credit concentration and credit risk, forming Hypothesis 1 (H₁):

Hypothesis 1 (H₁): In year t , the higher the Sector Concentration Index of real sector credits (SCI_{it}), the higher the credit risk of the real sector (NPL_{it}).

Studies in this field are generally carried out on bank-level data, thus controlling for bank characteristics. Bank scale (Demirbaş Özbekler, 2019; Gönenç & Kılıçhan, 2004 Tunay, 2015; Türkmen & Yiğit 2012; Yalçın & Tunay, 2020), equity ratio and liquidity (Demirbaş Özbekler, 2019; Sarı 2019; Sarı, 2022; Sarı & Konukman 2021; Tunay, 2015) ...etc. are used in these analyses.

In this study conducted with sectoral data, interest coverage ratio (INTC_{it}), chosen as the only control variable, represents the ratio of operating profit to financing expense for each sector at time t . It indicates the ability to generate income from core operations and meet financing expenses, thus

signaling borrowing levels, borrowing costs, and investment profitability. A negative relationship between INTC and credit risk is expected.

Hypothesis 2 (H₂): In year t, a higher Interest coverage ratio of sector i (INTC_{it}) is associated with a lower credit risk of the real sector (NPL_{it}). Table 1 presents the summary of the analysis variables detailed in this section.

Table 1. Summary of Variables

Variable	Explanation	Source	Exp.Signs
NPL_1	Banking Sector NPL / Total Cash Loans	BRSA loans	DV
NPL_2	Banking Sector NPL (Gross) / Total Cash Loans	BRSA ratios	DV
NPL_3	Real Sector Bad Debts / Cash&Non-Cash Credits	CBRT company accounts	DV
SCI_AS	Sector Concentration Index_ Asset Size (AS)	CBRT company accounts	+
SCI_VA	Sector Concentration Index_Value Added (VA)	CBRT company accounts and TSI	+
SCI_FN	Sector Concentration Index_Firm Number (FN)	CBRT company accounts	+
INTC	Interest Coverage Ratio	CBRT company accounts	-

Note: NPL_1: Banking Sector Non-Performing Loans/Total Cash Loans. NPL_2: Banking Sector Non-Performing Loans (Gross)/Total Cash Loans. NPL_3: Real Sector Bad Debts/Cash and Non-Cash Credits. SCI_AS: Sector Concentration Index in terms of the sector's asset size (AS). SCI_VA: Sector Concentration Index in terms of value added (VA). SCI_FN: Sector Concentration Index in terms of firm number (FN). INTC_{it} Interest coverage ratio. DV: Dependent Variable. Exp.: Expected.

3.2. Descriptive Statistics of Variables

This section presents the descriptive statistics of analysis variables in Table 2 and includes two graphs for two selected variables. The trend of NPL_1 throughout the analysis period is depicted in Figure 1, while the development of the concentration index of SCI_AS over 14 years is illustrated in Figure 2. Table 3 displays the correlation coefficients between independent variables. Besides, this section includes Table 4 which indicates in which direction and to what extent sectoral credit distribution deviates from the optimal credit rationing specified on sectoral asset volume.

Table 2. Descriptive Statistics of Variables

	Obs.	Mean	Std. Dev.	Min	Max
NPL_1	238	3.56	0.99	2.16	5.68
NPL_2	238	3.42	0.91	2.10	5.36
NPL_3	238	2.23	0.76	1.58	4.26
SCI_AS	238	51.75	16.75	28.19	79.79
SCI_VA	238	507.94	156.33	295.40	779.19
SCI_FN	238	490.22	77.21	388.82	664.50
INTC	238	1.57	1.44	-3.30	10.09

Note: NPL_1: Banking Sector Non-Performing Loans/Total Cash Loans. NPL_2: Banking Sector Non-Performing Loans (Gross)/Total Cash Loans. NPL_3: Real Sector Bad Debts/Cash and Non-Cash Credits. SCI_AS: Sector Concentration based on the sector's asset size (AS). SCI_VA: Sector Concentration Index in terms of value added (VA). SCI_FN: Sector Concentration Index in terms of firm number (FN). INTC_{it} Interest coverage ratio. Obs.: Number of observations. Std. Dev.: Standard deviation. Min.: Minimum. Max.: Maximum.

According to descriptive statistics presented in Table 2, The NPL_1 mean value indicates that, on average, non-performing loans make up 3.56% of total loans in the banking sector. As shown in Figure 1, which depicts the development of non-performing loans (NPL_1) in the banking sector from 2009 to 2022, NPL_1 followed a horizontal trajectory between 2013 and 2017 but increased thereafter, peaking in 2019. The highest NPL ratio (5.68%) occurred in 2019, while the lowest ratio (2.16%) was recorded in 2022. The first two NPL ratios calculated from banking sector data (NPL_1 and NPL_2) appear to have similar means and standard deviations. However, NPL_3 which is measured by real sector data appears to have a lower mean and standard deviation, indicating potentially different measurement methods and criteria. NPL_3 mean value represents that bad debts account for 2.23% of total real sector credit. NPL_3 reached the maximum level of 4.26% in 2019 as in NPL_1 and NPL_2.

Figure 1: Trend of NPL_1

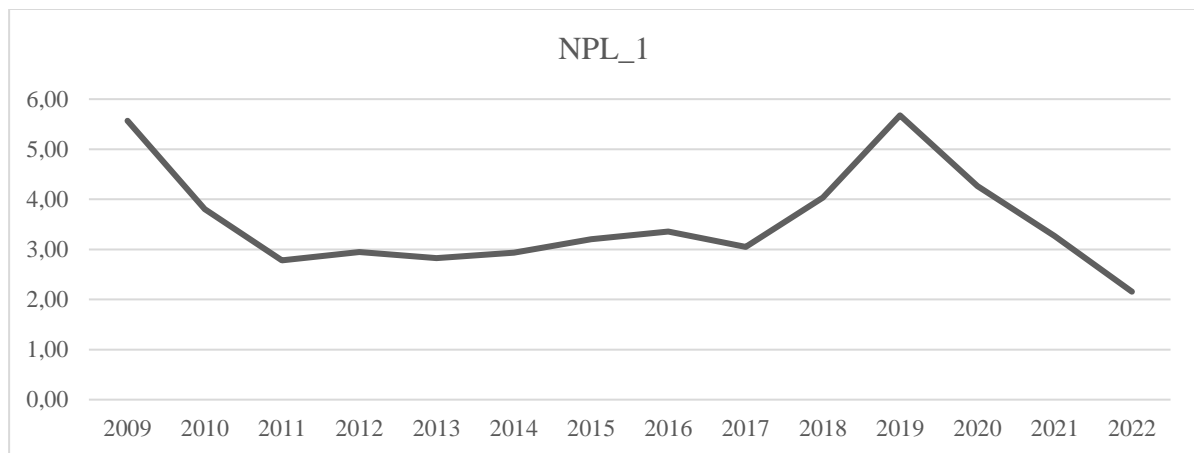
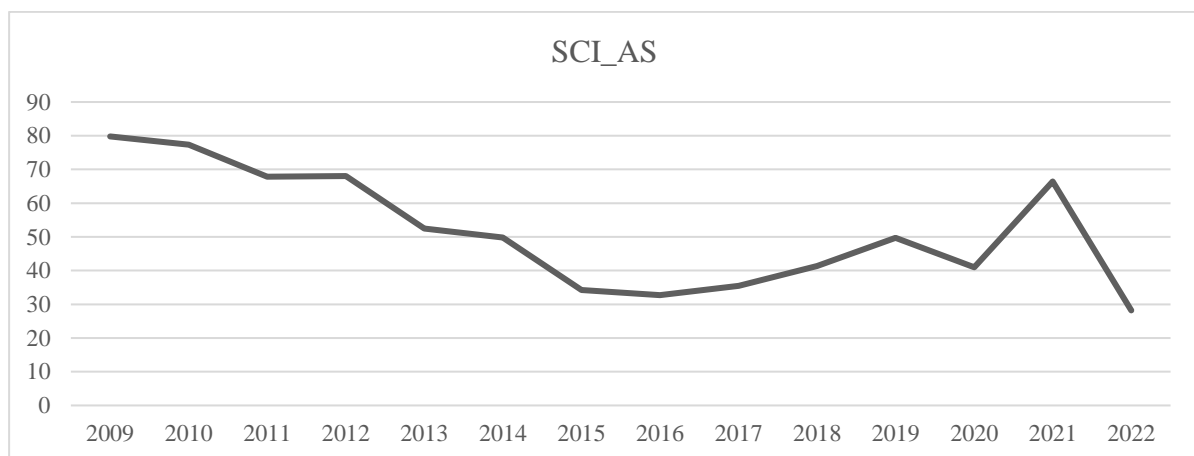


Figure 2: Trend of SCI_AS



SCI_AS has a higher variation coefficient than SCI_VA and SCI_FN, indicating greater variability in sectoral credit concentration when measured by asset size. As shown in Figure 2, the downward trend in sectoral credit concentration in terms of asset size (SCI_AS) continued until 2016, reaching a value of 32.71, before reversing into an upward trend after 2016, with its highest levels recently recorded

in 2021 (66.47) and 2019 (49.74). While the highest SCI_AS figure was observed in 2009 (79.79), the minimum level occurred in 2022 (28.19).

The real sector's mean interest coverage ratio is positive (1.57) but weak in covering interest expenses and shows substantial variability, ranging from -3.30 to 10.09 among the observed entities.

Table 3. Correlation Coefficients between Independent Variables

Variable	SCI_AS	SCI_VA	SCI_FN
SCI_AS	1		
SCI_VA	0.72***	1	
SCI_FN	0.28***	-0.36***	1
INTC	0.21***	0.17***	0.11*

Note: SCI_AS: Sector Concentration Index based on sector's asset size. SCI_VA: Sector Concentration Index in terms of value added. SCI_FN: Sector Concentration Index in terms of firm number. INTC: Interest coverage ratio. *, ** and *** indicate 10%, 5% and %1 significance level.

Table 4. Sectoral Credit Distribution and Deviations

Sectors	$\mu(W_t)$	$\mu(\bar{W}_{t,AS})$	$\mu(W_t - \bar{W}_{t,AS})$	$\mu(W_t - \bar{W}_{t,AS})^2$	$W_{2021} - \bar{W}_{2021,AS}$	$(W_{2021} - \bar{W}_{2021,AS})^2$
	$\mu(CS)$	$\mu(AS)$	$\mu(CS-AS)$	$\mu(CS-AS)^2$	$CS_{2021} - AS_{2021}$	$(CS_{2021} - AS_{2021})^2$
Agriculture	0.49	0.56	-0.07	0.01	-0.15	0.02
Mining	1.22	1.80	-0.58	0.35	-0.59	0.34
Manufacturing	31.50	27.19	4.30	21.24	1.25	1.57
Electric	8.87	7.61	1.26	3.33	2.78	7.75
Water	0.20	0.24	-0.05	0.00	-0.09	0.01
Construction	13.37	13.82	-0.45	0.51	-0.43	0.18
Trade	21.17	22.18	-1.01	7.84	-6.33	40.11
Transport	6.39	6.40	-0.01	2.51	3.39	11.47
Accommodation	3.48	2.79	0.68	0.61	1.39	1.92
Information	2.40	3.30	-0.90	0.96	-0.73	0.53
Real estate	2.34	1.98	0.36	0.20	0.97	0.94
Professional	5.53	9.08	-3.54	14.30	-1.07	1.15
Administrative	1.88	1.61	0.27	0.10	-0.03	0.00
Education	0.23	0.39	-0.16	0.03	-0.18	0.03
Human health	0.70	0.74	-0.04	0.00	-0.12	0.02
Arts	0.18	0.20	-0.02	0.00	-0.02	0.00
Other service	0.06	0.10	-0.04	0.00	-0.03	0.00

Note: The first section under the sector names in Table 4 represents the 14-year average of sectoral credit distribution, while the second section, comprising the last two columns, shows the credit distribution for the selected year, 2021. μ represents the 14-year average. W_t denotes the share of the respective sector's credit risk (CS) within the real sector's total credit risk. $\bar{W}_{t,AS}$ is the share of the sector's asset size (AS) into real sector total asset size, as the optimal credit allocation benchmark. W_{2021} denotes the sector's credit share for the year 2021 (CS_{2021}). $\bar{W}_{2021,AS}$ is the ratio of the sector's asset size (AS) to the real sector's asset size for 2021 (AS_{2021}). Agriculture: agriculture, forestry and fishing. Mining: mining and quarrying. Electric: Electricity, gas, steam and air conditioning supply. Water: Water supply, sewerage, waste management and remediation activities. Trade: Wholesale and retail trade; repair of motor vehicles and motorcycles. Transport: Transport and storage. Accommodation: Accommodation and food service activities. Information: Information and communication. Real estate: Real estate activities. Professional: Professional, scientific and technical activities. Administrative: Administrative and support service activities. Human health: Human health and social work activities. Arts: Arts, entertainment and recreation. Other service: Other service activities

The correlations in Table 3 show that the Sector Concentration Index variables (SCI_AS, SCI_VA, SCI_FN) are positively correlated with each other to varying degrees. This indicates that sectors with a high concentration in one aspect tend to have high concentration in other aspects as well. However, SCI_VA and SCI_FN are negatively correlated, suggesting that sectors with a high concentration in terms of firm number tend to have lower concentration in terms of value added. The INTC variable exhibits relatively weaker positive correlations with the SCI variables.

Table 4 provides the distribution of sectoral credit risk within the real sector and, the deviation and squared deviation of the sector's credit share from the optimal credit share based on asset size, on average over 14 years and for the specific year 2021. According to the SCI_AS and SCI_FN indices for 2021, and as also seen in Figure 2 including SCI_AS indices, the real sector experienced the highest sectoral credit concentration in 2021. Therefore, sector credit distribution values in 2021 are also included in Table 3 as the second section.

According to the first section of Table 4 presenting the 14-year averages of sectoral credit distribution and deviations with the assumption of asset size as ideal distribution, there has been an increase in credit towards the manufacturing and electric (electricity, gas, steam and air conditioning supply) sectors, while credit allocation has decreased towards the professional (professional, scientific and technical activities), trade (wholesale and retail trade), and transport (transport and storage) sectors, respectively. In other words, banks have directed the loans they cut from the professional, trade and transportation sectors to the manufacturing sector. The disproportionately high allocation of credit towards manufacturing firms and, the disproportionately low allocation to the other three sectors (professional, trade, and transport) seem to be influential in the last 14 years sectoral credit concentrations.

The second section of Table 4, comprising the last two columns, shows the extent to which sectors' credit shares deviate from the optimal share (based on assumed asset size) for the year 2021. Similar to the previous section, when examining the top five sectors with the highest deviation, it is evident that credit usage has increased in the transport, electric, accommodation (accommodation and food service activities), and manufacturing sectors, respectively, while there has been a significant decrease in credit usage in the trade sector. This decline in the trade sector's credit share has played a key role in shaping credit sector concentration in 2021.

3.3. Method, Findings and Discussions

Panel data consisting of 17 sectors and 14 years were estimated using panel data analysis. According to the three ideal sector distribution assumptions three alternative sector concentration indices (SCI_AS, SCI_VA, SCI_FN) were calculated. Similarly, since there are three dependent variables (NPL_1, NPL_2, NPL_3) proxying credit risk, we estimated nine alternative regression specifications.

The general form of the panel data model (Baltagi, 2005p. 224; Tatoğlu, 2012p. 162) is shown with Equation (2), where Y represents the dependent variable, X' represents the independent variable(s), and ε_{it} represents the error term. By adding the dependent and independent variables of this study to the general panel data model, 9 alternative equations were created and presented as Equations (3) through equations (10).

$$Y_{it} = \beta X'_{it} + \varepsilon_{it}, \quad (2)$$

$$NPL_1_{i,t} = \beta (SCI_AS_{i,t}) + \beta (INTC_{i,t}) + \varepsilon_{i,t}, \quad (3)$$

$$NPL_1_{i,t} = \beta (SCI_VA_{i,t}) + \beta (INTC_{i,t}) + \varepsilon_{i,t}, \quad (4)$$

$$NPL_1_{i,t} = \beta (SCI_FN_{i,t}) + \beta (INTC_{i,t}) + \varepsilon_{i,t}, \quad (5)$$

$$NPL_2_{i,t} = \beta (SCI_AS_{i,t}) + \beta (INTC_{i,t}) + \varepsilon_{i,t}, \quad (6)$$

$$NPL_2_{i,t} = \beta (SCI_VA_{i,t}) + \beta (INTC_{i,t}) + \varepsilon_{i,t}, \quad (7)$$

$$NPL_2_{i,t} = \beta (SCI_FN_{i,t}) + \beta (INTC_{i,t}) + \varepsilon_{i,t}, \quad (8)$$

$$NPL_3_{i,t} = \beta (SCI_AS_{i,t}) + \beta (INTC_{i,t}) + \varepsilon_{i,t}, \quad (9)$$

$$NPL_3_{i,t} = \beta (SCI_VA_{i,t}) + \beta (INTC_{i,t}) + \varepsilon_{i,t}, \quad (10)$$

$$NPL_3_{i,t} = \beta (SCI_FN_{i,t}) + \beta (INTC_{i,t}) + \varepsilon_{i,t}, \quad (11)$$

In Equations (3) to (11);

NPL_1_{i,t}: Banking Sector Non-Performing Loans/Total Cash Loans.

NPL_2_{i,t}: Banking Sector Non-Performing Loans (Gross)/Total Cash Loans.

NPL_3_{i,t}: Real Sector Bad Debts/Cash and Non-Cash Credits.

SCI_AS_{i,t}: Sector Concentration Index based on the sector's asset size (AS).

SCI_VA_{i,t}: Sector Concentration Index based on the sector's value added (VA).

SCI_FN_{i,t}: Sector Concentration Index based on the sector's firm number (FN).

INTC_{i,t}: Interest coverage ratio

Table 5 presents the results of tests aimed at determining appropriate estimators for the nine panel data models.

Table 5. Preliminary Test Results for Panel Model Determination

Model / Test		F Test	LR Test	LM Test	ALM Test	Score Test	Hausman Test	
1	NPL_1 / SCI_AS	Statistics	0.38	0	6.54**	38.32***	0	6.52*
		P-Value	0.9857	1.0000	0.0106	0.0000	1.0000	0.0516
		Decision	Pooled	Pooled	Random	Random	Pooled	Fixed
2	NPL_1 / SCI_VA	Statistics	0.17	0	7.9***	40.99***	0	2.6
		P-Value	0.9999	1.0000	0.0049	0.0000	1.0000	0.2731
		Decision	Pooled	Pooled	Random	Random	Pooled	Random
3	NPL_1 / SCI_FN	Statistics	0.12	0	8.20***	35.47***	0	1.9
		P-Value	1.0000	1.0000	0.0042	0.0000	1.0000	0.3873
		Decision	Pooled	Pooled	Random	Random	Pooled	Random
4	NPL_2 / SCI_AS	Statistics	0.39	0	6.50**	38.45***	0	6.03**
		P-Value	0.9843	1.0000	0.0108	0.0000	1.0000	0.0489
		Decision	Pooled	Pooled	Random	Random	Pooled	Fixed
5	NPL_2 / SCI_VA	Statistics	0.17	0	7.87***	41.11***	0	2.67
		P-Value	0.9999	1.0000	0.0050	0.0000	1.0000	0.2633
		Decision	Pooled	Pooled	Random	Random	Pooled	Random
6	NPL_2 / SCI_FN	Statistics	0.12	0	8.21***	35.73***	0	1.88
		P-Value	1.0000	1.0000	0.0042	0.0000	1.0000	0.3898
		Decision	Pooled	Pooled	Random	Random	Pooled	Random
7	NPL_3 / SCI_AS	Statistics	0.18	0	7.83***	45.78***	0	0.47
		P-Value	0.9998	1.0000	0.0051	0.0000	1.0000	0.7895
		Decision	Pooled	Pooled	Random	Random	Pooled	Random
8	NPL_3 / SCI_VA	Statistics	0.03	0	8.91***	38.98***	0	2.67
		P-Value	1.0000	1.0000	0.0028	0.0000	1.0000	0.2633
		Decision	Pooled	Pooled	Random	Random	Pooled	Random
9	NPL_3 / SCI_FN	Statistics	0.33	0	6.79***	29.36***	0	5.03*
		P-Value	0.9940	1.0000	0.0092	0.0000	1.0000	0.0807
		Decision	Pooled	Pooled	Random	Random	Pooled	Fixed

Note: NPL_1: Banking Sector Non-Performing Loans/Total Cash Loans. NPL_2: Banking Sector Non-Performing Loans (Gross) / Total Cash Loans. NPL_3: Real Sector Bad Debts/Cash and Non-Cash Credits. SCI_AS_{it}: Sector Concentration Index in terms of the sector's asset size. SCI_VA_{it}: Sector Concentration Index in terms of value added. SCI_FN_{it}: Sector Concentration Index in terms of firm number. INTC_{it}: Interest coverage ratio. *, ** and *** indicate 10%, 5% and %1 significance level.

Despite a few Hausman test results favoring the fixed effects estimator, taking into account the data characteristics, the nine models given in Equations (3) to (11) are estimated using a fixed effects estimator, and the parameters of the nine regressions are presented in Tables 6.

Table 6. Parameters of Estimations with Fixed Effects Estimator

Dependent Variables Explanatory Variables	NPL_1		NPL_2		NPL_3	
	Coeff.	t-sta.	Coeff.	t-sta.	Coeff.	t-sta.
SCI_AS	0.02***	(14.13)	0.02***	(14.23)	0.01***	(6.28)
INTC	-0.22***	(-4.73)	-0.21***	(-4.70)	-0.12***	(-4.05)
F / X ² statistics	81***		101***		23***	
SCI_VA	0.001***	(12.77)	0.001***	(13.05)	-0.001***	(-28.28)
INTC	-0.153***	(-3.80)	-0.14***	(-3.79)	-0.05*	(-1.86)
F / X ² statistics	81***		85***		772***	
SCI_FN	0.002***	(10.62)	0.002***	(10.27)	0.004***	(22.53)
INTC	-0.13**	(-2.26)	-0.12**	(-2.23)	-0.15***	(-3.58)
F / X ² statistics	154***		143***		315***	

Note: Table 6 presents statistics for 9 panel data models applied fixed effects estimator with robust standard errors. Panel data consists of 17 sectors and 14 years. The first row includes three dependent variables. NPL_1: Banking Sector Non-Performing Loans/Total Cash Loans. NPL_2: Banking Sector Non-Performing Loans(Gross)/Total Cash Loans. NPL_3: Real Sector Bad Debts/Cash and Non-Cash Credits. The first column refers to the three independent variables. SCI_AS: Sector Concentration Index in terms of the sector's asset size. SCI_VA: Sector Concentration Index in terms of value added. SCI_FN: Sector Concentration Index in terms of firm number. INTC: Interest coverage ratio. Coef.: coefficient. Sta.: statistics. *, ** and *** indicate 10%, 5% and %1 significance levels, respectively.

The results presented in Table 6 provide insights into the regression parameters with three alternative dependent variables (NPL_1, NPL_2, NPL_3) and three different sector concentration indices (SCI_AS, SCI_VA, SCI_FN) across nine model specifications. The second column of Table 6 shows the coefficients for the effect of the SCI variables on NPL_1. In the model assessing the relationship between NPL_1 and SCI_AS, the coefficients for SCI_AS are statistically significant, indicating a positive correlation between sectoral credit concentration based on asset size and the ratio of non-performing loans to total cash loans in the banking sector. Although this result is statistically significant, the coefficient of SCI_AS is 0.03, implying that a 10% increase in the sector concentration index corresponds to a 0.2% rise in NPL_1. While a 0.2% increase may not seem substantial on its own, it could represent a significant amount depending on the total loan portfolio size of the banking sector and may contribute to financial stability concerns.

In the same model, the strong negative relationship between interest coverage and the NPL_1 ratio suggests that higher interest coverage leads to a reduction in non-performing loans. For NPL_1, the INTC coefficient is -0.22, indicating that an increase in the interest coverage ratio by 1 unit results in a 0.22% decrease in the non-performing loans ratio. Economically, this implies that firms with a better ability to cover interest payments are likely to experience lower default rates, thereby enhancing the credit quality and overall health of the banking system. Similar patterns are observed in the regression models examining NPL_1 concerning SCI_VA and SCI_FN. In both cases, the coefficients for the respective SCI variables are statistically significant, indicating a positive relationship between sectoral credit concentration in terms of value added or firm number and the NPL_1 ratio. Additionally, the coefficients for INTC remain statistically significant and negative in these models as well.

The third column of Table 6 presents the results of regressions with NPL₂ as the dependent variable, representing banking sector non-performing loans (gross) as a ratio to total cash loans. The parameters of the three models confirm the positive effect of sectoral credit concentration indices on the second alternative NPL rate. Specifically, the coefficients for SCI_{AS} (0.02) suggest that greater concentration may lead to increased risk exposure within the banking sector. The INTC variable still has an economically and statistically significant negative effect on NPL₂. The strong coefficients for INTC demonstrate that improvements in firms' ability to cover interest payments are linked to lower levels of non-performing loans and better asset quality in the banking sector.

The last column of Table 6 presents the parameters of regressions where the dependent variable is NPL₃, representing the ratio of real sector bad debts to cash and non-cash credits. The models that include the SCI_{AS} and SCI_{FN} concentration indices provide evidence that sectoral credit concentration amplifies bad debt rates within the real sector. In contrast, models regressing SCI_{VA} against the bad debt ratio reveal a significant negative relationship. Additionally, a higher INTC remains a crucial factor in mitigating the default rate within the real sector. The coefficients for SCI_{AS} (0.01) and SCI_{FN} (0.004) indicate a positive association with bad debts; however, the economic significance may be limited due to the small magnitude of these coefficients. Conversely, the strong negative coefficients for INTC consistently demonstrate that higher interest coverage is linked to lower bad debt rates, reinforcing the importance of firms' ability to meet their interest obligations in reducing defaults in the real sector.

When we combine all results from the nine models in Table 6, we can infer that higher sectoral credit concentration in real sector credits, as measured by different sector concentration indices, is associated with increased credit risk levels measured by both banking sector non-performing loan data and real sector bad debts data. Diversification compatible with the sectors' asset size is more effective in reducing credit risk. The negative relationships of INTC imply that sectors characterized by lower interest coverage ratios are more prone to having higher non-performing or bad debt ratios.

Overall, the positive coefficients for the SCI variables underscore the potential risks associated with sectoral concentration. Credit default risk is more sensitive to a diversified loan portfolio in line with asset size. The consistently negative and strong coefficients for INTC highlight the critical role of interest coverage in maintaining financial health and reducing non-performing loans.

The results correspond with the six studies included in this research—three based on Turkish data and three from other countries—that directly focus on credit risk and sectoral loan diversification. Notably, studies such as Bebczuk and Galindo (2008), using data from Argentina's major firms and bank debt data, Chen et al. (2013) on 16 commercial banks in China, and Beck and De Jonghe (2013) in an international context, demonstrate the increasing impact of sectoral concentration on credit risk. Furthermore, three (Tunay, 2015; Sarı, 2019; Yalçın & Tunay, 2020) of the five Turkish studies that

directly examine the relationship between sectoral credit concentration and credit risk conclude that diversification in loan portfolios reduces credit risk.

A robustness test was conducted using system GMM estimations that included the one-lagged value of the related NPL variable as the first regressor in each model specification. According to the findings of system GMM presented in Table 7, concentration indexes positively impact NPL rates, with the SCI_AS index (based on asset size) having the strongest effect. One-period lagged NPLs are statistically significant across all models. INTC variable is negatively correlated in 5 out of 9 models at 10% and 5% significance levels.

Table 7. The Parameters of Estimations with System GMM

Dependent Variables	NPL_1		NPL_2		NPL_3	
Explanatory Variables	Coeff.	z-sta.	Coeff.	z-sta.	Coeff.	z-sta.
L_NPL	0.64***	94.85	0.64***	98.18	0.53***	99.04
SCI_AS	0.02***	23.72	0.02***	24.41	0.02***	34.56
INTC	-0.05*	-1.67	-0.05*	-1.67	-0.03	-1.53
P_Hansen	0.001		0.001		0.001	
P_Diff. in Hansen	0.7776		0.789		0.737	
L_NPL	0.73***	83.24	0.73***	83.92	0.66***	103.31
SCI_VA	0.001***	12.99	0.001***	13.21	0.001***	23.18
INTC	-0.06*	-1.94	-0.06**	-1.97	-0.03	-1.49
P_Hansen	0.001		0.001		0.001	
P_Diff. in Hansen	0.637		0.639		0.915	
L_NPL	0.51***	14.39	0.53***	15.10	0.09***	3.30
SCI_FN	0.003***	8.54	0.003***	8.13	0.004***	18.75
INTC	-0.08	-1.61	-0.07	-1.60	-0.06*	-1.76
P_Hansen	0.001		0.001		0.001	
P_Diff. in Hansen	0.835		0.848		0.712	

Note: Table 7 presents statistics of system GMM estimations with robust standard errors for 9 panel models. The observation number in each model is 221. L_NPL reflects the one-lagged value of the related NPL variable. L_NPL enters all regressions as the first regressor. P_Hansen and P_Difference-in-Hansen are p-values for exogeneity tests. Coef.: coefficient. Sta.: statistics. *, ** and *** indicate 10%, 5% and %1 significance.

4. CONCLUSION

This study highlights the significant risks posed by sectoral concentration in bank loans, which increases susceptibility to credit risk and contagion within the financial system. Analyzing data from the Turkish real and banking sectors from 2009 to 2022, we distinguish our research by utilizing the Sector Concentration Index (SCI) alongside a comprehensive dataset. The SCI aligns with optimal diversification strategies in portfolio theory, allowing for a more meaningful comparison between the sectoral distribution of bank loans and the market's ideal distribution, as a corrected form of the commonly used Herfindahl-Hirschman Index (HHI). Unlike previous studies that primarily relied on bank-level data, our analysis integrates both sectoral and bank-level data.

Our set data evaluation indicates a disproportionately high allocation of credit to manufacturing firms, while other sectors, such as professional services, trade, and transport, receive comparatively less.

This allocation has significantly influenced sectoral credit concentrations over the past 14 years. The panel data analysis reveals a positive correlation between sectoral credit concentration, measured by various indices, and non-performing loan (NPL) rates in the banking sector, as well as bad debt rates in the real sector. Among the three concentration indexes examined, the one based on asset size demonstrates the strongest effect on NPLs, suggesting that diversification according to asset volume can more effectively mitigate credit risk. Furthermore, operating within sectors characterized by low-interest coverage ratios exacerbates credit risk. This finding underscores the importance of sector-specific financial health in managing default rates and ensuring adequate interest coverage to reduce credit risk in the real economy.

Overall, sectoral concentration in real sector credits contributes to heightened credit risk, manifesting as non-performing loans in the banking sector and bad debt in the real sector. This outcome emphasizes the benefits of diversification in reducing credit risk, aligning with economic theory, portfolio management principles, and financial intermediation theory, which assert that insufficient diversification increases vulnerability to credit risk.

These findings provide valuable insights into the complex relationship between sectoral concentration and credit risk. Given the financial and economic implications, targeted policy recommendations are essential. Based on these findings, it is recommended to implement policies that encourage diversification in lending practices, particularly by promoting loan allocation proportional to asset size. Additionally, policies should focus on enhancing the monitoring and supervision of sectoral credit concentration.

One possible avenue for further research is to distinguish the determinants of sectoral credit concentration, which could contribute to developing more effective risk management strategies and maintaining financial stability, potentially expanding the generalizability of these findings.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors contributed equally to the entire process of the research.

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Green Bonds as Catalysts for Low-Carbon Financing Mobilization: Examining their Impact on Sustainable Development

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Abstract

This study examines the crucial implication of green bonds in impede low-carbon investment and their subsequent power on sustainable development. Green bonds, being a financial tool, have gained growing awareness due to its capability to direct investments towards ecologically sustainable projects and initiatives. Green bonds have gained popularity to deal with sustainable development and climate change. It can finance credit to green projects, However, we must assess how successfully they fund low-carbon projects and how they affect sustainability. This research aims to explore the effectiveness of green bonds in magnetize funds that encourage low-carbon practice. This study investigates the societal and environmental impacts, market dynamics, and transparency issues surrounding green bonds, while examining their purpose in funding green projects, promoting credit inclusion, and advancing sustainability. A standardized survey has been conducted on 420 people of northern India, and questionnaire validated through pilot survey in form of reviews from experts and pre-testing. Smart PLS4 bootstrapping and PLS partial least square methods have been applied to find out desired results as per objectives of the research. The study's results highlight the positive impact of green bonds on sustainable development, emphasizing the importance of adherence to sustainability regulations, investor-focused management strategies, and financial inclusion, thereby encouraging key stakeholders across sectors to adopt more environmentally and ethically conscious practices. In addition, investment of green bonds in eco-friendly projects can improve a company's status and plead to awareness among society. Findings the prospective of low-carbon investment through green bonds might prompt strategist to consider set of laws.

Keywords: Government Policy, Market Condition, Economy, Green Growth, Finance, investor sentiments



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Article Type	Application Date	Admission Date
Research Article	April 10, 2024	December 28, 2024

1. INTRODUCTION

Green bonds have been utilized as a financial innovation to deal with sustainability and environmental concerns (Chen & Zhao, 2021). The idea of green bonds scored popularity in the early on 2000s, when first time in 2007 it's exercised by the European investment bank. Green bonds are intended with the particular idea of funding scheme and mission that have a constructive impact on the society and environment. They are critical in promoting a sustainable prospect by mitigating emissions from carbon. Green Bonds, initially launch in 2007 by the European Investment Bank as a financial tools designed to funding projects that have constructive effect on climate (Serena, 2022; Ay et al., 2023). Green bonds holds distinguish character as compare to other bonds as they are utilized only for sustainable projects. General research has been conducted on Green Bonds, by the number of scholars with concern that to define the concept and link the finance with environmental (Ng, 2022). The market and demand of Green Bond has been increased. The paper has examined the development of financial market for green investment with a detailed prominence on issues such as growing interest of investor for green investment, motives for environmental laws and the active involvement of financial institutions in endorse the issuance of Green Bonds (Pham, 2016). The evolution and growth in green bonds market has become the key mechanism for financing low-carbon projects. Various researches have reported the positive impact of Green Bonds financing on green or low carbon oriented projects. The researchers have made efforts to find out the environmental and social effects on green projects financed by the ecofriendly green investment like bonds and revealed their contribution to reducing the carbon for sustainable development (Wang et al., 2022). The research has examines the impact of Green Bond issuance on distribution of credit in financial market and advocated the use of capital towards ecofriendly projects (Piñeiro-Chousa et al., 2022). While green bonds have garnered significant attention, a review of above related studies highlights the key issues and challenges they face. These issues include the exercise of green washing, where issuers may amplify the benefits from their green projects and the would like to recognize with world level standard of assessment for ecological congenial (Adekoya et al., 2023). The researchers have also assessed importance for more transparency and exposure to guarantee the authenticity of Green Bonds (Broadstock & Cheng, 2019). Policies of Government and regulatory structure deeply control the endorsement of Green Bonds. Researchers have explored the incentives effectiveness, benefits from taxation, and system in encourage the involvement of both investors and issuers in the market of green financial market. (Rodríguez et al., 2022).

The importance to accomplish the goal of low carbon and growth of sustainable economies has become more evident in context of issues and challenges. In sort to tackle problems such as diminishing biodiversity, climate change, and decreasing in natural resources, we should restructure our economic system. Investment is very important in support this development by allocate funds to ecofriendly schemes on priority base for sustainable wealth and mitigating the emissions. The "Green Bond" is a new economic system that has gained magnetism for its ability to dispense capital towards green

proposal that endorse environmental sustainability (Liu et al., 2023; Scarişoreanu & Ghiculescu, 2023). Green Bonds are a meticulous financial mechanism has designed to obtain financial resources for ecofriendly schemes. Green bonds have acknowledged as a realistic tool for raising funds that encourage low-carbon schemes and make promising finance in competency of energy, energy renewable, carbon free transportation and other projects promoting sustainability. They provide with as an involvement between the economic sector and economic movement, empower investors to hold ecofriendly schemes and projects that line up with their ecological and moral standards even as generating fiscal proceeds. This paper investigates the bubble of Green Bonds and its impact on financing of low carbon projects. The goal is to evaluate the level to which Green Bonds have effectively channelized funds into green projects and, supporting universal efforts to tackle challenges of carbon emissions and endorse ecological stewardship. This study investigates the methods and factors that affect the problem and acceptance of Green Bonds, and its effect on the distribution of monetary resources, and their function in facilitating an evolution to a low-carbon wealth. The endeavor of this research is to present an investigation of the effectiveness of this distinctive monetary tool in addressing ecological concern. This present vital insight for law makers, monetary organization, stakeholders, and ecological campaigner dedicated to speed up the move towards a more sustainable future of economies. Through an inclusive investigation of the market of Green Bond, this study try to find to add to the enduring discussion on green economics and its vital position in nurturing a more cost-effectively mindful and wealthy civilization for potential generations. The inspiration for this study curtails from the imperative call for to deal with climate change and precede sustainable growth. The attractiveness of green bonds for raise finances for ecofriendly schemes has been increased. Nevertheless, there are requirements to be more divergent regarding the authentic effect of green finance on sustainable economies. This study significantly assess the mobilization of low-carbon and sustainable growth impact of green bonds.

This research investigates the various consequences and outcome of green bonds on sustainable growth, making it distinctive. This study focused to assess the critical factors like such regulations of governments, investor's opinions, and dynamics of market that influence the performance of ecofriendly green bond investment. It assists us to know how financial mechanism may advance the society and environment by using an inclusive approach.

The rest structure of this paper is as follows: Section 2 elaborates on the Literature Review; Section 3 introduces the Research Model; Section 4 discusses the Research Methodology; Section 5 presents the Data Analysis; Section 6 provides the Discussion, Section 7 depicts the Conclusions; and Section 8 explores the Managerial Implications.

2. LITERATURE REVIEW

A study focuses on the need for knowledge of the variables that affect the progress of green bonds and how they affect the success of issuers in achieving goals of (ESG) environmental, social, and

governance (Tiwari et al., 2023). The text highlights the worth of finance in promoting sustainable development. It recognizes governance and disclosure quality as essential drivers of growth and examines the benefits of green bonds. Additionally, suggestions for future study paths are put up.

Abhilash et al. (2022) investigate how the green bond rules implemented by prominent Chinese financial authorities directly and positively influence the green bond industry. Further study indicates that some attributes of issuers, such as management type (government-owned), business type (green industry), and sector type (financial issuer), exhibit a more pronounced positive response to policy announcements and result in a more significant number of green bond issuances. Thier study's findings emphasize financial regulators' crucial contribution to promoting the green finance mission in China (Abhilash et al., 2022).

Green innovations and green financing are integral to sustainable development Tolliver et al. (2020). Asian nations in the most densely populated and rapidly expanding areas of the global face the challenge of sustaining economic expansion while simultaneously tackling climate change and ecological consequences. South Korea, Japan and China have individually adopted measures to encourage environmentally friendly innovation and provide financial support for such initiatives. Although each country has distinct capabilities, the degree to which nation can enhance environmentally sustainable growth, register green patents, issue green bonds, attract foreign direct investment in green bonds, and disclose ESG insights will significantly influence their transition towards sustainable growth models (Prakash & Sethi, 2021).

Busch et al. (2016) analyzes the function of financial markets in advancing sustainable business practices. Although ESG factors are often included in investment choices, there is a paradox where actual organizational changes towards sustainability are restricted. To overcome this challenge, it is necessary to transition towards a sustainable investment approach focusing on long-term goals and enhance the reliability of environmental, social, and governance (ESG) data. The research also examines the possible market ramifications of using ESG standards.

Emanuele Campiglio (2016) explores the impact of monetary and macroprudential monetary regulations on banks' lending strategies. By adjusting the incentives and restrictions that banks face, such as implementing varying reserve requirements based on the purpose of lending, there is potential to stimulate credit creation in low-carbon sectors. This is particularly viable in developing economies, where the central banking system typically enables greater public oversight of credit distribution and a broader array of monetary policy tools beyond adjusting interest rates.

This research attempts to find out the answers of questions given below:

RQ1. Is there any relationship between green Bond issuance on Sustainable Development?

RQ2. Does investors sentiments has impact on Sustainable Development?

RQ3. Is market conditions affecting the Sustainable Development..

RQ4. Does government policies and Stakeholders engagement working as a mediator and moderator between givel variables respectively?

Nannan Wang (2014) explores the evolution of regulation instruments that promote low-carbon administration in China. The instruments are examined in five elements about the critical strategies in low-carbon governance in China, which include energy conservation, the development of new energy sources, reforestation efforts, the promotion of a circular economy, and industry restructuring. This research proposes that law enforcement for the newly established laws should be enhanced, and more rigorous supervision systems should be implemented to ensure the effective execution of low-carbon guidelines, measures, and standards, particularly in energy-intensive sectors. China must regularly improve its backward laws and industrial standards to effectively support the low-carbon development strategy.

Piñeiro-Chousa et al. (2022) examines the macroeconomic impacts of government green subsidies, which an unanticipated carbon tax or green sovereign bonds may pay. In reaction to a carbon tax, investors change their risk assessment of enterprises and how this affects their low-carbon investment choices. The authors note that green bond financing and carbon prices may compromise decarbonization, distributive impacts, and public debt sustainability. Transmission networks differ by policy and instrument. Green subsidies from sovereign bond issuance boost GDP and reduce inequality compared to carbon taxes. Despite GDP growth, the economy's relative decoupling has hampered carbon reductions. Investor climate risk adjustments balance this trade-off, resulting in total decoupling (Piñeiro-Chousa et al., 2022).

Green bonds have become increasingly important as they fund sustainable ecological initiatives that tackle pressing issues such as environmental change and water management. Companies have also embraced CSR strategies and green efforts in response to growing environmental consciousness. This study is important because research on the connection between social media and green bonds, especially regarding investor sentiment, is scarce. This study uses panel data analysis to investigate the weight of social media investors' opinions on the green bond market (Chen & Zhao, 2021).

Upon investigating the effect of market procedures on accomplishing sustainable growth of industries in China, it has been revealed that there is a association between flexible policies for environmental concern, technical development, and executing rules and laws. The results revealed that flexible environmental rules improve sustainability by stimulating technology innovations, whereas the soundness of this association varies across several geographical regions. This paper highlights the importance to execution of policies to deal the "execution gap efficiently" and offers suggestion for constructive polices to foster sustainable development in industries of China (Naeem et al., 2023).

Kedia Joshipura provides a viewpoint highlighting the significance of considering all parties involved to achieve sustainable development and optimize value for the company (Bansal et al., 2023). The main obstacle governments encounter is providing financial resources for ecologically friendly programs. Low-carbon financing refers to a financial strategy designed to facilitate the growth of a low-carbon economy (Ahmed et al., 2023). The core objective of low-carbon funding is to raise finance for eco friendly projects that hold up sustainability and have a least carbon impact (Rasoulinezhad, 2022). Green bonds are a valuable tool for funding projects that promote environmental sustainability. The bond's name reflects its primary objective. The advancement and achievement of green bonds are crucial for achieving the goal of sustainable development.

A traditional way of looking at the status of businesses to view markets as tools for organizing accountability and strategies of corporate sector. A widely recognized business philosophy that interprets and indicates this status is the market orientation (MO). MO clearly make a distinction between economic obligations and other responsibilities, such as ethical and legal ones (Tolliver et al., 2019). Oguntuase and Windapo (2021) have studied the two widely recognized business theories, market and stakeholder views, are examined and compared as competing strategies for corporate responsibility in sustainable development. Although stakeholder orientation provides more comprehensive incorporation of expectations and values compared to market orientation, they exhibit significant parallels in the context of sustainability views and the perception of the corporation's role in pursuing sustainable development. Both strategies shift the focus away from the firm by highlighting the importance of either consumers or stakeholders in strategizing. Both approaches are also grounded in assumptions that align with a perspective of limited sustainability, which some argue needs to be revised to achieve long-term and widespread sustainability.

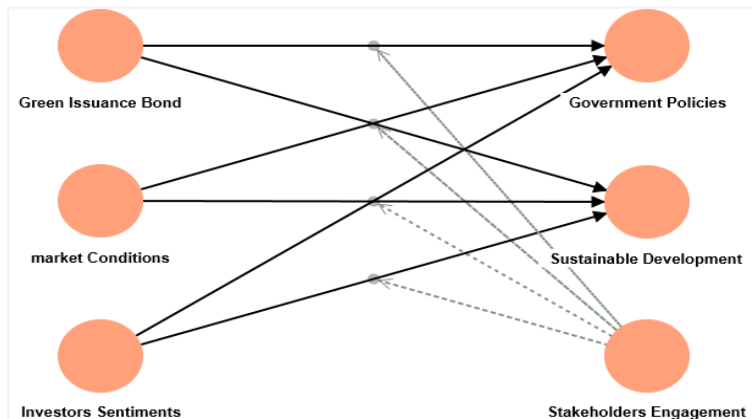
Based on the study conducted by Wu and Liu, excelling in environmental protection can be a powerful strategy to attract investors and exceed their expectations (Wu & Liu, 2023). Adekoya delve into the significance of financial markets in promoting sustainable development (Adekoya et al., 2023). The authors particularly inquire about how financial markets support and enable more sustainable business techniques. The authors emphasize that their present role is quite humble and come to the conclusion that, on the traditional routes, there is a paradoxical situation. While financial market participants increasingly incorporate ESG standards into their various decisions for investments, the reality within organizations needs to reflect a significant move towards more sustainable business practices.

3. RESEARCH MODEL

A model was proposed to examine the relationship between various factors such as management's environmental values and leadership, stakeholder engagement, environmental effectiveness, and restaurant performance (Obine, 2019). The study also explored the moderating

influence of chain affiliation on this relationship. The model presented in the study provides a framework for testing these variables and their impact on stakeholder engagement. Although the results were not statistically significant, it was observed that stakeholder engagement played a more crucial role in promoting environmental sustainability in chain restaurants compared to independent restaurants. The impact of environmental sustainable development on monetary as well as nonfinancial performance was discovered to be comparable for the both chain and autonomous restaurants.

Figure 1: Conceptual Model



Source: Authors Compilations

4. RESEARCH METHODOLOGY

4.1. Factor Analysis

Factor analysis was applied to accomplish research objectives after the literature review variables were framed, and a questionnaire was developed for factor analysis. Considering the first variable, green bond issuance had ten items in the first draft; in the second draft, six items were left, and the final construct was framed as four items in the last draft. Considering the second variable of market condition, there were ten items in the first draft, five items in the second draft, and four items remained in the last draft. As far as the third variable, investor sentiment, was concerned, there were ten items in the first draft, 5 in the second draft and 3 in the last draft. Considering the fourth variable of government policy, there were ten items in the first draft, six in the second draft and four in the final draft, which were used as part of the research. The next variable is stakeholder engagement, which had ten items in the first draft, seven in the second draft, and four in the final draft. The final variable used in the research was sustainable development, with ten items in the first draft, four in the second draft, and three in the last draft. Items in the final draft of each variable were used for the data collection on the full sample size of 420 respondents, and the reason for choosing this number is justified in the next section of the research.

4.2. Sample Size Calculation

G power software has been applied to calculate the size of the sample. In the test family tab, a t-test has been used, while in the tab of statistical linear multiple regression selected; in the tab of power analysis, the "A priori: compute for sample size and sample size effect has been inserted." Figure 2 was inserted to get a sample size 420 in the following software segment. It explains independent variables affecting the adequate sample size of 164 normally distributed. To be on the safer side, current research is conducted on 420 respondents, which is double the calculated sample size.

In this study, a questionnaire was designed using Google form, and distributed to 700 respondents, resulting in 420 completed responses. It was circulated to 700 respondents in northern India. In the study, 20 responses have been removed because of incomplete responses. We have obtained responses from 420 respondents on which PLS algorithm and bootstrapping have been applied with Smart PLS4. Northern India offered an ideal case study to determine the impact of low-carbon financing mobilization on sustainable development. Green bond issuance, market conditions, Government policies, investors' sentiments, and stakeholders' engagement in a particular region of India may be useful results for another comparable region. Furthermore, the researcher will be able to understand the complexities of green bond financing mechanisms for low-carbon or sustainable development with the financial market and regulatory environment. This will be useful globally for low-carbon strategies with sustainable efforts in a region with discussion.

Figure 2: Sample Size Calculation Using G* Power

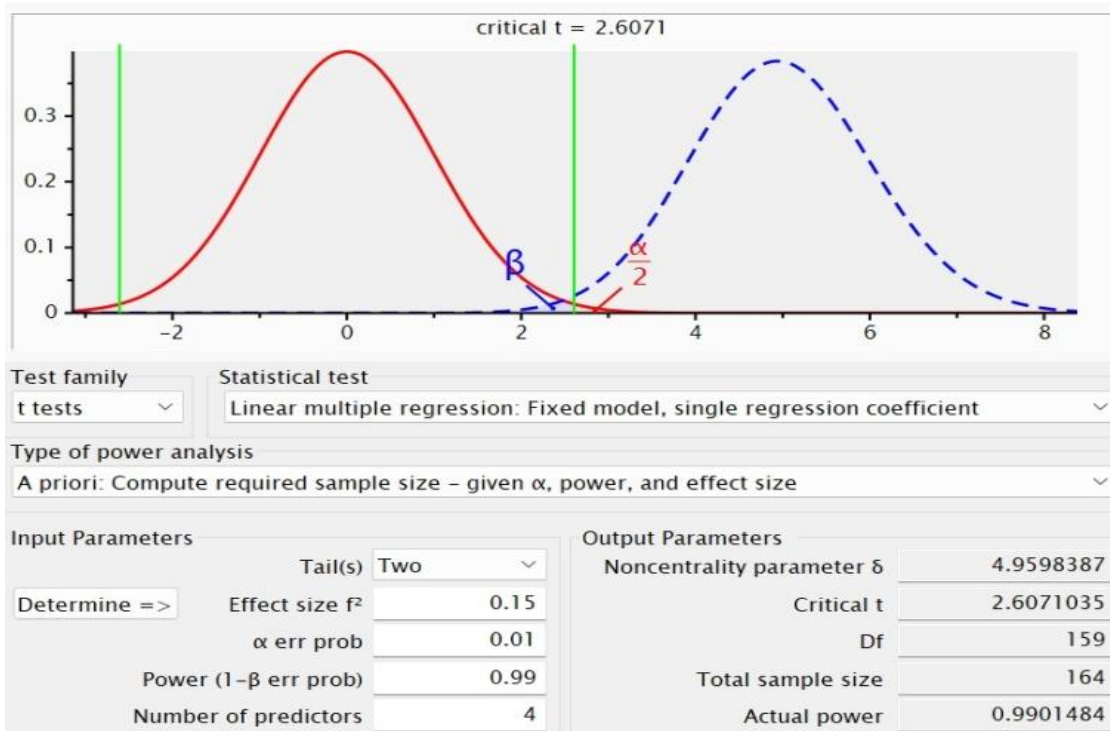


Table 1: Sample Demographics

Investors' Age	Count	Percentage	Educational Qualification	Count	Percentage
Less than 30 years	120	28.57	Graduate Level	100	23.81
Between 30 to 45 years	180	42.85	Post Graduate Level	140	33.33
Between 40 to 55 years	85	20.23	Professional	180	42.86
55 years and above	35	8.33		420	100
	420	100			
Gender			Investor experience		
Male	220	52.38	Pleasant	220	52.38
Female	200	47.61	Unpleasant	200	47.61
	420	100		420	100
Income			Marital Status		
Below 30,0000 per annum	70	16.66	Married	340	80.95
30,0000-50,0000 per annum	150	35.71	Unmarried	80	19.04
Above 50,0000 per annum	200	47.62		420	100
	420	100			
Respondents type					
individual investors	65	15.48			
institutional investors	200	47.62			
researcher and academicians	140	33.33			
government regulators	15	3.57			
	420	100			

Table 1 provides a comprehensive overview of the demographic characteristics of a sample comprising 420 investors. Upon analyzing the age distribution, it is evident that the largest portion of investors, accounting for 42.85% of the sample, falls between the 30 to 45 years age range. Following closely after are persons aged 40 to 55 years, making up 20.23% of the total. The sample comprises 28.57% of investors under 30 and 8.33% aged 55 and above. Regarding educational credentials, the data indicates that most investors have professional experience (42.86%), while postgraduates account for 33.33%, and graduates make up 23.81% of the sample. The sample has a relatively equal distribution of genders, with males accounting for 52.38% and females for 47.61% of the investors. Remarkably, investors' experiences are equally divided between enjoyable (52.38%) and disagreeable (47.61%). Regarding income, a substantial part of investors make more than 500,000 per year (47.62%), while 35.71% generate between 300,000 and 500,000 per year, and 16.67% earn less than 300,000 per year. The investors' marital status indicates that a significant proportion have been married (80.95%), while 19.05% are unmarried. The responses include a heterogeneous blend, including 15.48% private investors, 47.62% institutional investors, 33.33% researchers and academics, and a lesser fraction of 3.57% representing government regulators. This descriptive study offers useful insights into the makeup of the investor sample, providing a basis for further investigation and making decisions in financial planning and market targeting.

5. DATA ANALYSIS

5.1 PLS-Algorithm

Figure 3: PLS-Algorithm

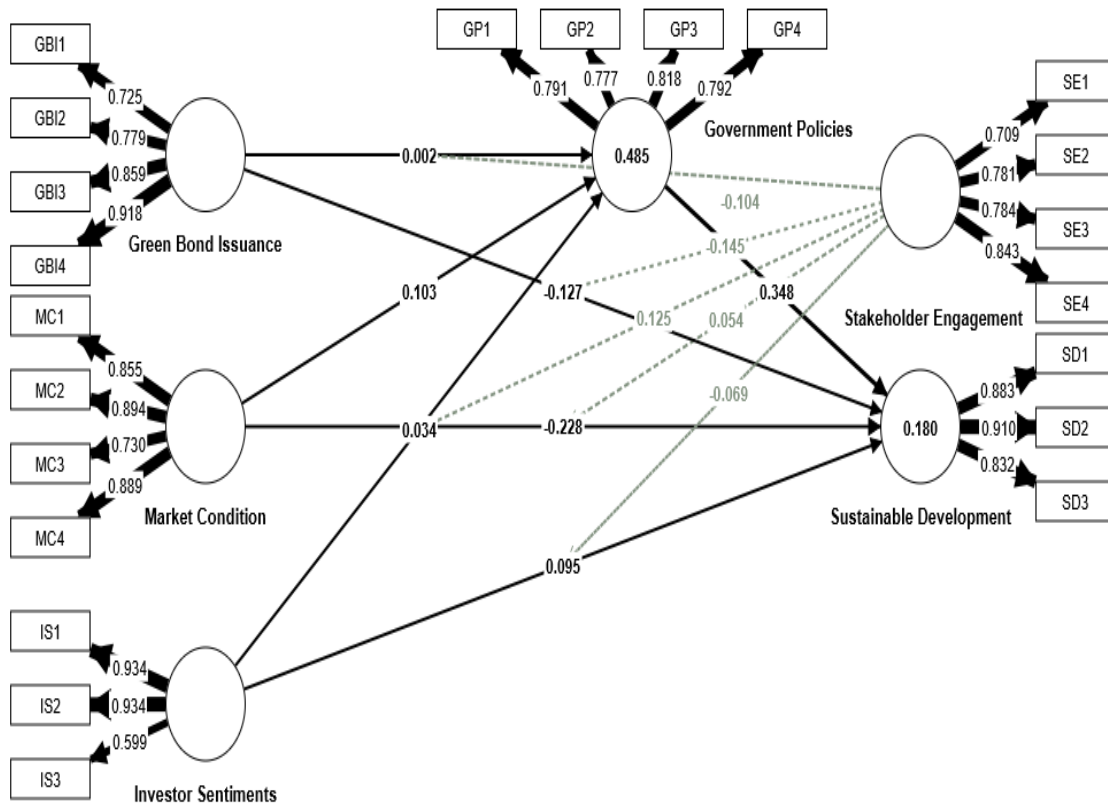


Figure 3 presents calculations about implementing the PLS algorithm on the conceptual model. The arrow connecting one construct to another indicates the path coefficients, while the arrows originating from constructs denote correlations.

Table 2: Construct Reliability and Validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Government Policies	0.807	0.817	0.873	0.632
Green Bond Issuance	0.847	0.975	0.893	0.678
Investor Sentiments	0.869	0.525	0.872	0.702
Market Condition	0.868	0.906	0.908	0.713
Stakeholder Engagement	0.785	0.799	0.861	0.609
Sustainable Development	0.847	0.851	0.908	0.766

Crucial details about the construct validity and reliability of different components or constructs can be found in a study in Table 2. The table displays four important metrics for each construct, which are associated with various parts of sustainability and finance: Cronbach's alpha, Composite reliability (rho_a), Composite reliability (rho_c), and Average variance extracted (AVE). Within the framework of the table, let us analyse these indicators.

An indicator of internal consistency dependability is Cronbach's alpha. The level of correlation between items inside a concept is evaluated. All the constructions in this table have Cronbach's alpha scores between 0.785 and 0.869. These results are within the acceptable range, showing a moderate to high degree of correlation between items within each construct and indicating strong internal consistency.

Composite reliability, which includes rho_a and rho_c, is a way to gauge a construct's total dependability. The construct's dependability may be understood from the rho_a and rho_c numbers. The table's constructions span a range of 0.861 to 0.908 for rho_c and 0.525 to 0.975 for rho_a. Reliability is best shown by rho_a values greater than 0.70 and rho c values greater than 0.80. Most of the table's constructions are reliable (as shown by their high rho_a values), but "Investor Sentiments" falls short. Given this, it is reasonable to assume that the elements of the "Investor Sentiments" construct are not rock solid like those in other constructions.

One way to evaluate convergent validity is by looking at the Average Variance Extracted (AVE). In contrast to the variation caused by measurement error, it evaluates the degree of inter-item correlation within a concept. The AVE values in the table vary between 0.609 and 0.766; every single construct is over the suggested cutoff of 0.50. A favourable indicator of convergent validity would be if the underlying components explain a substantial variation in each construct rather than measurement error.

Table 3. HTMT Inference

	Government Policies	Green Bond Issuance	Investor Sentiments	Market Condition	Stakeholder Engagement	Sustainable Development	Stakeholder Engagement x Investor Sentiments	Stakeholder Engagement x Market Condition	Stakeholder Engagement x Green Bond Issuance
Government Policies									
Green Bond Issuance	0.388								
Investor Sentiments	0.312	0.638							
Market Condition	0.503	0.708	0.719						
Stakeholder Engagement	0.84	0.488	0.43	0.656					
Sustainable Development	0.337	0.159	0.122	0.082	0.206				
Stakeholder Engagement x Investor Sentiments	0.324	0.207	0.298	0.325	0.508	0.265			
Stakeholder Engagement x Market Condition	0.404	0.195	0.21	0.36	0.46	0.249	0.853		
Stakeholder Engagement x Green Bond Issuance	0.284	0.223	0.147	0.212	0.387	0.286	0.838	0.834	

The Heterotrait-Monotrait (HTMT) ratios, as shown in Table 3, are important for determining the discriminant validity of a study's many components. Assuring that different concepts are, in fact, distinct and not too connected to one another is what discriminant validity is all about.

The diagonal values, which represent the comparison of each construct to itself, have all been below 1.0, indicating that each construct has discriminant validity of itself. This is the first phase in developing discriminant validity. As a result, a more robust relation exists between values of items across each construct compared to values of items from different constructions, which is a vital attribute for ensuring dependable assessment.

The subsequent chain of integers comprises of the off-diagonal values, which point out the HTMT ratios when assessing various structures. Such values must be less than a preset standard frequently about 0.85 or 0.9 to reveal discriminant validity under best possible conditions. The table highlights substantial validity among the constructs, as values are below from preset threshold. This advocates that the ideas are diverse and do not containing any uniformity in context of variability.

The ratios of HTMT ratios presented in Table 3 revealed that the research element containing validit of robust discriminant. The off-diagonal components specify significant differences across the structures, though the diagonal components point out the internal consistency of each one build. This credibility of the selected concepts has been proved by results as per objectives of the stuy. Findings of the research may be usefull to analyze with greater certainty by ensuring thew fair and clear constructs.

Table 4. Model Fit

	Saturated model	Estimated model
SRMR	0.109	0.109
d_ULS	3.022	3.016
d_G	0.917	0.908
Chi-square	510.028	503.738
NFI	0.655	0.66

Table 4 reveals the results as per SEM through compares the estimated research model. Such models are key mechanism to examine the scale to which the envisaged model corresponds to the concrete information.

This statistic calculates the standardized residual covariance, starting with the Standardized Root Mean Square Residual (SRMR).The value of SRMR for together the saturated and anticipated models is concerning 0.109. This scale of proximity point out that the anticipated model presents an adequate match to the data. The anticipated model does sound regarding this constraint when the SRMR is short, and a short SRMR typically means an improved match.

At this point, we shall examine the indices d_ULS and d_G, introduced by McDonald, which are utilized to assess the differences between the saturated and hypothesized models. Lesser values point

out a healthier match. At this point, the saturated model have 3.016 and 0.908, for the d, ULS and d G values respectively, while the anticipated model has fairly lesser values. Based on these indications, the estimated model is quite well-fit, with these differences suggesting that it is considerably closer to the saturated model.

Finally, a standard metric for evaluating model fit, the Chi-square (χ^2) statistic, is considered. In general, a lower chi-square value indicates a better fit in relation to degrees of freedom. Whereas the saturated model's chi-square value is 503.738, the estimated model's value is 503.738, a lower number. Even though this points to a good fit, it is worth noting that chi-square values are quite sample-size dependent; hence, other fit indices should be explored.

Overall, Table 4's model fit statistics give the impression that the estimated model fits the data well. While both models have comparable SRMR values, the estimated model has better d_ULS and d_G values and a lower chi-square value, which means it fits the data rather well. To thoroughly evaluate model fit, it is recommended to consider various fit indices and how they are used in the research project.

5.2. Bootstrapping

Figure 4: Bootstrapping of Conceptual Model

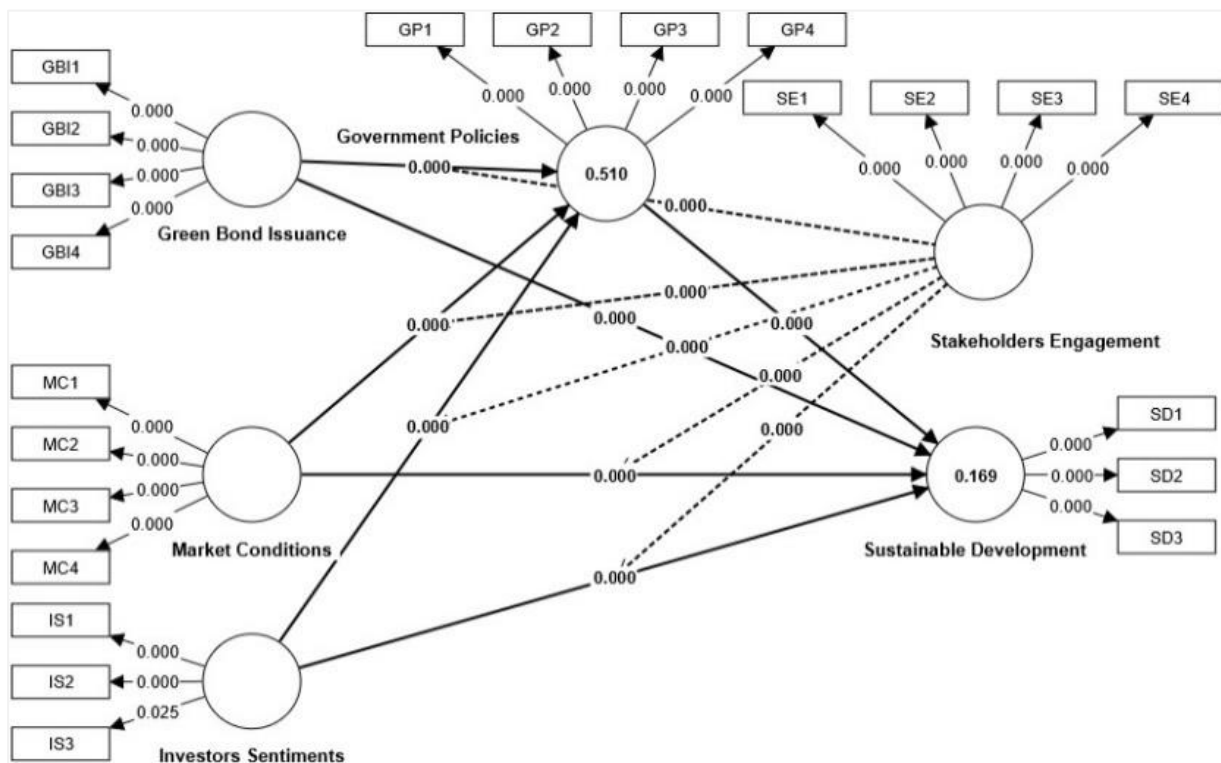


Figure 4 presents calculations about bootstrapping implementing the PLS algorithm on the conceptual model. The arrow connecting one construct to another represents the path coefficients, whereas the arrows emanating from constructs represent correlations.

Table 5: Hypothesis Testing

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	t statistics (|O/STDEV|)	p values	Status
Government Policies -> Sustainable Development	0.348	0.339	0.152	6.981	0	Rejected
Green Bond Issuance -> Government Policies	0.002	0.018	0.131	7.112	0	Rejected
Green Bond Issuance -> Sustainable Development	0.127	0.135	0.16	8.547	0	Rejected
Investor Sentiments -> Government Policies	0.034	0	0.165	6.988	0	Rejected
Investor Sentiments -> Sustainable Development	0.095	0.073	0.21	5.412	0	Rejected
Market Condition -> Government Policies	0.103	0.116	0.118	5.111	0	Rejected
Market Condition -> Sustainable Development	0.228	0.216	0.18	8.811	0	Rejected
Stakeholder Engagement -> Government Policies	0.64	0.617	0.094	6.827	0	Rejected
Stakeholder Engagement -> Sustainable Development	0.02	0	0.165	6.912	0	Rejected
Stakeholder Engagement x Investor Sentiments -> Government Policies	0.125	0.092	0.118	4.11	0	Rejected
Stakeholder Engagement x Investor Sentiments -> Sustainable Development	0.069	0.059	0.19	5.794	0	Rejected
Stakeholder Engagement x Market Condition -> Sustainable Development	0.054	0.055	0.145	6.111	0	Rejected
Stakeholder Engagement x Green Bond Issuance -> Government Policies	0.104	0.072	0.115	8.561	0	Rejected
Stakeholder Engagement x Green Bond Issuance -> Sustainable Development	0.145	0.174	0.146	5.891	0	Rejected

The findings of hypothesis testing for distinct correlations between different constructs in a research project are shown in Table 5. Everything from the initial data set to the sample mean, standard deviation, t-statistics, p-values, and the current state of each hypothesis test is laid out in the table.

To determine whether the associations between constructs are statistically significant, we may look at the t-statistics in the table. These are determined by dividing the original sample (O) by the standard deviation (STDEV). A larger T-statistic indicates a stronger association. Furthermore, the p-values linked to each hypothesis test determine the statistical significance of the correlations.

When the given p-values are zero, it usually means that the associations under test are very significant statistically. This leads us to the conclusion that the correlations between the constructs are not coincidental but rather substantial, and we can thus reject all of the hypotheses.

As an example, the null hypothesis (i.e., no association between "Government Policies -> Sustainable Development") is rejected due to a t-statistic of 6.981 and a p-value of 0. The results show a statistically significant relationship between sustainable development and government policies.

Similarly, high t-statistics and p-values of 0 indicate that all other relationships, including "Green Bond Issuance -> Government Policies," "Investor Sentiments -> Sustainable Development," and "Stakeholder Engagement x Green Bond Issuance -> Government Policies," are statistically significant and reject the null hypothesis.

Finally, all hypotheses are rejected with very low p-values, as shown in Table 5, which shows that the correlations between the investigated constructs are statistically significant. The findings provide credence to the connections between the constructs, as shown by the t-statistics, which are vital for deriving meaningful conclusions from the study.

5.3. Mediation Analysis

Table 6: Mediation analysis of Investor Sentiments -> Government Policies-> Sustainable Development

Type of effect	Effect	Path Coefficient	t-Stats	Remarks
Total Effect	Green Bond Issuance -> Sustainable Development	0.486	6.159**	Significant Total Effect
Indirect Effect	Green Bond Issuance -> Government Policies-> Sustainable Development	0.112	0.015	Insignificant Indirect Effect
Direct Effect	Green Bond Issuance -> Financial Inclusion	0.339	6.981**	Significant Direct Effect
VAF (Variance Accounted For)	Indirect Effect/Total Effect		23.05%	

An analysis was conducted to determine the connections between "Investor Sentiments," "Government Policies," "Green Bond Issuance," and "Sustainable Development." The outcomes of this mediation are shown in Table 6. We want to learn more about these concepts' interplay and mutual effect by doing this investigation.

To start, let us look at the "Total Effect" as it relates to the "Green Bond Issuance" and "Sustainable Development." A total effect path coefficient 0.486 yields a p-value of 6.159**, indicating statistical significance. This indicates a strong connection between "Green Bond Issuance" and "Sustainable Development." This substantial overall effect indicates that changes in Green Bond Issuance directly affect Sustainable Development.

The next part of the study goes into the "Indirect Effect," where the function of "Government Policies" is particularly examined as a mediator between "Green Bond Issuance" and "Sustainable Development." An unimportant t-statistic of 0.015 is linked to the indirect effect's path coefficient of 0.112. Because of this, it seems that "Government Policies" play little to no mediating role in the connection between "Green Bond Issuance" and "Sustainable Development" here. To rephrase, "Government Policies" does not seem to mediate this connection.

This research takes into account both the "Direct Effect" between "Green Bond Issuance" and "Financial Inclusion" and other factors. With a t-statistic of 6.981**, the direct effect's path coefficient of 0.339 is statistically significant. This indicates a strong connection between "Green Bond Issuance" and "Financial Inclusion." This research provides further evidence that shifts in the issuance of green bonds affect financial inclusion.

Finally, the indirect impact is divided by the overall effect to get the "Variance Accounted For" (VAF). Here, the indirect impact is responsible for around 23.15% of the overall effect, as shown by the VAF of 23.15%. Despite the lack of significance of the indirect impact, this percentage does provide light on how much of the overall effect may be explained by the possible mediating role of "Government Policies."

Additionally, Table 6's mediation analysis reveals a substantial overall influence of "Green Bond Issuance" on "Sustainable Development," but "Government Policies" plays no significant mediating role in this connection. On top of that, "Green Bond Issuance" and "Financial Inclusion" have a direct and substantial impact on one another. Despite the lack of statistical significance in this particular study, the VAF nevertheless shows what percentage of the overall impact the indirect effect represents. These results provide light on the interconnected nature of these concepts and how they affect Financial Inclusion and Sustainable Development.

Table 7: Mediation analysis of Market Conditions -> Government Policies-> Sustainable Development

Type of effect	Effect	Path Coefficient	T-Stats	Remarks
Total Effect	Market Condition -> Sustainable Development	0.369	6.159**	Significant Total Effect
Indirect Effect	Market Condition -> Government Policies-> Sustainable Development	0.281	7.916**	Significant Indirect Effect
Direct Effect	Market Condition -> Financial Inclusion	0.216	8.811**	Significant Direct Effect
VAF (Variance Accounted For)	Indirect Effect/Total Effect		76.15%	

A study was conducted to determine the connections between "Market Conditions," "Government Policies," and "Sustainable Development." The findings are shown in Table 7. We want to learn more about these concepts' interplay and mutual effect by doing this investigation.

Examining the "Total Effect" within the context of the relationship between "Market Conditions" and "Sustainable Development," the results reveal a statistically significant outcome (t-statistic = 6.159**), with a path coefficient of 0.369. Accordingly, this indicates a substantial connection between "Market Conditions" and "Sustainable Development." This large aggregate effect shows that changes in market conditions significantly affect sustainable development.

Moving on to the "Indirect Effect," this examination delves into the function of "Government Policies" as a mediator between "Market Conditions" and "Sustainable Development." The indirect impact has a significant path coefficient of 0.281 and a t-statistic of 7.916**. There seems to be a strong mediating role for "Government Policies" in the connection between "Market Conditions" and "Sustainable Development." Put another way, government policies are impacted by changes in market conditions, which in turn affect sustainable development. There is a statistically significant mediation effect.

We also examine the "Direct Effect" that "Market Conditions" have on "Financial Inclusion" in our study. The direct effect's path coefficient is 0.216, and its t-statistic is 8.811**, indicating that it is extremely significant. This suggests a strong and statistically significant correlation between "Market Conditions" and "Financial Inclusion." consequently, market conditions directly affecting the Financial Inclusion.

Finally, the indirect effects is divided by the on the whole outcome to obtain the "Variance Accounted For" (VAF). With a VAF of 76.15 per cent, it is obvious that the indirect consequence is accountable for a noteworthy amount of the overall effect. This shows that "Government Policies" arbitrate the connection amid "Market Conditions" and "Sustainable Development" to a huge extent, amplification a key sum of the total effect.

After all in conclusion, Table 7 exhibit several notable outcome from the mediation investigation. A considerable crash exists amid "Market Conditions" and "Sustainable Development." The function of "Government Policies" as a mediator in this association is significant. There is also a strong connection among "financial inclusion" and "Market Conditions". The mediation collision of "Government Policies" reports for a great deal of the entire outcome, as demonstrated by the VAF. These outcomes light up the composite interaction between these notions and how they affect sustainable development and Financial Inclusion.

Table 8: Mediation testing of Investor Sentiments -> Government Policies-> Sustainable Development

Type of effect	Effect	Path Coefficient	T-Stats	Remarks
Total Effect	Investor Sentiments -> Sustainable Development	0.057	6.899**	Significant Total Effect
Indirect Effect	Investor Sentiments -> Government Policies-> Sustainable Development	0.051	7.211**	Significant Indirect Effect
Direct Effect	Investor Sentiments -> Financial Inclusion	0.073	5.412**	Significant Direct Effect
VAF (Variance Accounted For)	Indirect Effect/Total Effect		89.47%	

As per Table 8, a mediation test has been conducted to evaluate the relationship between investors' sentiments, government policies and sustainable development." The key purpose of this research paper is to conclude the level of mutual impact and interdependence among various variables.

Since, "Total Effect" in relation to the "Investor Sentiments" and "Sustainable Development." through a t-statistic of 6.899**, the in general the overall impact path coefficient having value of 0.057 is highly found statistically noteworthy or significant. This point out a relevant and sound relationship among the "Investor Sentiments" and "Sustainable Development." This huge combined effect emphasized the considerable and direct intervention of changes in investor sentiment on sustainable development.

The subsequently the study seems at the "Indirect Effect," which is the role of "Government Policies" as a mediator among "Investor Sentiments" and "Sustainable Development." Significant effect has been found with values of t-statistic of 7.211** and a path coefficient 0.051. This result reveals that "Government Policies" are an important sources among "Investor Sentiments" and "Sustainable Development." What this means is that making changes in the sentiments of investors have an indirect effect in form of regulatory changes on sustainable development.

Additionally, the research investigates into the "Direct Effect" that be present amid sentiments of investors and financial inclusion." And this has been also found significant with values of t-statistic of 5.412**, the direct effect's path coefficient of 0.07 respectively. It can be said that there is a sound relationship between these two variables. Finally it can be said that financial inclusion directly affected by the sentiments of investors.

Lastly, the indirect impact is divided by the overall effect to get the "Variance Accounted For" (VAF). The high VAF of 89.47% suggests that the indirect impact is responsible for a sizeable chunk of the overall effect. It seems that "Government Policies" have a significant mediating function in the link between "Investor Sentiments" and "Sustainable Development," which accounts for a significant amount of the total impact.

Table 8 summarises the mediation study and shows multiple significant results. A strong and substantial overall impact exists between "Investor Sentiments" and "Sustainable Development." Furthermore, "Government Policies" are crucial intermediaries in this connection. The two concepts have a strong causal relationship, with "Investor Sentiments" influencing "Financial Inclusion." The very high VAF highlights how "Government Policies" significantly mediate the link between "Investor Sentiments" and "Sustainable Development." These findings provide light on the complex relationships between these factors and how they impact Financial Inclusion and Sustainable Development.

6. DISCUSSION

This inclusive study provides noteworthy insights for executives in numerous sectors. It highlights the capability of green bonds to investment initiatives that encourage sustainable development (Verma & Bansal, 2023). Financial organizations and organizational administration should identify the optimistic impact of green bonds in supporting the mobilization of low-carbon investment for ecofriendly schemes. Businesses aiming to go forward ecological sustainability should comprise issue of green bonds in their financial structures (Bhatnagar et al., 2022). In addition, the research highlights the critical role of government policies in concluding the gap among sentiments of investor and sustainable growth (Kukreja, 2020). Executives should proactively set up communication with law makers to make sure that their activities bring into line with and advantage from these systems. The study highlights the implication of investors sentiment in influencing sustainable development effects, emphasizing the requirement for accountability and transparency to promote positive investor sentiments (Luo et al., 2022). The significance of financial inclusion is revealed as a vital factor as it is directly affected by the sentiments of investor. Management of Banks and credit supplying firms are advised to consider green financing resolution encourage ecofriendly atmosphere.

7. CONCLUSION

The finding of the study may provide significant advantages for corporations and banks from a managerial perspective. Green bonds positively influence sustainable development since organizations may intentionally use them to fund environmentally beneficial activities. In order to attract investment that supports environmentally friendly goals and enhances corporate reputation, managers may consider including green bonds in their financial strategies.

The study's social context indicates that investor sentiments have significant role in determining sustainable development outcomes. Companies and banks should be held accountable for their impact on society and the environment via transparent and truthful reporting. Transparency on the beneficial societal and environmental effects of their work is crucial for managers to gain the support and trust of investors.

The study shows that government policies act as intermediary diagonally sentiments of investor and sustainable development from a political point of view. Legislators should be acquainted with the

requirement to ascertain legislative structures to encourage green bonds as a finance and sustainable economy. Private and public participation should also be utilized frame policies that endorse green investment for sustainable development.

The suggestions are considerable from an environmental viewpoint. Based on the results, green bonds instruments effectively raise finance for ecofriendly projects that needs more attention to diminish carbon footprint. Use of green funds, institutions can improve environmental anxiety such as resource diminishing and climate change.

Eventually, the examination into sustainable development and green bonds has grater implication. Executives may strengthen their company's reputations through us of green bonds for green financing in key green projects. To attain sustainable development at a community level, it is essential to connect in visible reporting and effectively administer the sentiments of investors. Political associates may endorse encouraging legislation to encourage ecofriendly investments and promote considerable efforts for sustainable economy. Exploiting eco-friendly funding alternatives is a practical move toward to contributing towards ecological safeguarding and achieving universal goal of sustainability. These outcomes highlight the need to incorporate green fund into business strategies and authoritarian frameworks.

To sum up, the study's outcomes point out that green bonds have a valuable effect on sustainable development. It as well give emphasis to the implication of compliant to sustaining legislation, management investor approach, and promotion of financial inclusion. This valuable interpretation can bend dominant individuals in numerous sectors, prompting them to embrace and apply more ecologically and ethically cognizant methods.

8. MANAGERIAL IMPLICATIONS

The study article offers helpful information that managers in many fields may use to make better judgments (Fatima et al., 2023). Green bonds should be widely promoted to fund sustainable development; this is one of the main points. According to Verma et al. (2023), financial institutions and organizational managers should consider the potential impact of green bonds in mobilizing low-carbon funding for sustainability-focused and environmentally oriented initiatives.

This suggests that corporations aiming to finance initiatives contributing to environmental sustainability should consider issuing green bonds. Government the research emphasizes government policies and diaries between investor sentiment and sustainable development outcomes in the resistance of coordinating corporate goals with governmental and regulatory frameworks that encourage green funding and sustainability efforts, which is highlighted by this discovery (Piñeiro-Chousa et al., 2021). To ensure their projects align with and profit from these policies, managers should interact with lawmakers aggressively.

Facts advocate that investor feelings considerably affects sustainable development fallout. This demonstrates the magnitude of watch and developing favorable investor thoughts. Executives should prioritize connection in efforts that encourage accountability and transparency while reporting on ecological and social act. Visible and precise reporting may assist get funding for environmentally mindful activities and schemes to improve sustainability.

The description also emphasizes the significance of financial inclusion. Facts demonstrates that investor sentiment is a solution feature persuade financial inclusion. Leaders of Banking industry and credit union should believe including environmentally pleasant financial solutions.

Eventually, the study elucidates the association between green bonds and sustainable development, offering precious insights for executives. The content emphasizes the requirement to employ green bonds to finance sustainability schemes, adhere to legal conditions, administer investor attitudes, and improve ease of use to financial services. These outcomes can sway decision-makers in numerous businesses to embrace additional environmentally and communally accountable methods, yielding good effects for in cooperation the society and environment.

Ethics committee approval for the study was obtained from the Chandigarh University Ethics Committee on April 10, 2024, with document number CU-USB-MBA-2024-APRIL-090.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that they all equally contributed to all processes of the research.

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APPENDIX (QUESTIONNAIRE)

Dependent Variable: Sustainable Development:

- To what extent do you believe sustainable development is crucial for the well-being of future generations?
· 1: Strongly Disagree · 2: Disagree · 3: Somewhat Disagree
· 4: Neutral · 5: Somewhat Agree · 6: Agree · 7: Strongly Agree
- How effective do sustainable development practices are in addressing environmental challenges?
· 1: Not Effective at All · 2: Ineffective · 3: Somewhat Ineffective
· 4: Neutral · 5: Somewhat Effective · 6: Effective · 7: Highly Effective
- In your opinion, does sustainable development lead to economic growth and prosperity?
· 1: Strongly Disagree · 2: Disagree · 3: Somewhat Disagree
· 4: Neutral · 5: Somewhat Agree · 6: Agree · 7: Strongly Agree
- How important is prioritizing sustainable development when making policy decisions?
· 1: Not Important at All · 2: Slightly Important · 3: Somewhat Important
· 4: Moderately Important · 5: Very Important · 6: Extremely Important · 7: I Do not Know
- To what extent do you believe sustainable development is achievable in the current global context?
· 1: Not Achievable at All · 2: Unlikely to Achieve · 3: Somewhat Unlikely to Achieve
· 4: Neutral · 5: Somewhat Likely to Achieve · 6: Likely to Achieve · 7: Highly Likely to Achieve

Independent Variable: Green Bond Issuance:

- How familiar are you with the concept of green bonds and their issuance?
· 1: Not Familiar at All · 2: Slightly Familiar · 3: Somewhat Familiar
· 4: Moderately Familiar · 5: Very Familiar · 6: Extremely Familiar · 7: I am an Expert
- To what extent do you believe green bond issuance has increased recently?
· 1: Not Increased at All · 2: Slightly Increased · 3: Somewhat Increased
· 4: Moderately Increased · 5: Significantly Increased · 6: Dramatically Increased · 7: I Do not Know
- How important is green bond issuance for environmentally sustainable projects?
· 1: Not Important at All · 2: Slightly Important · 3: Somewhat Important
· 4: Moderately Important · 5: Very Important · 6: Extremely Important · 7: I Do not Know
- In your opinion, are organizations and governments issuing enough green bonds to meet sustainability goals?

- 1: Not Issuing Enough · 2: Issuing Insufficient Amounts · 3: Issuing Some
 - 4: Issuing Sufficient Amounts · 5: Issuing More Than Enough · 6: Unsure · 7: I Do not Know
5. Do you believe that green bond issuance can significantly influence low-carbon financing?
- 1: Strongly Disagree · 2: Disagree · 3: Somewhat Disagree
 - 4: Neutral · 5: Somewhat Agree · 6: Agree · 7: Strongly Agree

Independent Variable: Market Conditions:

1. How do you perceive the current economic conditions affecting the issuance of green bonds?
 - 1: Strongly Negative Impact · 2: Negative Impact · 3: Somewhat Negative Impact
 - 4: Neutral · 5: Somewhat Positive Impact · 6: Positive Impact · 7: Strongly Positive Impact
2. To what extent do you believe that market interest rates influence the attractiveness of green bonds for investors?
 - 1: Strongly Disagree · 2: Disagree · 3: Somewhat Disagree
 - 4: Neutral · 5: Somewhat Agree · 6: Agree · 7: Strongly Agree
3. How confident are you in the stability of the financial market when it comes to green bond investments?
 - 1: Not Confident at All · 2: Not Very Confident · 3: Somewhat Not Confident
 - 4: Neutral · 5: Somewhat Confident · 6: Very Confident · 7: Extremely Confident
4. In your opinion, how much do market conditions affect the willingness of organizations to issue green bonds?
 - 1: No Influence at All · 2: Minimal Influence · 3: Some Influence
 - 4: Moderate Influence · 5: Strong Influence · 6: Very Strong Influence · 7: Overwhelming Influence
5. How likely do investors prioritize bond investments over traditional investments during favourable market conditions?
 - 1: Very Unlikely · 2: Unlikely · 3: Somewhat Unlikely
 - 4: Neutral · 5: Somewhat Likely · 6: Likely · 7: Very Likely

Independent Variable: Investor Sentiment:

1. To what extent do you believe investors are enthusiastic about green bond investments supporting sustainability?
 - 1: Not Enthusiastic at All · 2: Slightly Enthusiastic · 3: Somewhat Enthusiastic
 - 4: Neutral · 5: Somewhat Enthusiastic · 6: Enthusiastic · 7: Very Enthusiastic
2. How confident are you in investors' ability to differentiate between green and conventional bonds?
 - 1: Not Confident at All · 2: Not Very Confident · 3: Somewhat Not Confident
 - 4: Neutral · 5: Somewhat Confident · 6: Very Confident · 7: Extremely Confident
3. In your view, do investors prioritize their investments' environmental and social impact when considering green bonds?
 - 1: Not a Priority at All · 2: Low Priority · 3: Moderate Priority
 - 4: High Priority · 5: Top Priority · 6: I Do not Know · 7: I am Unsure
4. How influential is investor sentiment in driving organizations to issue green bonds?
 - 1: Not Influential at All · 2: Slightly Influential · 3: Somewhat Influential
 - 4: Moderately Influential · 5: Highly Influential · 6: Very Highly Influential · 7: Extremely Influential
5. To what extent do you believe investors' positive sentiment toward green bonds can encourage their wider adoption?
 - 1: Not Encouraging at All · 2: Slightly Encouraging · 3: Somewhat Encouraging
 - 4: Neutral · 5: Somewhat Encouraging · 6: Encouraging · 7: Very Encouraging

Moderating Variable: Government Policies:

1. To what extent do you believe that government policies significantly influence the success of green bond initiatives?
 - 1: No Influence at All · 2: Minimal Influence · 3: Some Influence
 - 4: Moderate Influence · 5: Strong Influence · 6: Very Strong Influence · 7: Overwhelming Influence
2. How well do you think government policies align with the goals of promoting green finance and sustainable development?
 - 1: Not Aligned at All · 2: Slightly Aligned · 3: Somewhat Aligned
 - 4: Moderately Aligned · 5: Well Aligned · 6: Very Well Aligned · 7: Perfectly Aligned
3. How effective are government incentives and regulations in encouraging organizations to use green bonds?
 - 1: Not Effective at All · 2: Ineffective · 3: Somewhat Ineffective
 - 4: Neutral · 5: Somewhat Effective · 6: Effective · 7: Highly Effective
4. do government policies provide sufficient support and clarity to green bond issuers and investors?
 - 1: Not Sufficient at All · 2: Insufficient · 3: Somewhat Insufficient
 - 4: Neutral · 5: Somewhat Sufficient · 6: Sufficient · 7: Highly Sufficient
5. How well do you think governments are at adapting their policies to the evolving needs of green finance and sustainability?
 - 1: Not Well at All · 2: Not Very Well · 3: Somewhat Not Well

· 4: Neutral · 5: Somewhat Well · 6: Well · 7: Very Well

Mediating Variable: Stakeholder Engagement:

1. To what extent do you believe stakeholder engagement is critical in ensuring the success of green bond-funded projects?

· 1: Not Critical at All · 2: Slightly Critical · 3: Somewhat Critical

· 4: Neutral · 5: Somewhat Critical · 6: Critical · 7: Very Critical

2. How well do organizations engage with stakeholders (e.g., communities and environmental groups) when implementing green bond projects?

· 1: Not Well at All · 2: Not Very Well · 3: Somewhat Not Well

· 4: Neutral · 5: Somewhat Well · 6: Well · 7: Very Well

3. how important is stakeholder feedback in shaping the direction and impact of green bond-financed initiatives?

· 1: Not Important at All · 2: Slightly Important · 3: Somewhat Important

· 4: Moderately Important · 5: Very Important · 6: Extremely Important · 7: I Do not Know

4. How effectively do organizations involve stakeholders in decision-making processes related to green bond projects?

· 1: Not Effective at All · 2: Ineffective · 3: Somewhat Ineffective

· 4: Neutral · 5: Somewhat Effective · 6: Effective · 7: Highly Effective

5. How satisfied are you with transparency and communication between our organization's stakeholders regarding green bond initiatives?

· 1: Very Dissatisfied · 2: Dissatisfied · 3: Somewhat Dissatisfied

· 4: Neutral · 5: Somewhat Satisfied · 6: Satisfied · 7: Very Satisfied

A Novel Approach for Portfolio Optimization Using Fuzzy AHP Based on Gustafson Kessel Clustering Algorithm *

Türkan ERBAY DALKILIÇ¹, Yeşim AKBAŞ², Serkan AKBAŞ³

Abstract

Portfolio management involves modeling risk-return relationships. However, the diverse factors impacting financial markets introduce uncertainty into future portfolio selection. The aim of this study is to propose a portfolio selection model to assist investors in creating the most suitable investment plan in the financial market uncertainty. In this context, a preliminary reduction step is applied to the stocks using the Gustafson-Kessel (GK) algorithm, a fuzzy clustering method, to select portfolio stocks. Later, trapezoidal fuzzy numbers (TrFNs) were defined instead of triangular fuzzy numbers (TFNs) used in the Constrained Fuzzy Analytic Hierarchy Process (AHP) for portfolio selection problems. By using new fuzzy numbers, the weights of the criteria were obtained as TrFNs. Then, a linear programming problem was modeled using the weights of the obtained criteria as a TrFN. For this purpose, a method available in the literature was used that uses price variables in the objective function as TFNs. In this study, a linear programming model that uses these variables as TrFNs is proposed as an alternative to the method that uses the price variables in the objective function as TFNs. In this proposed model, the weights obtained from the Constrained Fuzzy AHP using TrFNs are used as price variables in the objective function of the created linear programming problem. Proposed model then applied to the 48-month return data set of stocks in the Istanbul Stock Exchange 100 (ISE-100) index to determine which stocks the investor should choose and the investment rates investor should make in these stocks. In addition, in order to examine the effectiveness of the proposed model within the scope of the study, portfolio distributions were obtained with different portfolio optimization methods using the same data set and the results were compared.

Keywords: *Fuzzy AHP, Gustafson-Kessel algorithm, Portfolio selection, Trapezoidal fuzzy numbers.*



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* The article was prepared as one of the outputs of the doctoral thesis titled "Fuzzy Logic Based Solutions for Multi Criteria Decision Making Problems and its Application to Portfolio Selection" presented in 2022.

<https://doi.org/10.30798/makuiibf.1469103>

Article Type	Application Date	Admission Date
Research Article	April 16, 2024	November 21, 2024

1. INTRODUCTION

By means of technological developments in financial markets, new financial instruments are being developed and the number of markets where investors can trade is increasing. While this situation means new opportunities for investors, it also makes the investor's decision-making process more difficult by offering more tools and markets to the investor. In this case, both individual and institutional investors need analyzes to decide which market and which financial instrument to invest in. For this reason, investors often want to benefit from portfolio selection methods to gain profit. Modeling the relationship between risk and return is very important in portfolio management. In addition, financial markets are immediately affected by social and political changes, causing uncertainty in the portfolio selection process. In the field of portfolio management, studies are frequently carried out on both measuring and managing risk, which represents uncertainty. Various portfolio theories have been put forward to reduce risk. Traditional Portfolio Theory, which was accepted until the 1950s, made recommendations based on the principle that risk can be reduced by diversifying with a large number of financial instruments. Modern Portfolio Theory, proposed by H. M. Markowitz in 1952, brought additional approaches to Traditional Portfolio Theory and made important contributions to reducing risk in portfolio management (Markowitz, 1952). Developed theories and studies reveal a common view that risk management is an important factor on returns.

Financial markets are instantly affected by economic, social and political events, causing these markets to have an uncertain structure. This uncertainty in financial markets also causes uncertainty in the risk and return criteria that are effective in portfolio selection. Therefore, this uncertainty situation needs to be taken into consideration in portfolio optimization problems. In cases of such uncertainty, the fuzzy logic approach, which is an effective method, is preferred. Since many decisions made today involve uncertainty or cannot be represented with precise numerical expressions, the concept of fuzzy logic has been applied to decision-making methods. Fuzzy logic, first introduced by Zadeh in 1965, is used to control processes in situations where complex and information is uncertain (Zadeh, 1965). The fact that fuzzy logic can be applied to both qualitative and quantitative decision problems due to the use of linguistic variables has been one of the biggest reasons why Fuzzy AHP is preferred in decision-making problems. In the Fuzzy AHP, verbal expressions generally characterized by fuzzy numbers are used to show the evaluation values of all alternatives according to subjective and objective criteria. The most important advantage of Fuzzy AHP is the convenience it provides when considering multiple criteria. Since the preferences in AHP are perception-based judgments of decision makers, the fuzzy approach can define a more accurate decision-making process. The earliest work in the field of fuzzy AHP was seen in 1983, when Van Laarhoven and Pedrycz compared fuzzy ratios defined with triangular membership functions (van Laarhoven and Pedrycz, 1983). In 1985, Buckley stated the priorities of fuzzy comparison ratios with trapezoidal membership functions (Buckley, 1985). In 1996, Chang proposed a new approach for the fuzzy AHP by using TFNs in comparisons (Chang, 1996). Stam et al.

have studied how artificial intelligence can be used in the approach of determining the priority values of the AHP (Stam et al., 1996). Shapiro and Koissi, examined and compared the models in three articles by van Laarhoven and Pedrycz (van Laarhoven and Pedrycz, 1983), Buckley (Buckley, 1985) and Chang (Chang, 1996), which form the basis of Fuzzy AHP (Shapiro and Koissi, 2017). In 1997, Weck et al. used the fuzzy AHP when choosing between different production cycle alternatives (Weck et al., 1997). In 1999, Cheng, Yang and Hwang proposed a new method using the fuzzy AHP, to evaluate weapon systems in their studies (Cheng et al., 1999). Fuzzy AHP is widely used by researchers in many fields in the literature.

Trying to simplify complex world problems has been one of the main goals of scientists. In this context, one of the methods aimed at classifying complex events or elements is cluster analysis. The most widely known cluster analysis method is the classical clustering method. In the classical clustering method, each element defined in the cluster must be assigned to a cluster. This assignment is made with a membership degree of zero or one, depending on whether the item belongs to the set or not. In the classical clustering method, the membership values of the elements in the cluster are only 0 or 1. However, in order to eliminate the problem that this situation is not valid for real life problems, Zadeh proposed the fuzzy set theory, in which membership values can take not only 0 or 1, but also values between 0 and 1 (Zadeh, 1965). Bezdek et al. developed the Fuzzy C Means (FCM) algorithm, one of the popular clustering algorithms, inspired by Zadeh's fuzzy set theory (Bezdek et al., 1984). Unlike the classical clustering algorithm, the FCM algorithm allows data points to be assigned to more than one cluster. In the FCM algorithm, Euclidean distance is used to determine data classes and the clusters must be spherical. The GK algorithm was developed to detect clusters of data sets that show scattering in different geometric shapes. In the GK clustering algorithm, Mahalanobis distance is used to determine the classes to which the data belong, and there is no restriction on the clusters being spherical. There are many clustering algorithms in the literature that work similarly to GK (Gath-Geva (GG) (Gath and Geva, 1989), Entropy Weighted Fuzzy C-Means (EWFCM) (Cardone and Martino, 2020), Kernel-Based Fuzzy C-Means (KFCM) (Zhang and Chen, 2003).

There are many studies in the literature where clustering algorithms are used in portfolio selection. In his study, Huang aimed to create an automatic stock market forecaster and portfolio selection mechanism. In his proposed mechanism, financial data is automatically collected every three months to predict trends in the next quarter or six months. The mechanism proposed in his study is based on the FCM clustering algorithm and fuzzy theories (Huang, 2009). Khedmati and Azin's work consists of two stages. First, they used clustering algorithms in sample selection. They then used four different portfolio optimization algorithms to create the optimal portfolio (Khedmati and Azin, 2020). Chen and Huang proposed a portfolio selection model in which future return and risk rates are represented by TFNs. They also proposed a cluster analysis to divide equity investment funds into several groups based on different evaluation index (Chen and Huang, 2009).

The aim of this study is to propose a portfolio selection model for investors to make the most appropriate investment under uncertainties in financial markets. In this context, a preliminary reduction step is first applied to the stocks in the data set in order to determine the stocks that will be included in the portfolio and the ratio of these stocks to be included in the portfolio. This reduction was carried out using the GK algorithm, one of the fuzzy clustering algorithms. Later, trapezoidal fuzzy numbers were defined instead of TFNs used in the Restricted Fuzzy AHP proposed by Enea and Piazza in the literature for portfolio selection problems (Enea and Piazza, 2004). By using new fuzzy numbers, the weights of the criteria were obtained as TrFNs. Then, a linear programming problem was modeled using the weights of the obtained criteria as a trapezoidal fuzzy number. For this purpose, a method available in the literature was used. In this method, a linear programming model that uses TrFNs instead of price variables used as TFN in the objective function is proposed.

The rest of the paper is as follows. GK clustering algorithm is given in Section 2. In Section 3, Fuzzy Inference System (FIS) is briefly mentioned. The proposed algorithm for portfolio selection is given step by step in Section 4. Section 5 provides application and comparison results. Conclusion is given in Section 6.

2. GUSTAFSON-KESSEL CLUSTERING ALGORITHM

GK clustering algorithm was proposed by Gustafson and Kessel in 1979 (Gustafson and Kessel, 1979). The GK clustering algorithm is an extension of the standard FCM clustering (Serir et al., 2012) to enable the use of Mahalanobis distance to detect data classes. While there is a restriction for clusters to be spherical in the FCM approach, there is no such restriction in the GK approach. In order to identify different geometric shapes in the data set, this algorithm uses the covariance matrices of the relevant clusters in distance measurement instead of the Euclidean distance in the FCM clustering approach (Abdullah et al., 2017). When studies conducted by many researchers in different fields are examined in the literature, it is seen that the GK clustering algorithm performs better than the FCM approach (Abdullah et al., 2017; Ghosh et al., 2011; Hadiloo et al., 2018; Miller et al., 2009). The objective function of the GK clustering algorithm is as given by;

$$J(X, \mu, v) = \sum_{j=1}^C \sum_{i=1}^N (\mu_{ij})^m D^2(x_i, v_j), \quad (1)$$

where, m denotes the fuzziness index, x_i is the i^{th} observation value, v_j is the center of j^{th} cluster, $D^2(x_i, v_j)$ is the Mahalanobis distance between x_i and v_j .

Step 1. Initial membership degrees $\mu^0 = [\mu_{ij}]$ are determined randomly from a uniform distribution in the range $[0,1)$.

Step 2. Fuzzy cluster centers are calculated for each cluster as in Eq. (2).

$$v_j = \frac{\sum_{i=1}^N \mu_{ij}^m x_i}{\sum_{i=1}^N \mu_{ij}^m}, \quad j = 1, \dots, C \quad (2)$$

Step 3. The fuzzy covariance matrix (F_j), is calculated for each cluster using Eq. (3).

$$F_j = \frac{\sum_{i=1}^N \mu_{ij}^m (x_i - v_j)(x_i - v_j)^t}{\sum_{i=1}^N \mu_{ij}^m}, \quad j = 1, \dots, C \quad (3)$$

Step 4. Mahalanobis distances for each data are calculated with Eq. (4).

$$D^2(x_i, v_j) = (x_i - v_j)^t A_j (x_i - v_j), \quad i = 1, \dots, N, \quad j = 1, \dots, C \quad (4)$$

Here;

$$A_j = (\det(F_j))^{\frac{1}{s}} * F_j^{-1}, \quad j = 1, \dots, C \quad (5)$$

A_j in Eq.5 is a positive definite $s \times s$ matrix.

Step 5. The membership matrix is updated with Eq. (6).

$$\mu_{ij} = \frac{1}{\sum_{k=1}^C \left(\frac{D(x_i, v_j)}{D(x_i, v_k)} \right)^{\frac{2}{m-1}}}, \quad j = 1, \dots, C \quad i = 1, \dots, N \quad (6)$$

Step 6. Updated membership degrees are compared with previous membership degrees and the process of obtaining optimal membership degrees is stopped when the condition $|\mu^t - \mu^{t-1}| < \varepsilon$ is provided, where ε is the termination tolerance.

3. FUZZY INFERENCE SYSTEM

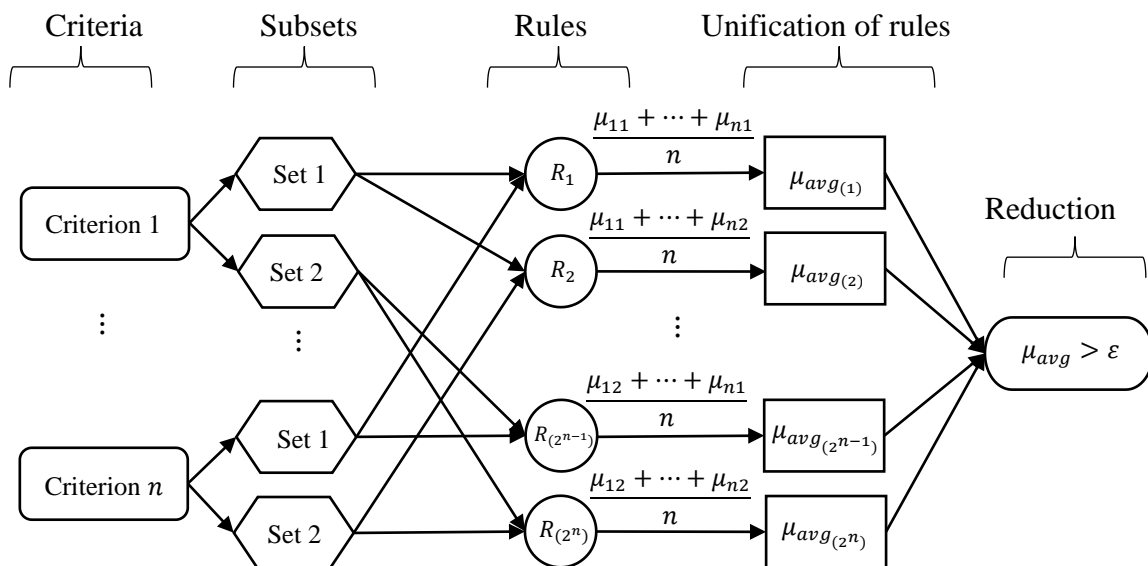
Fuzzy Inference System (FIS) is called a system that includes a collection of operations that enable the system to behave with a single output by banding together the relationships between input and output fuzzy sets in the fuzzy rule base. Using IF-THEN rules, fuzzy logic, can model qualitative aspects of human expressions and reasoning processes (Jang, 1993), formulate actions with high levels of uncertainty and make decisions, without using precise quantitative information (Cox, 1994). FIS consists of three basic conceptual components: A rule base that includes the selection of fuzzy rules, database used to define membership functions in rules and a reasoning mechanism that performs inference (Jang et al., 1997). Although there are different FIS approaches in the literature, Mamdani type FIS and Sugeno type FIS are the most important. After Fuzzy rule-based systems were proposed by Mamdani (Mamdani, 1974), Mamdani and Assilian (Mamdani and Assilian, 1975) developed Mamdani type FIS including Zadeh's (Zadeh, 1975) concept of linguistic variables.

Adaptive Neuro Fuzzy Inference System (ANFIS) is a fuzzy technique that incorporates the learning function of neural networks into fuzzy inference systems. The Takagi-Sugeno-Kang (Sugeno and Kang, 1988; Takagi and Sugeno, 1985) graded inference system is the most common fuzzy inference system. Adaptive networks consist of interconnected nodes, and these nodes contain functions with fixed or variable parameters. With the learning algorithm, the adaptive network determines how the change in these parameters will occur in order to minimize the error size.

4. A NEW ALGORITHM FOR PORTFOLIO SELECTION

The aim of this study is to carry out the portfolio selection process under uncertainty from a data set containing many stocks with the proposed hybrid algorithm. In many portfolio selection processes in the literature, financial indicators such as return and risk of stocks are mostly used, but it is observed that expert opinions are not included. This study proposes a portfolio selection process in which, in addition to return and risk, financial indicators such as price / earnings, market value / book value and net profit / stockholder's equity are used as criteria and expert opinions are also included in the process. The proposed portfolio selection process takes place in three stages. In the first stage, the stocks that are weak in terms of financial ratios belonging to the stocks determined as the criteria are eliminated by using the GK algorithm. The diagram of the fuzzy inference system designed for the elimination process is as shown in Figure 1.

Figure 1. Reduction diagram based on fuzzy inference system



The ANFIS diagram given in Figure 1 is a five-layer architecture. These 5 layers consist of input variables, subsets, created rules, combining the rules by taking their average, and the reduction process, respectively. In Fig. 1, n is the number of criteria, μ_{ij} is the membership degree of i^{th} criterion to j^{th} subset ($i = 1, \dots, n, j = 1, 2$), R_k is the rule obtained from the membership degrees of criteria to subsets and $\mu_{avg(k)}$ is the average membership value obtained from the rules ($k = 1, \dots, 2^n$). After the

elimination, the portfolio selection process continues with the remaining stocks. The second stage is the determination of the weights of the criteria in the process using Fuzzy AHP. The FLP problem to be used to determine the portfolio distribution is created with the weights obtained in the second stage (Zimmermann, 1978). Finally, the method suggested by Lai and Hwang in the literature was used to solve the FLP problem created with the obtained weights (Lai and Hwang, 1992). TFNs are used in modeling FLP problems in the literature. In this study, mathematical models were created in which the theoretical structure that takes TFN into account was adapted to use TrFNs (Akbaş and Erbay Dalkılıç, 2021). The stages of the hybrid portfolio selection algorithm based on TrFNs, where the adapted methods are used together, are as follows.

Step 1: Criteria are determined to make a portfolio distribution on stocks. These criteria are the criteria required to be maximized or minimized when selecting a portfolio. Financial data of stocks are given in Table 1. In Table 1, the number of criteria is given as n , the number of assets is m and D_{mn} represents the financial value of the m^{th} asset for the n^{th} criterion.

Table 1. Financial data of assets

Assets	Financial Data				
	C_1	...	C_j	...	C_n
1	D_{11}	...	D_{1j}	...	D_{1n}
⋮	⋮	⋮	⋮	⋮	⋮
m	D_{m1}	...	D_{mj}	...	D_{mn}

Step 2: With the GK algorithm, the membership degrees of asset data to the "Subset 1 (S_1)" and "Subset 2 (S_2)" subsets created for the criteria are determined. Thus, since there will be n criteria and two subsets of each criterion, a total of 2^n different rules will be created. In line with the created rules, the membership degrees of the entities in the subsets of each criterion are given in Table 2.

Table 2. Membership degrees of assets in the subsets belonging to each criterion

Assets	Membership Degree									
	C_1		...	C_j		...	C_n			
	Subset 1	Subset 2	...	Subset 1	Subset 2	...	Subset 1	Subset 2		
1	$\mu_{11}(S_1)$	$\mu_{11}(S_2)$	...	...	$\mu_{1j}(S_1)$	$\mu_{1j}(S_2)$	...	...	$\mu_{1n}(S_1)$	$\mu_{1n}(S_2)$
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
m	$\mu_{m1}(S_1)$	$\mu_{m1}(S_2)$	...	...	$\mu_{mj}(S_1)$	$\mu_{mj}(S_2)$	...	...	$\mu_{mn}(S_1)$	$\mu_{mn}(S_2)$

Step 3: From the 2^n different rules created, the membership degrees belonging to the "Subset 1" cluster are determined for each criterion that is desired to be maximized, and the membership degrees belonging to the "Subset 2" cluster are determined for each criterion that is desired to be minimum. Then, the average of the membership degrees (μ_{avg}) of the rules created in line with the criteria is calculated. The calculation of the average membership degrees is shown in Table 3.

Table 3. The calculation of the average membership degrees

Assets	Membership Degree					μ_{avg}
	Subset1/Subset2	...	Subset1/Subset2	...	Subset 1/Subset2	
	C_1		C_j		C_n	
1	$\mu_{11}(S_1/S_2)$	...	$\mu_{1j}(S_1/S_2)$	...	$\mu_{1n}(S_1/S_2)$	$(\mu_{11}(S_1/S_2) + \dots + \mu_{1j}(S_1/S_2) + \dots + \mu_{1n}(S_1/S_2))/n$
\vdots	\vdots	\vdots	\vdots	\vdots	\vdots	\vdots
m	$\mu_{m1}(S_1/S_2)$	...	$\mu_{mj}(S_1/S_2)$	...	$\mu_{mn}(S_1/S_2)$	$(\mu_{m1}(S_1/S_2) + \dots + \mu_{mj}(S_1/S_2) + \dots + \mu_{mn}(S_1/S_2))/n$

Step 4: According to the rule created from the membership degrees obtained by the GK algorithm, the average of the weights calculated is greater than a determined ε value ($\mu_{avg} > \varepsilon$), and the stock reduction process is carried out.

Step 5: Comparison values (b_{ijp}) determined by decision makers regarding the criteria are given in Table 4.

Table 4. Criteria comparison matrix.

	C_1	...	C_j	...	C_n
C_1	(1 1 1 1) \vdots (1 1 1 1)	...	b_{1j1} \vdots b_{1jp}	...	b_{1n1} \vdots b_{1np}
\vdots	\vdots	\ddots	\vdots		\vdots
C_i	b_{i11} \vdots b_{i1p}	...	b_{ij1} \vdots b_{ijp}	...	b_{in1} \vdots b_{inp}
\vdots	\vdots		\vdots	\ddots	\vdots
C_n	b_{n11} \vdots b_{n1p}	...	b_{nj1} \vdots b_{njp}	...	(1 1 1 1) \vdots (1 1 1 1)

A TrFN consist of four parameters and is expressed with:

$$b_{ijp} = (b_{ijp}^l, b_{ijp}^{m_1}, b_{ijp}^{m_2}, b_{ijp}^u), \quad i = 1, \dots, n; \quad j = 1, \dots, n; \quad p = 1, \dots, P. \quad (7)$$

here, b_{ijp} is the importance value of i^{th} criteria corresponding to j^{th} criteria, according to p^{th} decision maker.

Step 6: $a_{ij} = [a_{ij}^l, a_{ij}^{m_1}, a_{ij}^{m_2}, a_{ij}^u]$ TrFNs obtained by taking the geometric mean of the b_{ijp} values for each criterion in Table 4 represent an average decision maker's opinion and given Table 5. To preserve the symmetric structure of the comparison matrix $A = [a_{ij}]$, we must have; $\forall i \neq j, a_{ji} = (1/a_{ij}^u, 1/a_{ij}^{m_2}, 1/a_{ij}^{m_1}, 1/a_{ij}^l)$ and $\forall i = j, a_{ij} = (1,1,1,1)$.

Table 5. The comparison matrix consisting of TrFNs

	C_1	...	C_j	...	C_n
C_1	(1 1 1 1)	...	a_{1j}	...	a_{1n}
\vdots	\vdots	\ddots	\vdots		\vdots
C_i	a_{i1}	...	a_{ij}	...	a_{in}
\vdots	\vdots		\vdots	\ddots	\vdots
C_n	a_{n1}	...	a_{nj}	...	(1 1 1 1)

Step 7: Let $S_i = (S_i^l, S_i^{m_1}, S_i^{m_2}, S_i^u)$ be the fuzzy score for the i^{th} criterion of comparison matrix, where the indices l, m_1, m_2 and u denote its lower, medium1, medium2 and upper respectively. Here, S_i^l and S_i^u are obtained as given by Eqs. (8-9):

$$S_i^l = \min \left[\left(\prod_{j=1}^n a_{ij} \right)^{\frac{1}{n}} \right] / \sum_{k=1}^n \left[\left(\prod_{j=1}^n a_{kj} \right)^{\frac{1}{n}} \right], i = 1, \dots, n, \tag{8}$$

$$S_i^u = \max \left[\left(\prod_{j=1}^n a_{ij} \right)^{\frac{1}{n}} \right] / \sum_{k=1}^n \left[\left(\prod_{j=1}^n a_{kj} \right)^{\frac{1}{n}} \right], i = 1, \dots, n,$$

subject to the constraints:

$$a_{kj} \in [a_{ij}^l, a_{ij}^u] \quad \forall j > k, \tag{9}$$

$$a_{jk} = \frac{1}{a_{jk}} \quad \forall j < k,$$

$$a_{jj} = 1.$$

Moreover, $S_i^{m_t}$ calculated by

$$S_i^{m_t} = \left[\left(\prod_{j=1}^n a_{ij}^{m_t} \right)^{\frac{1}{n}} \right] / \sum_{k=1}^n \left[\left(\prod_{j=1}^n a_{kj}^{m_t} \right)^{\frac{1}{n}} \right], t = 1,2; i = 1, \dots, n, \tag{10}$$

Step 8: Using the weights determined in Step 7, the fuzzy linear programming problem is modeled as given in Eq. (11).

$$\begin{aligned} & \max \sum_{l=1}^L w_l \lambda_l + \sum_{t=1}^T \beta_t \gamma_t, \\ & \lambda_l \leq \mu_{Z_l}(x), \quad l = 1, \dots, L, \\ & \gamma_t \leq \mu_{g_t}(x), \quad t = 1, \dots, T, \end{aligned} \tag{11}$$

$$\sum_{l=1}^L w_l + \sum_{t=1}^T \beta_t = 1,$$

$$g_k(x) \leq b_k, k = 1, \dots, K,$$

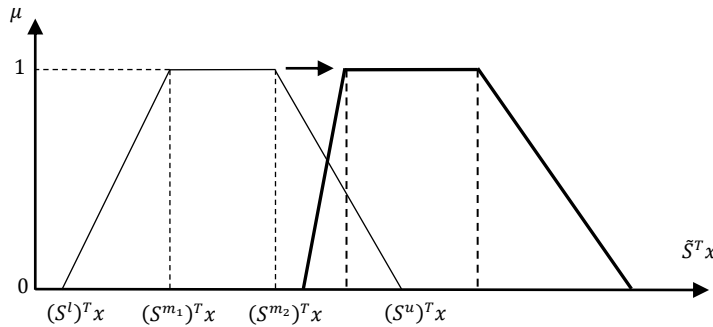
$$\lambda_l \in [0,1], \gamma_t \in [0,1], w_l \geq 0, \beta_t \geq 0,$$

$$x_m \geq 0, m = 1, \dots, M.$$

Here, the coefficients corresponding to fuzzy goals w_l and the coefficients corresponding to fuzzy constraints β_t are obtained from TrFNs. λ_l is the fuzzy targets, γ_t is the fuzzy constraint parameters, $\mu_{Z_l}(x)$ is the membership function for each target and $\mu_{g_t}(x)$ is the membership functions for each fuzzy constraint.

Step 9: In order to maximize the fuzzy goal, the parameters of the weights are shifted as in Figure 2 and new objective functions are created as in Eq. (12).

Figure 2. The strategy to solve $\max \tilde{S}^T x$



$$\begin{aligned} \min Z_1 &= (S^{m_1} - S^l)^T x, \\ \max Z_2 &= (S^{m_1})^T x, \\ \max Z_3 &= (S^{m_2})^T x, \\ \max Z_4 &= (S^u - S^{m_2})^T x, x \in X. \end{aligned} \tag{12}$$

Step 10: The fuzzy programming method proposed by Zimmerman was used in the normalization process to solve Eq. (12) (Zimmermann, 1978). The Positive Ideal Solution (PIS) and the Negative Ideal Solution (NIS) of the four objective functions are obtained by Eqs. (13-16):

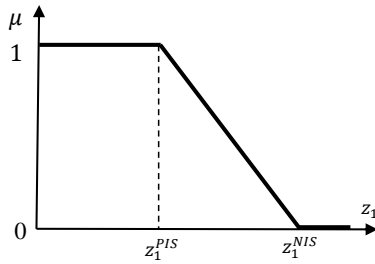
$$Z_1^{PIS} = \min_{x \in X} (S^{m_1} - S^l)^T x, \quad Z_1^{NIS} = \max_{x \in X} (S^{m_1} - S^l)^T x, \tag{13}$$

$$Z_2^{PIS} = \max_{x \in X} (S^{m_1})^T x, \quad Z_2^{NIS} = \min_{x \in X} (S^{m_1})^T x, \tag{14}$$

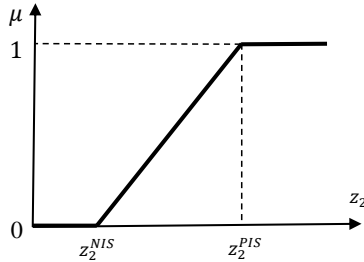
$$Z_3^{PIS} = \max_{x \in X} (S^{m_2})^T x, \quad Z_3^{NIS} = \min_{x \in X} (S^{m_2})^T x, \tag{15}$$

$$Z_4^{PIS} = \max_{x \in X} (S^u - S^{m_2})^T x, \quad Z_4^{NIS} = \min_{x \in X} (S^u - S^{m_2})^T x. \tag{16}$$

Step 11: The linear membership functions of the objective functions given in Eqs. (13-16) are obtained from Eqs. (17-18).



$$\mu_{z_1} = \begin{cases} 1, & z_1 < z_1^{PIS}, \\ \frac{z_1^{NIS} - z_1}{z_1^{NIS} - z_1^{PIS}}, & z_1^{PIS} \leq z_1 \leq z_1^{NIS}, \\ 0, & z_1 > z_1^{NIS}, \end{cases} \quad (17)$$

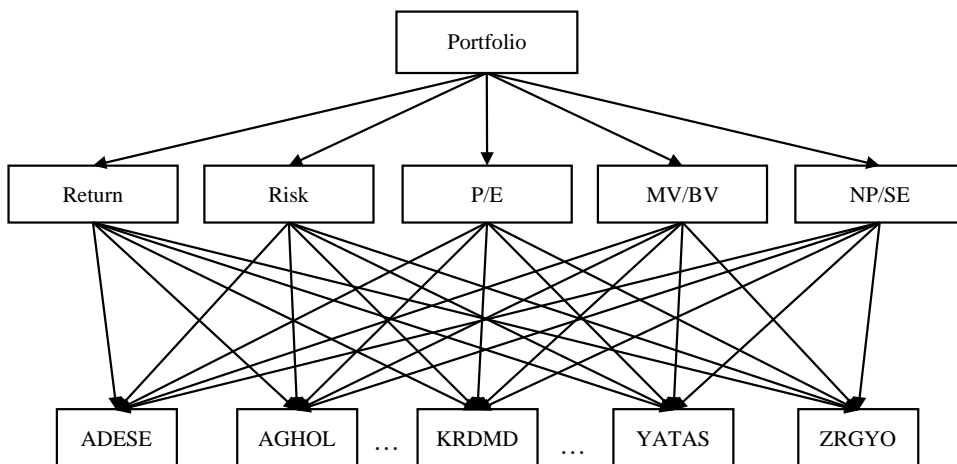


$$\mu_{z_2} = \begin{cases} 1, & z_2 < z_2^{PIS}, \\ \frac{z_2 - z_2^{NIS}}{z_2^{PIS} - z_2^{NIS}}, & z_2^{PIS} \leq z_2 \leq z_2^{NIS}, \\ 0, & z_2 > z_2^{NIS}, \end{cases} \quad (18)$$

5. APPLICATIONS

In this section, the portfolio distribution of stocks traded in the ISE-100 index is obtained using the proposed method. To achieve the optimal portfolio distribution, five criteria were determined in the form of Return, Risk, Price/Earnings (P/E), Market Value/Book Value (MV/BV) and Net Profit/Equity (NP/SE). In this study, monthly return rates of stocks are taken as the return criterion and it is desired to be maximized. The risk criterion is calculated from the return rates of stocks and is desired to be minimized. Price / Earnings ratio is used to measure the price of a stock according to the profit it makes, Market Value / Book Value ratio is used to measure the price of a stock according to its equity capital, Net Profit / Stockholder’s Equity ratio, also known as return on equity, is used to measure how much profit shareholders make in return for their unit investment. These ratios are desired to be minimized, maximized and maximized respectively. The hierarchical structure of the problem is given in Figure 3.

Figure 3. Hierarchical structure of the application



ISE-100 data was sourced from <https://tr.investing.com/>. Between January 1, 2018, and December 31, 2021, this dataset comprises the 48-month Return, Risk, P/E, MV/BV, NP/SE ratios of stocks. Since there were 85 stocks in the ISE-100 index between the mentioned dates, the study was carried out on these 85 stocks. In line with the determined criteria, data on stocks are given in Table 6.

Using the GK algorithm, the degrees of membership of each criterion determined within the scope of the study into two clusters designated as "High" and "Low" was calculated. Thus, two sets are formed for each criterion. Since there were 5 criteria within the scope of the study and two rules for each criterion, low and high, a total of 32 rules were created. With the knowledge that the criteria determined in this study will be maximized or minimized; Membership degrees of the "high return - low risk - low P/E - high MV/BV and high NP/SE" rule and the average μ_{avg} weights of the five membership degrees that can decide which stocks will be included in these rules are given in Table 7.

Table 6. Stocks and financial ratios

	Stocks	Return	Risk	P/E	MV/BV	NP/SE
1	ADESE	0.043	0.364	1.86	0.39	9.09
2	AGHOL	0.023	0.154	16.26	0.95	1.32
3	AKBNK	0.005	0.115	2.33	0.47	13.86
4	AKSA	0.047	0.117	9.16	4.43	29.08
5	AKSEN	0.040	0.123	8.64	2.09	17.92
6	ALGYO	0.040	0.134	1.65	0.67	32.9
7	ALARK	0.036	0.127	5.21	2.53	28.49
8	ALBRK	0.013	0.132	12.64	0.64	6.55
9	ALKIM	0.038	0.083	10.27	4.15	38.13
⋮	⋮	⋮	⋮	⋮	⋮	⋮
78	TURSG	0.036	0.148	5.19	1.34	27.62
79	VAKBN	-0.006	0.117	4.39	0.38	14.03
80	VERUS	0.026	0.134	20.48	4.18	24.87
81	VESBE	0.057	0.120	8.31	2.7	39.78
82	VESTL	0.041	0.165	3.95	0.83	20.26
83	YKBNK	0.012	0.121	2.27	0.47	13.54
84	YATAS	0.018	0.148	6.75	1.82	32.56
85	ZRGYO	0.064	0.112	9.88	1.69	14.65

In accordance with this rule, stocks with high returns, low risks, low P/E ratios, high MV/BV ratios and high NP/SE ratios were determined.

Table 7. Membership degrees of stocks

	Stocks	Membership Degrees					μ_{avg}
		Return High	Risk Low	P/E Low	MV/BV High	NP/SE High	
1	ADESE	0.994	0.036	0.807	0.090	0.013	0.388
2	AGHOL	0.198	0.714	0.065	0.017	0.109	0.220
3	AKBNK	0.074	0.982	0.836	0.078	0.012	0.396
4	AKSA	0.999	0.989	0.751	0.917	0.880	0.907
5	AKSEN	0.973	0.999	0.822	0.132	0.134	0.612
6	ALGYO	0.971	0.967	0.794	0.049	0.978	0.752
7	ALARK	0.895	0.997	0.988	0.312	0.855	0.810
8	ALBRK	0.000	0.980	0.280	0.053	0.040	0.271
9	ALKIM	0.932	0.790	0.584	0.875	0.998	0.836
:	:	:	:	:	:	:	:
78	TURSG	0.898	0.811	0.988	0.000	0.813	0.702
79	VAKBN	0.188	0.987	0.956	0.092	0.015	0.448
80	VERUS	0.406	0.966	0.005	0.880	0.636	0.579
81	VESBE	0.960	0.995	0.863	0.391	0.992	0.840
82	VESTL	0.980	0.515	0.934	0.029	0.277	0.547
83	YKBNK	0.006	0.997	0.832	0.078	0.009	0.385
84	YATAS	0.040	0.811	0.986	0.056	0.973	0.573
85	ZRGYO	0.926	0.971	0.643	0.031	0.025	0.519

According to the rule created from the membership degrees obtained by the GK algorithm, the weights calculated as greater than 0.7 ($\mu_{avg} > 0.7$) were selected and the stock elimination process was carried out. The 22 stocks remaining after the stock elimination process and the average weights of the stocks are given in Table 8.

Table 8. Stocks with $\mu_{avg} > 0.7$

	Stocks	$\mu_{avg} > 0.7$
1	BRISA	0.9532
2	EGEEN	0.9273
3	AKSA	0.9074
4	SARKY	0.8833
5	OTKAR	0.8820
6	FROTO	0.8764
7	TTRAK	0.8739
8	TOASO	0.8711
9	VESBE	0.8402
10	ALKIM	0.8358
11	ISMEN	0.8280
12	DEVA	0.8276
13	ALARK	0.8096
14	DOAS	0.7632
15	ERBOS	0.7583
16	ALGYO	0.7520

(Table 8 cont.)

	Stocks	$\mu_{avg} > 0.7$
17	LOGO	0.7438
18	KARTN	0.7409
19	TKNSA	0.7332
20	KOZAL	0.7291
21	HEKTS	0.7213
22	TURSG	0.7021

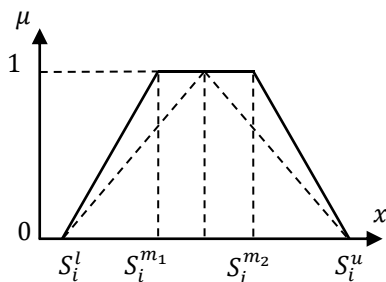
After the stock elimination process, the algorithm proposed within the scope of the study is run to make portfolio distribution. The importance levels of the criteria are given in Table 9. These levels are determined as TFNs, by four decision makers who are securities and investment analyst.

Table 9. Importance levels of criteria

	Return	Risk	P/E	MV/BV	NP/SE
Decision Maker 1	(9 10 10)	(5 7 9)	(3 5 7)	(5 7 9)	(7 9 10)
Decision Maker 2	(7 9 10)	(7 9 10)	(5 7 9)	(5 7 9)	(3 5 7)
Decision Maker 3	(9 10 10)	(9 10 10)	(7 9 10)	(7 9 10)	(5 7 9)
Decision Maker 4	(7 9 10)	(7 9 10)	(3 5 7)	(5 7 9)	(7 9 10)

TFNs in the importance scale were converted into TrFNs by keeping their right and left distributions constant and expanding the point at which they had the highest membership degree to a certain range, as shown in Figure 4.

Figure 4. Transformation of TFN into TrFN



The importance levels of the criteria are obtained by taking the geometric average of the decision maker's opinions are given in Table 10.

Table 10. Representation of the importance degrees given by decision makers as TrFNs

Criteria	Importance degree
Return	(7.94 9.10 9.62 10.00)
Risk	(6.85 8.22 8.95 9.74)
P/E	(4.21 5.78 6.76 8.15)
MV/BV	(5.44 6.95 7.90 9.24)
NP/SE	(5.21 6.78 7.70 8.91)

The fuzzy pairwise comparison matrix obtained by using decision maker opinions for the five criteria of the problem is given in Table 11.

Table 11. Matrix of pairwise comparisons of criteria

	Return	Risk	P/E	MV/BV	NP/SE
Return	(1 1 1 1)	(0.82 1.02 1.17 1.46)	(0.97 1.35 1.66 2.38)	(0.86 1.15 1.38 1.84)	(0.89 1.18 1.42 1.92)
Risk	(0.68 0.85 0.98 1.22)	(1 1 1 1)	(0.84 1.22 1.55 2.31)	(0.74 1.04 1.29 1.79)	(0.77 1.07 1.32 1.87)
P/E	(0.42 0.60 0.74 1.03)	(0.43 0.65 0.82 1.19)	(1 1 1 1)	(0.46 0.73 0.97 1.50)	(0.47 0.75 1.00 1.56)
MV/BV	(0.54 0.72 0.87 1.16)	(0.56 0.78 0.96 1.35)	(0.67 1.03 1.37 2.17)	(1 1 1 1)	(0.61 0.90 1.17 1.77)
NP/SE	(0.52 0.70 0.85 1.12)	(0.53 0.76 0.93 1.30)	(0.64 1.00 1.33 2.13)	(0.56 0.85 1.11 1.64)	(1 1 1 1)

The fuzzy weight of each criterion was calculated by applying the Step (7-8) part of the algorithm for the Constrained Fuzzy AHP, where TrFNs are used in portfolio selection, and is given in Table 12.

Table 12. Fuzzy weights of the criteria in the problem

Criteria	Weights
Return	(0.17 0.23 0.26 0.32)
Risk	(0.15 0.20 0.24 0.30)
P/E	(0.10 0.15 0.18 0.25)
MV/BV	(0.12 0.17 0.21 0.28)
NP/SE	(0.12 0.17 0.20 0.27)

The linear programming problem was modeled as in P₁, using the values of the stocks related to the criteria.

$$\begin{aligned}
 P_1: \quad & Z_{Re(max)} = 0.038x_1 + 0.050x_2 + \dots + 0.075x_{21} + 0.036x_{22}, \\
 & Z_{Ri(min)} = 0.134x_1 + 0.146x_2 + \dots + 0.150x_{21} + 0.147x_{22}, \\
 & Z_{P/E(min)} = 7.42x_1 + 7.27x_2 + \dots + 49.15x_{21} + 5.19x_{22}, \\
 & Z_{MV/BV(max)} = 4.51x_1 + 4.85x_2 + \dots + 14.09x_{21} + 1.34x_{22}, \\
 & Z_{NP/SE(max)} = 34.38x_1 + 54.63x_2 + \dots + 33.29x_{21} + 27.62x_{22}, \\
 & x_1 + x_2 + \dots + x_{21} + x_{22} = 1, \\
 & x_i \geq 0, i = 1, \dots, 22.
 \end{aligned}$$

Here x_i , represents the percentage of investment to be made in the i th stock. PIS and NIS values of each objective function were determined using the MATLAB program and are given in Table 13.

Table 13. PIS and NIS values of each objective function

Objective Functions	PIS	NIS
$Z_{Re(max)}$	0.08	0.03
$Z_{Ri(min)}$	0.08	0.27
$Z_{P/E(min)}$	1.65	49.15
$Z_{MV/BV(max)}$	14.09	0.67
$Z_{NP/SE(max)}$	71.37	27.12

A new fuzzy multi-objective linear programming model (P₂) is created using the fuzzy weights.

$$\begin{aligned}
 P_2: \max & (0.17 \ 0.23 \ 0.26 \ 0.32)\lambda_1 + (0.15 \ 0.20 \ 0.24 \ 0.30)\lambda_2 + (0.10 \ 0.15 \ 0.18 \ 0.25)\lambda_3 + \\
 & (0.12 \ 0.17 \ 0.21 \ 0.28)\lambda_4 + (0.12 \ 0.17 \ 0.20 \ 0.27)\lambda_5 \\
 \lambda_1 \leq & \frac{(0.038x_1+0.050x_2+\dots+0.075x_{21}+0.036x_{22})-0.03}{0.05}, \\
 \lambda_2 \leq & \frac{0.27-(0.134x_1+0.146x_2+\dots+0.150x_{21}+0.147x_{22})}{0.19}, \\
 \lambda_3 \leq & \frac{49.15-(7.42x_1+7.27x_2+\dots+49.15x_{21}+5.19x_{22})}{47.50}, \\
 \lambda_4 \leq & \frac{(4.51x_1+4.85x_2+\dots+14.09x_{21}+1.34x_{22})-0.67}{13.42}, \\
 \lambda_5 \leq & \frac{(34.38x_1+54.63x_2+\dots+33.29x_{21}+27.62x_{22})-27.12}{44.25}, \\
 x_1 + x_2 + \dots + x_{21} + x_{22} = & 1, \quad x_m \geq 0, \quad m = 1, \dots, 22, \\
 \lambda_i \in [0,1], i = & 1, \dots, 5.
 \end{aligned}$$

In the P₂ model, $\lambda_1, \lambda_2, \lambda_3, \lambda_4$ and λ_5 refer to the membership functions for the Return, Risk, Price/Earnings, Market Value/Book Value and Net Profit/ Stockholder's Equity criteria, respectively. Problem P₂ is created using the values in Table 13.

The problem P₂ also includes the constraint that will ensure that the sum of the stock distribution ratios is 1. The objective functions created for the solution of the P₂ problem are given in Eq. (20).

$$\begin{aligned}
 \min & 0.06\lambda_1 + 0.05\lambda_2 + 0.05\lambda_3 + 0.05\lambda_4 + 0.05\lambda_5 \ (Z_1) \\
 \max & 0.23\lambda_1 + 0.20\lambda_2 + 0.15\lambda_3 + 0.17\lambda_4 + 0.17\lambda_5 \ (Z_2) \\
 \max & 0.26\lambda_1 + 0.24\lambda_2 + 0.18\lambda_3 + 0.21\lambda_4 + 0.20\lambda_5 \ (Z_3) \\
 \max & 0.06\lambda_1 + 0.06\lambda_2 + 0.07\lambda_3 + 0.07\lambda_4 + 0.07\lambda_5 \ (Z_4)
 \end{aligned} \tag{20}$$

The PIS and NIS of each objective function given by Eq. (20) were solved within the constraints of the P₂ model and the results obtained are given in Table 14.

Table 14. PIS and NIS of the four objective functions created for the solution of the P₂ model

	PIS	NIS
Z1	0	0.1835
Z2	0.6372	0
Z3	0.7621	0
Z4	0.2437	0

Membership functions for each objective function are obtained by Eq. (21-24).

$$\mu_{z_1} = \begin{cases} 1 & z_1 < 0 \\ \frac{0.1835 - z_1}{0.1835} & 0 \leq z_1 \leq 0.1835 \\ 0 & z_1 > 0.1835 \end{cases} \tag{21}$$

$$\mu_{z_2} = \begin{cases} 1 & z_2 < 0.6372 \\ \frac{z_2}{0.6372} & 0 \leq z_2 \leq 0.6372 \\ 0 & z_2 > 0 \end{cases} \quad (22)$$

$$\mu_{z_3} = \begin{cases} 1 & z_3 < 0.7621 \\ \frac{z_3}{0.7621} & 0 \leq z_3 \leq 0.7621 \\ 0 & z_3 > 0 \end{cases} \quad (23)$$

$$\mu_{z_4} = \begin{cases} 1 & z_4 < 0.2437 \\ \frac{z_4}{0.2437} & 0 \leq z_4 \leq 0.2437 \\ 0 & z_4 > 0 \end{cases} \quad (24)$$

Then, the P₃ model is created using the obtained membership degrees.

P₃: *max* α

$$\begin{aligned} 0.1835\alpha + (0.06\lambda_1 + 0.05\lambda_2 + 0.05 + 0.05\lambda_4 + 0.05\lambda_5) &\leq 0.1835 \\ 0.6372\alpha - (0.23\lambda_1 + 0.20\lambda_2 + 0.15\lambda_3 + 0.17\lambda_4 + 0.17\lambda_5) &\leq 0 \\ 0.7621\alpha - (0.26\lambda_1 + 0.24\lambda_2 + 0.18\lambda_3 + 0.21\lambda_4 + 0.20\lambda_5) &\leq 0 \\ 0.2437\alpha - (0.06\lambda_1 + 0.06\lambda_2 + 0.07\lambda_3 + 0.07\lambda_4 + 0.07\lambda_5) &\leq 0 \\ 0.05\lambda_1 - (0.038x_1 + 0.050x_2 + \dots + 0.075x_{21} + 0.036x_{22}) &\leq -0.03, \\ 0.19\lambda_2 + (0.134x_1 + 0.146x_2 + \dots + 0.150x_{21} + 0.147x_{22}) &\leq 0.27, \\ 47.50\lambda_3 + (7.42x_1 + 7.27x_2 + \dots + 49.15x_{21} + 5.19x_{22}) &\leq 19.15, \\ 13.42\lambda_4 - (4.51x_1 + 4.85x_2 + \dots + 14.09x_{21} + 1.34x_{22}) &\leq -0.67, \\ 44.25\lambda_5 - (34.38x_1 + 54.63x_2 + \dots + 33.29x_{21} + 27.62x_{22}) &\leq -27.12, \\ x_1 + x_2 + \dots + x_{21} + x_{22} &= 1 \\ x_m \geq 0, m = 1, \dots, 22, \alpha \in [0,1]; \lambda_j \in [0,1], j = 1, \dots, 5. \end{aligned}$$

By solving the P₃ problem, the portfolio distribution was obtained as given in Table 15.

Table 15. The ratios to be invested in the stocks by solving the P₃ model.

Stocks	Percentage of stocks
OTKAR	0.9567
TKNSA	0.0433

As can be seen in Table 15, using the proposed method, it was determined that for optimum investment, the investor fund should be allocated to OTKAR and TKNSA stocks at rates of 95.67% and 4.33%, respectively.

In order to examine the effectiveness of the proposed model, portfolio distributions were obtained using the mean-variance method and Conditional Value at Risk (CVAR) methods. The Mean Variance method (Markowitz, 1952) is used to reduce risk without reducing expected return by using the correlation between investment assets. Results regarding the Mean Variance method were obtained

using MATLAB. Additionally, in this numerical application, the asset distributions of the portfolio were obtained using CVaR method (Rockafellar and Uryasev, 2000) at the $\alpha = 0.01$ significance level with MATLAB. Finally, the portfolio distribution was made in January and February 2022 according to the results obtained from the applied methods and compared according to the return rates.

Table 16. Results obtained from the methods used in the study

	Stocks	Investment Rate (IR)	Return Rate (%) (RR)		Investment Return (%)	
			(Monthly)		(IR × RR)	
			January 2022	February 2022	January 2022	February 2022
Results obtained from the proposed method	OTKAR	0.9567	0.0718	0.0612	6.87	5.86
	TKNSA	0.0433	0.1820	-0.1874	0.79	-0.81
	Total				7.66	5.04
Results obtained from the Mean-Variance method	ADESE	0.0254	0	-0.0533	0	-0.14
	ALKIM	0.0076	0.1737	-0.1081	0.13	-0.08
	AEFES	0.0235	-0.0196	-0.168	-0.05	-0.40
	BIMAS	0.2046	0.1476	0.0391	3.02	0.80
	CCOLA	0.1006	0.2874	-0.0465	2.89	-0.47
	ERBOS	0.0227	0.0563	-0.1133	0.13	-0.26
	EREGL	0.0586	-0.0312	0.1393	-0.18	0.82
	ISFIN	0.0069	0.0194	-0.1234	0.01	-0.08
	OYAKC	0.0151	0.1456	-0.1978	0.22	-0.30
	RTALB	0.0044	-0.121	-0.1706	-0.05	-0.07
	TSKB	0.0105	0.0556	-0.1513	0.06	-0.16
	VERUS	0.0381	-0.0859	0.0089	-0.33	0.03
	VESTL	0.0171	-0.0343	-0.0687	-0.06	-0.12
	ZRGYO	0.4648	-0.1029	0.055	-4.78	2.56
Total					1.01	2.13
CVaR $\alpha = 0.01$	ADESE	0.0241	0	-0.0533	0	-0.13
	ALKIM	0.0759	0.1737	-0.1081	1.32	-0.82
	BIMAS	0.1866	0.1476	0.0391	2.75	0.73
	CCOLA	0.0840	0.2874	-0.0465	2.41	-0.39
	DEVA	0.0155	0.0786	-0.0935	0.12	-0.14
	ERBOS	0.0207	0.0563	-0.1133	0.12	-0.23
	EREGL	0.0686	-0.0312	0.1393	-0.21	0.96
	ISFIN	0.0123	0.0194	-0.1234	0.02	-0.15
	ISMEN	0.0488	-0.1114	-0.1543	-0.54	-0.75
	OYAKC	0.0065	0.1456	-0.1978	0.09	-0.13
	RTALB	0.0100	-0.121	-0.1706	-0.12	-0.17
	TSKB	0.0160	0.0556	-0.1513	0.09	-0.24
	VERUS	0.0070	-0.0859	0.0089	-0.06	0.01
	VESTL	0.0325	-0.0343	-0.0687	-0.11	-0.22
ZRGYO	0.3916	-0.1029	0.055	-4.03	2.15	
Total					1.85	0.46

Table 16 shows the portfolio distributions obtained from the methods applied in this study and the return rates of the stocks in these distributions for January and February 2022. Additionally, the table gives a comparison of the total return rates obtained when invested in January and February 2022, according to the results obtained from all methods.

6. CONCLUSION

With the advancement of technology, investors have started to manage their investments using computer-based software. However, it is observed that these software programs do not take expert opinions into account during the portfolio selection process and rely solely on financial ratios based on stock returns. This results in the same expected return for all investors at the same level of risk. To overcome this issue, incorporating both financial ratios and expert opinions based on experience into the model has made the proposed model more effective. Additionally, in the proposed portfolio selection model, during the process of selecting from a set of stocks under uncertainty, a pre-selection was made for indices with a large number of stocks to reduce the number of stocks in the index and efficiently the selection process. In this reduction process, two levels were determined for each criterion within the scope of the study and the membership degrees of the "high return - low risk - low P/E - high MV/BV and high NP/SE" rule suitable for optimal investment selection from 32 rules obtained for 5 criteria were calculated using the GK algorithm from fuzzy cluster methods. The reduction process was carried out with the weight values obtained in the form of the average of the calculated membership degrees. To determine the most suitable investment based on the reduced data set, expert opinions were included in the model, and a linear programming problem using trapezoidal fuzzy numbers was formulated to incorporate uncertainty into the process. In this study, the 48-month return rates of the stocks in the ISE-100 index between January 1, 2018 and December 31, 2021 financial rates of these stocks and decision-making opinions were used. After the stock reduction process using GK Cluster Algorithm, portfolio distribution was made with the proposed model. As can be seen from Table 16, according to the portfolio distributions obtained from the method proposed within the scope of the study, if invested in OTKAR and TKNSA stocks, total profit of 7.66% in January 2022 and 5.04% in February 2022 is obtained. When investing according to the January and February 2022 return rates of stocks obtained using the Mean-Variance method, a total profit of 1.01% and 2.13% is obtained, respectively. When investing according to the January and February 2022 return rates of stocks obtained using the CVaR method ($\alpha = 0.01$), a total profit of 1.85% and 0.46% is obtained, respectively. As can be seen from the results, the return percentage as a result of the investment method determined with the proposed method is greater than the return percentage obtained from other methods available in the literature. This can be stated that the solution process, in which the opinions of investment experts, criteria other than return and risk, and uncertainty are included, is a usable model for portfolio selection.

In further studies, the proposed algorithm can be used in portfolio selection by performing stock reduction in different indices using different fuzzy clustering algorithms (GG, EWFCM, KFCM ...).

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that they all equally contributed to all processes of the research.

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On the Financial Determinants of the Piotroski F-Score: An Analysis of Borsa İstanbul Firms

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Abstract

This study investigates the factors effective on Piotroski F-score which is a proxy for financial health of the firms. Manufacturing firms operate in Borsa İstanbul are considered in the analyses with using the time period of 2017:Q1-2024:Q3. This study contributes to the literature by identifying financial determinants of Piotroski F-Score in Türkiye. Driscoll and Kraay (1998) estimator is used with fixed effect panel regression in order to handle issues of heteroscedasticity, cross sectional dependency and autocorrelation in the model. Altman Z-score, return on invested capital, market to book ratio, Tobin's Q ratio and Beneish M-score significantly impact Piotroski F-score. According to the regression results, companies with lower financial distress risks (higher Altman Z-score) are expected to have better financial health. Similarly, those with improved return on invested capital tend to exhibit stronger financial health. Moreover, firms with higher market-to-book ratios are generally more profitable, potentially leading to higher Piotroski F-scores, indicating better financial health. A higher Tobin's Q value suggests greater performance expectations from the company, which correlates with higher financial health. Conversely, a negative relation between the Beneish M-score and Piotroski F-score implies that companies with a higher likelihood of earnings manipulation tend to have weaker financial health.

Keywords: *Piotroski F-score, Beneish M-Score, Altman Z-score Financial Health, Financial Performance, Borsa İstanbul, Panel Data Analysis*



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<https://doi.org/10.30798/makuiibf.1477251>

Article Type
Research Article

Application Date
May 2, 2024

Admission Date
December 28, 2024

1. INTRODUCTION

Investment in modern days has advanced to include more investment instruments, which has made it even harder for people to choose the right investment instrument. Notably, stock market investors look for several alternative companies to invest in since they would like to have a long-term vision. The main priority for portfolio investors, as stated by Anderson et al. (2021), is to establish an investment strategy that ensures consistent profitability. Numerous research studies have demonstrated that value stocks generally provide returns that exceed those offered by growth stocks. Evidence from US stock market data, as presented by Fama and French (1992), demonstrates that value stocks yield superior returns compared to growth stocks. Likewise, Asness et al. (2013) reveal, through the analysis of international stock market data, that value stocks consistently outperform growth stocks. Moreover, using international stock market data, Asness et al. (2013) prove that value stocks provide higher returns than growth stocks. Nevertheless, identifying suitable value stocks and developing a profitable value strategy are not easy tasks to accomplish immediately; they require time to understand and implement in specific situations. To address this issue, a model created by Piotroski (2000) can be employed to identify profitable stocks, which would make a profit when incorporated into a value stock portfolio. Piotroski maintains that this should be accomplished by changes to the fundamental principles of a company that utilize the historical financial statements of the company. Additionally, the use of historical financial statement data has been recommended because of the high prevalence of book to market companies that are typically under less analyst coverage, and thus, forecast information is not always accessible. The F-score, created by Piotroski (2000), has become popular as a simple, yet comprehensive, description of the financial health of an organization. The total number of 0/1 flags is used to describe the effectiveness of an organization's operations, their composition, and the changes in capital, profitability, and especially results, whether these qualities are increasing or decreasing (Walkshäusl, 2020; Rangapriya & Meenakumari, 2021). In the US stock market for the period 1976-1996, high-fidelity stocks that were below par were approximately 30% of the total market value, which was based on the book value of the stock and the annual return of the top 20% companies. The endeavor of Piotroski has been reproduced with positive results in the European stock market and the Asia-Pacific region, although not as pronounced as it is in the U.S. Also, robustness tests followed by Piotroski have confirmed its effectiveness on most small distressed firms, which often have low or no analyst coverage.

Piotroski F-score is no longer just a counting of gain or loss phenomenon in the investment decision-making process; rather, it comes out as a crucial supporting factor for investment decisions and future performance forecasting. The efficiency of the F-score has been supported by a study discerning between growing companies and those prone to financial distress. In a study, for instance, companies with a high F-score more often outperformed their counterparts with a lower score, implying an investment strategy advantage in terms of excess returns (He and Tan, 2022). Additionally, the F-score plays an important role in helping investors to find healthy firms and 'read' early warning signals of

potential distress. Value investing in strong F-scored stocks could be a healthy affair for investors and thereby channelizing their money into available growth opportunities with minimal risk exposure. Another benefit of the Piotroski F-score is for those investors who plan to stay invested for the long term. It helps them identify companies with strong financial fundamentals and the potential to perform consistently over time (Rangapriya & Meenakumari, 2021). So, Piotroski F-score has many areas of application, making it a much-needed tool for individuals who want to invest both in Türkiye and international markets to make the right choices in the confusion of financial matters. It allows investors who want to invest in manufacturing industry enterprises, which are the locomotive of an emerging economy like Türkiye, to shape their portfolios.

Piotroski F-score has been employed as a predictor of future profitability for companies and as an instrument to determine if the public's fundamental information is reflected in prices (Turtle & Wang, 2017). Piotroski and So (2012), Ahmed and Safdar (2018) demonstrate that the errors of investor expectations regarding the company's financial position, which are proxied through the F-score of Piotroski, lead to abnormal returns in the US stock market, as well as a premium for momentum. These effects are attributed to the company's financial position. Additionally, additional research shows that Piotroski's F-score is effective in other areas. Piotroski and So (2012), Ng and Shen (2016) demonstrate that the Piotroski F-score has the capacity to pre-sort Asian companies into subsequent winners and losers. Walkshäusl (2017) and Walkshäusl (2019) demonstrate that the Piotroski F-score is also involved in the understanding of the value and momentum effects in European stock returns that are associated with investors' misconceptions of fundamental issues. Ng and Shen (2020) demonstrate the existence of evidence on the market-wide Piotroski F-score and its association with the Australian and five Asian stock markets.

Piotroski F-score, one of the most applied financial indicators and primarily used in financial markets, has been tested in various capital markets, especially in determining financial health, financial distress or for the purpose of modelling a portfolio. However, there is not any study that tests the factors effective on Piotroski F-score. This study addresses a gap in the literature by examining the determinants of Piotroski F-score in the Turkish manufacturing sector. Although Tepeli and Kahraman (2023) considers Piotroski F-score as a proxy for financial success in Borsa İstanbul firms, they only investigate the impact of firm-specific debt structure ratios on financial success. Similarly, Karadeniz, and İskenderoğlu (2024a) examine the financial performance of lodging companies that are listed on Borsa İstanbul Hotels and Restaurants Sector through Piotroski F-score. Karadeniz and İskenderoğlu (2024c) examine the financial performance of health care companies traded in Borsa İstanbul Human Health and Social Work Activities Sector between 2020-2022 through Piotroski F-score. However, the current study takes into consideration various firm specific characteristics that might be effective on financial health such as Altman Z-score (Altman), return on invested capital (Roic), investment growth rate (Inv), price to earnings (PE) ratio, market to book (MB) ratio, enterprise value to net sales ratio (EV), Tobin's

Q ratio (Tobin) and Beneish M-score (Beneish). For this purpose, 2019:Q4-2023:Q3 data of 144 manufacturing industry companies traded in Borsa İstanbul are used. According to the empirical results Altman, Roic, MB, Tobin and Beneish variables are found to be effective on financial health of the manufacturing firms operating in Borsa İstanbul.

The next section presents the literature review related to the Piotroski F-score. Section 3 outlines the data and methodology used in this study. Empirical results are presented in Section 4, and the study concludes in the final section.

2. LITERATURE REVIEW

In recent finance literature, the Piotroski F-score has received much attention. Studies have explored the model's effectiveness using various variables across different nations' financial markets. Joseph Piotroski is attributed with creating and promoting the Piotroski F-score. In 2000, he releases a scientific article that described a strategy for investing in equity and demonstrated its effectiveness through his own research. The concept of the Piotroski F-score strategy is derived from a method that involves the utilization of certain fundamental features in order to achieve success in the stock market. Specifically, an investor can utilize information sourced from financial statements to reliably distinguish profitable firms “winners” from unprofitable ones “losers”. Piotroski has identified the financial statement elements for identifying the attractiveness of a stock that could be another step into value investing, which is already widely known and used (Piotroski, 2000; Piotroski, 2005). Meanwhile, numerous studies have shown its effectiveness; yet most of it rested on a good return from the shares of a few strong firms, while many other weak companies with unsatisfactory growth prospects had also to be considered simultaneously (Kusowska, 2021).

Based on Piotroski F-score, they are evaluated using high B/M stocks, but Mohr (2012) utilizes this score on growth stocks. The Piotroski F-score may be beneficial for creating market-average portfolios that yield high returns. Its utilization increases the explainability of multiple regression analysis regarding the association between return and variance in market conditions. In their research, Krauss et al. (2015) create a method of calculating the Piotroski F-score. They employ the Piotroski F-score in the US stock market from 2005 to 2010. Based on their findings from the time span of 2005 to 2015, individual investors who have minimal capital, like a few thousand US dollars, can consider applying the Piotroski F-score strategy. Nevertheless, one should be cautious about reported return figures because generally speaking, the brunt of those is taken out by market frictions.

An exploration into the global applicability of Piotroski F-score took place in countries such as Mexico and Finland. In Mexico, for instance, a comparison between Piotroski F-score and Ohlson Model is made using 63 Mexican stocks from 2005 to 2011. It has been found that Piotroski F-score is an effective financial tool revealing the current and historical financial stability of the organization. Another study, which examine the Finland stock market during the time span from 2004 to 2015,

construct portfolios based on Piotroski F-score because it is hypothesized that a higher Piotroski F-score might lead to higher risk-adjusted returns. As reported by Duran-Vazquez et al. (2014), the research report ends its review by indicating that their hypothesis prevails and has a positive impact on the investor's return. A study on the Piotroski F-score performance in the Indian stock market for 500 companies during 2010-2015 demonstrate that both a high Piotroski F-score and a high B/M ratio can help investors to shift their contemporaneous as well as future performances towards positive returns. In the study, they analyze how Piotroski F-score impacts stock projected returns, ROE (Return On Equity), M/B value ratio, dividend yield, and liquidity through a multiple regression model, which indicates that Piotroski F-score is one of the good indicators for equity investments (Tripathy & Pani, 2017). In a recent study conducted by Rangapriya and Meenakumari (2021), the focus is on examining the effectiveness of the Piotroski F-score as a means of identifying financially healthy companies and detecting early indications of financial distress within the Indian banking sector. All banks have Piotroski F-score ranging from 0 to 7, suggesting they are not compelling buys for the seven-year period. In some cases, some banks have revealed that Piotroski F-score continuously plummet for at least three years, and this may imply that financial trouble is approaching.

In 2024, Veeraraghavan undertakes an analysis of financial aspects of IT (Information Technology) companies that are listed on the National Stock Exchange of India on 15th August 2023. The research aims at analyzing the financial performance of these 99 companies on parameters such as revenue growth, profitability, solvency, market performance, and financial strength for the year ended March 31, 2023. The classification is based on income which resulted in four categories, namely: "very large"; "large"; "medium"; and "small". The financial strength of these companies is measured by the Piotroski F-score and the financial solvency by Altman Z-score. There are only 2 out of 17 companies in the "very large" and "large" group who possess a Piotroski F-score of more than 8, while as many as 10 out of 82 companies among Small and Medium Companies are with this score. Another research conducts an analysis on the stocks listed on the Bombay Stock Exchange, non-financial companies for 15 years starting from 1996 to 2010. It is suggested in this paper that investing based on Piotroski F-score allows for greater returns at risk-controlled levels (Singh & Kaur, 2015). After obtaining favorable findings regarding the investment style tests, more detailed studies are conducted with reference to individual sectors. Mesarić (2014) applies the Piotroski F-score to five automobile distributors from Croatia for the 2007-2012 period. The study is comprehensive and aimed at examining the financial performance of these firms as well as the health of the industry. The article establishes that Piotroski F-score acts as an advance warning signal of crisis. Thus, it is demonstrated to have added value for investors making investment decisions on a medium to long-term basis by revealing situations that may eventually lead to crises.

In an attempt to verify the statistical evidence of the Piotroski F-score efficiency and also because of its success, researchers become more enthusiastic about this matter. Walkshäusl (2020)

employees Piotroski's approach with modifications on sample type. In the same vein, from 2000-2018, Walkshäusl (2020) demonstrates how well the Piotroski F-score strategy works not only in developed countries that are not US-based but also in emerging markets. Tikkanen and Äijö (2018) also conducts another study which aimed at assessing the effectiveness of Piotroski F-score as one of the value investing strategies. To collect the required data, the experiment considered European companies throughout the period between 1992 and 2014. In their research, the authors considered B/M, EBIT/EV, EBITDA/EV, earnings divided by market capitalization, dividends to market capitalization, and Novy Marx profitability ratio. The implementation of the Piotroski F-score strategy has been found to significantly increase profits for all value investing strategies in this research; however, it is found most effective in the case of a company with an EBIT/EV ratio.

In the capital market of Polonia, investigation of the Piotroski F-score strategy has been extensive. The most recent study, which investigates the effectiveness of this method in the Polish stock exchange, is completed by Pilch (2021), Kusowska (2021), Pilch (2023a), and Pilch (2023b). The time period considered is from 2017-2020, and it concerns a sample of 54 companies in the IT and video game industries. In his research, Pilch (2021) advocates the Piotroski F-score method of identifying companies that have a significant financial foundation that promotes high returns on investments in the Warsaw Stock Exchange. Pilch documents that the strategy of the Piotroski F-score is still effective after several years since its original publication. Kusowska (2021) attempts to assess the effectiveness of the Piotroski F-score method based on the example of the Warsaw Stock Exchange from 2014 to 2020. The investigation revealed that, using financial statement analysis in the value investing method, returns can be increased for investors. Additionally, it has been observed that the Piotroski F-score analysis is more successful than simply purchasing the WIG30 index. Additionally, portfolios that comprised of companies with high F-scores for Piotroski are superior to those that comprised of companies with low F-scores. The research conducted by Pilch (2023a) seeks to create models similar to Piotroski F-score that base their data on information from the Polish stock exchange. The time period considered is from 2012-2022. However, models that included the X-score and Y-score are found to be less effective than the Piotroski F-score. Additionally, these models produce negative returns with raw and market-based. Conversely, the utilization of Piotroski F-score is considered purposeful, as it can produce a mean annual revenue-boosted return of 1.35%. Other models of scoring are also considered, but this research only demonstrates partial support for the high B/M strategy. The effectiveness of Piotroski F-scores like models is evaluated by Pilch (2023b) on the instance of the stock market of Poland. As a result, attention is devoted to models like PiotroskiTrfm and FS-score that are associated with Piotroski F-score. It is observed that companies with higher rankings had higher raw and average positive returns. However, these returns are less than the average return of low-scoring companies (for the FS score) or the entire high B/M portfolio. The findings of the study indicate that Piotroski F-score, FS-score, and Piotroski Trfm are generally beneficial tools for investments.

To assess the ability of the Piotroski F-score model to predict financial distress among the Tehran Stock Exchange-listed companies, Khalilian (2024) aims to provide a study. According to the study results, it is evident that there is a significant negative relation between the Piotroski F-score and the likelihood of financial distress, meaning that the Piotroski F-score model does well to identify weak firms so that these companies can avoid bankrupting themselves by making proper decisions. Based on the work of Hyde (2016), adopting the Piotroski F-score as an indicator to reveal the state of stocks with a favorable financial condition allowed the maximum return from investments. The test is conducted on S&P 500 and ASX 200 shares. It has been said in the article that more investigation of the Piotroski F-score connection with other variables could enhance its information content value and contribute to market participants receiving more reliable signs of financial distress. Xue (2022) focuses his research on the efficacy of a fundamental strength measure Piotroski F-score in the Shanghai A-share index. The results reveal that Piotroski F-score is able to anticipate short-term and medium-term profitability. Accordingly, Piotroski F-score can be seen as an innovative and standalone fundamental strength measure applicable to Chinese stock market. Buren et al. (2024) perform research that concerned 61 stocks on the Mongolian Stock Exchange within the period of 2011-2022. As a result, book value and Piotroski F-score are positively significant drivers of closed share prices. In Karadeniz and İskenderoğlu's (2024b) research, the financial strengths of 24 football clubs from the six national leagues under the Union of European Football Associations (UEFA) are investigated by the Piotroski F-score technique to analyze football clubs' financial strength at the international level. According to the F-score values, it is discovered that the financial strengths of football clubs were in an average position and they are considered investable entities. In terms of average F-score values, it is seen that Bayern Munich and also Sporting Lisbon made the best performances on this score while Lazio and AS Roma are the least successful football clubs. On the basis of the averages of nine financial indicators, the three most successful financial indicators are change in paid-in capital, earnings quality and cash flows from operating activities. The three least successful financial indicators are asset profitability, change in leverage and change in gross profit margin.

In research that is performed in the area of the Turkish capital market, Tepeli and Kahraman (2023) are interested in determining if borrowing levels and financial performance can be correlated. Based on the assessment conducted on the BIST All Shares index, it has been observed that short-term trade debts contribute significantly and positively to the Piotroski F-score; however, no relation is discovered between them and other variables. A different study conducted by Gökten et al. (2021) aim to explore the role of book value as a mediator between financial performance and market value. To measure financial performance, the researchers utilize Piotroski F-score indicators instead of relying solely on a single earnings proxy. The dataset use for this study includes quarterly accounting data and prices of publicly traded companies listed on Borsa İstanbul between 2009 and 2015. Findings from the model reveal that book value has a negative mediator effect which has disrupted the simple relation

between financial performance and stock value. Karadeniz and İskenderoğlu (2024a) have computed nine financial ratios concerning profitability, liquidity-leverage, and operating efficiency of the companies for the years 2018-2022 in order to analyse the financial performance of companies that were listed on Borsa İstanbul Hotels and Restaurants Sector as per the Piotroski F-score. Returns on companies' stocks have been tabulated for the period of 2019 to 2023 to appraise the forecasting efficacy of Piotroski F-scores of companies as concerns present and one-year lagged future performances. The most successful variable in the accommodation companies is the change in paid-in capital, while the least successful variable was the change in asset turnover. Finally, high F-scores for accommodation companies' stocks inside the portfolio reportedly outperformed those portfolios with lower F-scores in both the current year as well as the deferral period. In their research, Karadeniz and İskenderoğlu (2024c) use the Piotroski F-score to analyze the financial performance of health companies whose shares were traded in Borsa İstanbul Human Health and Social Work Activities Sector for the period 2020-2022. Almost entirely it is concluded that their financial performance was of a moderate nature according to the Piotroski F-scores and hence warrant for investment. Through this analysis, it is obviously seen that vitality and profitability, and main activities cash flows forms the best financial indicators of the companies under Piotroski F-score, but everyone failed in earnings quality indicator and main activities' cash flows are less than net profit figure.

With respect to the period studied and variables examined, findings from these studies reveal the usefulness of Piotroski F-score strategy. A number of studies substantially broaden Piotroski's original results. The appeal of this strategy to researchers is evident in its high returns and simplicity.

3. DATA AND METHODOLOGY

3.1. Data

This study examines the factors affecting the Piotroski F-score of manufacturing firms operating in Borsa İstanbul. 2017:Q1-2024:Q3 data of 144 manufacturing industry companies traded in Borsa İstanbul are used. The data for dependent and independent variables is collected from Finnet Stock Expert Database. While Piotroski F-score is the dependent variable, Altman Z-score, return on invested capital, investment growth rate, price to earnings ratio, market to book ratio, enterprise value, Tobin's Q ratio and Beneish M-score are the independent variables. The definition of these variables are as follows:

Piotroski F-score (Piotroski): The F-score, introduced by Piotroski in 2000, is a measure that combines nine binary indicators, each assigned a value of either 0 or 1. These indicators assess various aspects of a company's financial health. Among these indicators, four-gauge profitability, three assess liquidity, and two measure operating efficiency. For each indicator, a value of 1 represents strength, while 0 indicates weakness. By summing up these indicators, the F-score yields a score ranging from 0 to 9. Higher scores indicate better financial performance or quality (Lalwani & Chakraborty, 2018).

A total of 9 criteria are used to calculate the Piotroski F-score, which are further split into 3 groups (He & Tan, 2022):

Profitability;

1. Return on Assets (ROA) (F-score is assigned a value of 1 when ROA is positive, and 0 otherwise)
2. Operating Cash Flow (CFO) (If CFO is positive, F-score is 1, and 0 otherwise)
3. Change in Return of Assets (ROA) (F-score is 1 if Δ ROA is larger than zero; otherwise, F-score will be zero)
4. Accruals (If CFO is greater than ROA, F-score will equal 1; otherwise, F-score will be 0)

Leverage, Liquidity and New Issuance;

1. Change in Leverage (long-term) ratio (1 point awarded if the ratio decreases from the previous year, 0 points if it remains the same or increases)
2. Change in Current ratio (1 point awarded if the ratio decreases from the previous year, 0 points if it remains the same or increases)
3. No new shares were issued in the last year (lack of dilution) (1 point): Changes in paid-in capital are analyzed to identify the occurrence of a rights issue, which helps in detecting potential share dilution.

Operating Efficiency;

1. Change in Gross Margin (If F-score for a company is equal to 1, this means that the current year's ratio minus the prior year's ratio is greater than zero; otherwise, it equals 0)
2. Change in Asset Turnover ratio (If the current year's ratio minus prior years is greater than 0, then F-score is equal to 1; if not, it is equal to 0)

Altman Z-score (Altman): This variable is a proxy for the possibility of financial distress. Altman (1968) calculates the Z-score with the following formula:

$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5 \quad (1)$$

where

X_1 : Working capital/Total assets

X_2 : Retained Earnings/Total assets

X_3 : Earnings before interest and taxes/Total assets

X_4 : Market value equity/Book value of total debt

X_5 : Sales/Total assets

Return on Invested Capital (Roic): The return on invested capital in a company seeks to gauge the profitability generated from the capital put into an investment. It is calculated as follows (Damodaran, 2007):

$$ROIC = \frac{\text{Operating income}_t(1-\text{tax rate})}{\text{Book value of invested capital}_{t-1}} \quad (2)$$

ROIC assesses how well a company utilizes its capital to generate profits. It gauges the efficiency of capital investments by analyzing the returns generated from both debt and equity. This assessment evaluates the company's capacity to achieve success, secure financing, meet its financial obligations, and provide returns to its shareholders. A higher ROIC suggests that the company is making more profit for each dollar invested, signaling strong operational performance and effective management (Puspitasari et al., 2023).

Investment Growth Rate (Inv): It is the percentage growth of a company's investment compared to the previous period.

Price to Earnings Ratio (PE): This variable is the ratio of market price per share to the earnings per share.

Market to Book Ratio (MB): It is the ratio of the market value of a firm's stock to its book value.

Enterprise Value Ratio (FV): This variable is calculated by dividing the value of a firm to its net sales revenue.

Tobin's Q Ratio (Tobin): This variable is the ratio of total market value of a firm to the replacement cost of firm's assets. If Tobin's Q is less than 1, it suggests that the market values the company lower than the total value of its assets. Conversely, if Tobin's Q is greater than 1, it indicates that the market values the company higher than the sum of its assets. Therefore, higher Q ratios imply that the market assigns a higher performance expectation to the company (Lewellen & Badrinath, 1997).

Beneish M-score (Beneish): The Beneish M-score assesses how effectively a company manages its earnings. The M-score, akin to the Z-score but with a different aim, evaluates the likelihood of earnings manipulation instead of predicting bankruptcy signs. It comprises eight financial ratios designed to detect either potential earnings manipulation or the resulting distortions in financial statements. An M-score exceeding -2.22 suggests earnings manipulation by the company. Companies with higher Beneish M-scores are more prone to being identified as manipulators (Kukreja et al., 2020). Beneish M-score is calculated by using 8 financial ratios: DSRI (Days' Sales in Receivables Index), GMI (Gross Margin Index), AQI (Asset Quality Index), SGI (Sales Growth Index), DEPI (Depreciation Index), SGAI (Sales General and Administrative Expenses Index), LVGI (Leverage Index), TATA (Total Accruals to Total Assets) (Beneish, 1999). 8 factor M-score is calculated with the following formula:

$$M = -4.84 + 0.92 * DSRI + 0.528 * GMI + 0.404 * AQI + 0.892 * SGI + 0.115 * DEPI - 0.172 * SGAI + 4.679 * TATA - 0.327 * LVGI \quad (3)$$

3.2. Methodology

This study investigates the factors affecting Piotroski F-score. While Piotroski is the dependent variable, Altman, Roic, Inv, PE, MB, EV, Tobin and Beneish are the independent variables in the model. The variables expected to affect Piotroski F-score have been added to the model by considering the relevant literature. Due to the missing values in Beneish M-score variable, unbalanced panel data is used. Following model is used in the analysis:

$$Piotroski_{i,t} = Altman_{i,t} + Roic_{i,t} + Inv_{i,t} + PE_{i,t} + MB_{i,t} + EV_{i,t} + Tobin_{i,t} + Beneish_{i,t} \quad (4)$$

Fixed effects panel data analysis is used in this paper. Time invariant heterogeneity and unobserved time varying and time invariant factors can be controlled in the fixed effects specification. To choose between fixed effects and pooled OLS model F test is conducted. As a result of F test, fixed effect specification is preferred to OLS. Secondly, Breusch Pagan Lagrangian Multiplier test is performed to decide between random effects and OLS models. As a result, random effects estimator is chosen. Finally, based on Hausman test, fixed effects estimator is preferred over the random effects estimator. Furthermore, to mitigate the cross-sectional dependency, heteroscedasticity and autocorrelation issues, Driscoll and Kraay (1998) estimator is used. This reliable estimator is opted because it's commonly advised for fixed effect models, especially when the number of entities (N) is greater than the time periods (T) in the panel dataset, which holds true for this study. Driscoll and Kraay (1998) build on large-T asymptotics to show that the standard nonparametric covariance matrix estimator for time-series data can be adjusted to handle both cross-sectional and temporal dependencies. Their method essentially adapts a Newey-West-style correction to the cross-sectional averages of the moment conditions. By modifying the standard error estimates in this way, their approach ensures that the covariance matrix estimator remains consistent, even as the cross-sectional dimension (N) grows indefinitely. This innovation addresses the shortcomings of other large-T-consistent estimators, like the Parks-Kmenta and PCSE methods, which tend to become unreliable when the cross-sectional dimension (N) of a panel dataset is very large (Hoechle, 2007).

4. EMPIRICAL RESULTS

The descriptive statistics of the variables used in this study is shown in Table 1 below. Average firm in the sample has a Piotroski F-score of 5.45. Since Piotroski F-score below 7 indicates weaker financial strength, the financial strength of the sample companies is found out to be weak. The mean value of Altman Z-score is 6.85 (it is above 2.99) and it shows that the sample companies are financially healthy and not at risk of bankruptcy. In terms of earnings manipulation, the sample companies does not show an indication of financial fraud. Since the average Beneish M-score is less than -2.22, the firms have lower tendency to commit fraud. Roic is a tool used to gauge if a company is effectively generating value from the money it puts into its operations. Average Roic value of the firms is 16.71% and this shows that the companies have efficient capital utilization and strong value creation potential.

Furthermore, the manufacturing firms show 108.65% investment growth compared to the previous years. PE and MB ratios of the sample companies are 30.99% and 5.28%, respectively. The generally accepted PE ratio is around 20. Stocks in firms with a PE ratio above 20 are considered expensive, and stocks in firms with a PE ratio below 20 are considered cheap. When a firm's PE ratio is high, the firm's future expectations are high. The limit value for MB rate is considered to be 1. If the MB ratio is greater than 1, this usually indicates that the corresponding firm has profitability or growth potential. A high MB ratio can also reflect investor confidence in a firm. Therefore, these values suggest that investors are willing to pay a higher stock price than the current profit rate because they expect higher profits. The value of the firms is 2.17 times its net sales revenue in average. Finally, average firm has a 2.04 Tobin's Q ratio.

Table 1. Descriptive Statistics

Variable	N	Mean	Sd	p25	p50	p75	min	max
Piotroski	4448	5.45	1.67	4.00	5.00	7.00	1.00	9.00
Altman	4448	6.85	5.24	4.85	6.60	8.91	-41.03	32.75
Roic	4448	16.71	34.40	3.55	11.26	22.94	-99.29	385.36
Inv	4448	108.65	392.21	3.55	19.78	66.71	-95.06	994.37
PE	4448	30.99	242.48	0.00	8.09	17.28	1.13	791.89
MB	4448	5.28	90.06	1.14	1.93	3.65	0.22	226.47
EV	4448	2.17	3.94	0.74	1.18	2.07	0.05	67.70
Tobin	4448	2.04	2.88	1.07	1.37	2.00	0.41	61.70
Beneish	4367	-2.20	25.23	-2.58	-2.04	-1.33	-28.90	90.26

Source: Created by authors with using Finnet Stock Expert (2024).

Pearson correlation coefficients are shown in Table 2. According to the results of Table 2, there is not any multicollinearity issue in the variables. Since the multicollinearity affects the reliability of the regression results, it should be checked firstly. There is not high level of correlation (75%) among the variables. Furthermore, Altman Z-score and Roic positively and significantly affect Piotroski. However, EV variable has a negative impact on Piotroski. While Roic positively affects Altman, Inv and EV negatively affect it. Inv and EV have negative relation with Roic, and Tobin has a positive relation with Roic. There is a positive relation between Tobin and PE. EV also positively affects PE. Finally, Tobin has positive relation with Roic, MB and EV.

Table 2. Pearson Correlation Matrix

	Piotroski	Altman	Roic	Inv	PE	MB	EV	Tobin	Beneish
Piotroski	1								
Altman	0.2035*	1							
Roic	0.2389*	0.2551*	1						
Inv	-0.0502*	-0.1161*	-0.0420*	1					
PE	-0.0117	-0.0031	-0.0183	-0.0082	1				
MB	0.0102	-0.0065	-0.0043	-0.0022	0.0052	1			
EV	-0.0626*	-0.0826*	-0.0603*	0.0531*	0.0776*	0.0334	1		
Tobin	0.0312	0.0206	0.1341*	0.0297	0.0961*	0.0708*	0.6279*	1	
Beneish	-0.0241	-0.0071	-0.0137	0.0189	0.0040	0.0009	0.0169	0.0050	1

Source: Created by authors with using Finnet Stock Expert (2024).

Variance inflation factors (VIF) are also calculated in order to be sure of the absence of multicollinearity problem and it is shown in Table 3. VIF value above 10 is indicative of a serious multicollinearity. VIF value is below 10 for all of the independent variables used in the model. Therefore, there is not any multicollinearity issue among the predictor variables.

Table 3. VIF Values

Variable	VIF	1/VIF
Tobin	2.73	0.365778
EV	2.32	0.430475
Altman	1.53	0.654995
Roic	1.38	0.724877
PE	1.08	0.926806
Inv	1.04	0.958939
MB	1.01	0.991303
Beneish	1.01	0.994168
Mean VIF	1.51	

Source: Created by authors with using Finnet Stock Expert (2024).

In order to test cross sectional dependency, the CD test described in Pesaran (2004) and Pesaran (2015) is used. Cross sectional dependence test results are shown in Table 4.

Table 4. Cross Sectional Dependence Test

Variable	CD-test	p-value	average joint T	mean ρ	mean abs(ρ)
Piotroski	19.602	0	30.78	0.03	0.22
Altman	35.459	0	30.78	0.06	0.38
Roic	98.899	0	30.78	0.18	0.41
Inv	346.497	0	30.78	0.61	0.62
PE	23.831	0	30.78	0.04	0.17
MB	168.776	0	30.78	0.30	0.37
EV	192.644	0	30.78	0.34	0.40
Tobin	195.05	0	30.78	0.35	0.41
Beneish	126.669	0	29.68	0.23	0.30

Source: Created by authors with using Finnet Stock Expert (2024).

Since Pesaran CD test is appropriate when number of cross sections (N) is greater than time dimension (T), it is used in this study. The p-values for all of the regressions are zero. Therefore, the null is rejected which states a cross-sectional independence.

Table 5. CADF Panel Unit Root Test

Variables	I(0) Level
Piotroski	(-6.956)***
Altman	(-4.041)***
Roic	(-7.115)***
Inv	(-18.747)*
PE	(-11.706)***
MB	(-14.951)***
EV	(-1.278)***
Tobin	(-6.757)***
Beneish	(-5.571)***

Source: Created by authors with using Finnet Stock Expert (2024).

Table 5 presents the results of the unit root tests for the variables. To address the issue of cross-sectional dependence in the data, the CADF unit root test developed by Pesaran (2007) is used, as it accounts for this problem. The test results indicate that all variables are stationary at the I(0) level. This outcome leads us to reject the null hypothesis of a unit root, providing confirmation that the series are stationary.

Table 6 shows the autocorrelation and heteroskedasticity test results. Firstly, Durbin-Watson and Baltagi-Wu LBI tests are done in order to test the autocorrelation issue. Since the t statistics of these tests are below 2, there is an autocorrelation issue in the model. Secondly, Modified Wald test is used in order to check heteroskedasticity in the model. The null hypothesis which indicates there is homoscedasticity is rejected. This result suggests that there are varying levels of variability in the errors across different sections, along with some correlations among them. Heteroscedasticity like this can seriously affect the trustworthiness of our regression findings, so it's important to take steps to address it.

Table 6. Heterogeneity, Autocorrelation and Heteroskedasticity Test Results

	Test Statistics	P-Value
Autocorrelation		
Durbin-Watson	0.864	
Baltagi-Wu LBI	0.952	
Heteroskedasticity		
Modified Wald test	617.88	0

Source: Created by authors with using Finnet Stock Expert (2024).

Table 7 shows the results of F test, Hausman test and Breusch Pagan Lagrangian Multiplier test. These tests have been done in order to determine the appropriate model for the analysis. Firstly, the F test is conducted and it is concluded that fixed effects estimator is preferred to pooled OLS method

Secondly, Breusch Pagan LM test have been performed in order to decide between random effects estimator and OLS method. The null hypothesis in the LM test is that variances across entities is equal to zero. Since the null is rejected with a zero p-value, random effects model is preferred to OLS method. Finally, Hausman test have been done in order to make a decision between random effects estimator and fixed effect estimator. Since the null is rejected in the Hausman test, fixed effect estimator is preferred to random effect estimator.

Table 7. Hausman Test and Breusch Pagan Lagrangian Multiplier Test

Test	Test statistics	p-value
F Test	41.09	0
Hausman Test	18.84	0.02
Breusch and Pagan LM test	590.16	0

Since there are autocorrelation, heteroskedasticity and cross-sectional dependence issues in the model, Driscoll and Kraay (1998) standard error estimator is used in order to eliminate these statistical problems. According to the regression results in Table 8, Altman, Roic, MB, Tobin and Beneish variable have impacts on Piotroski F-score. Except Beneish, all the other variables positively affect Piotroski. Altman Z-score positively affects the financial strength of the manufacturing companies. Therefore, firms with lower risk of financial distress supposed to have higher financial health. Furthermore, the coefficient of Roic variable is positive as well. Thus, companies with higher Roic exhibit higher F-score, as better return on invested capital exhibit higher financial health. In addition, a positive relation between MB and Piotroski is reported in Table 8.

Table 8. Regression Results

Piotroski	Drisc/Kraay			
	Coefficient	Std. Err.	T statistics	P
Altman	0.060517	0.01052	5.75	0
Roic	0.008254	0.002322	3.55	0.001
Inv	-8.2E-05	6.96E-05	-1.18	0.24
PE	0.000158	0.000152	1.04	0.3
MB	0.0003	0.000112	2.68	0.008
EV	-0.02263	0.015078	-1.5	0.136
Tobin	0.041269	0.023487	1.76	0.081
Beneish	-0.00152	0.00078	-1.95	0.053
_cons	4.861856	0.098384	49.42	0

Source: Created by authors with using Finnet Stock Expert (2024).

Any firm that has an Altman Z-score below 1.8 is said to be financially distressed and toast unless there's a high risk of going bankrupt. Whereas a score of 3 and beyond has the company in the 'safe' zone with a minimal chance of filing for bankruptcy. The average Altman Z-score of the analyzed companies is 6.85, which indicates that these companies are of good financial health in relation to the Piotroski F-score. ROIC relates more with the growth status of the company. This would mean that

businesses which have a higher ROIC. Those which perform their operations more efficiently, will earn a higher income per unit of invested capital and will be in a position to continue investing later on. Since the average ROIC of the companies under analysis is 16.71%, it is expected to have a positive impact on the Piotroski F-score. The MB ratio preferred value is 1. MB ratio equal to 1 implies that the company's equity equals the book value. The average MB value for the companies analyzed is 5.28%. While this figure gives an impression that the shares are over-priced, and so, less attractive investments, they hold true to be preferred investments by investors because they represent financially healthy companies with high Piotroski F-scores. Another independent variable which significantly and positively affects Piotroski is Tobin. A higher Tobin's Q value indicates a higher performance expectation from the company. According to the regression results if the market assigns higher performance expectation to the company, the firm will have higher financial health. This is the excess of the market value of companies over their registered assets for companies that have a Tobin's Q ratio in excess of 1. Since the average Tobin's Q ratio of the companies being analyzed is 2.04, it means that these are companies which can be invested in be added to the investor's portfolios. This is also evidenced by the positive effect of this ratio on the Piotroski F-score. Finally, the regression results report a negative relation between Beneish and Piotroski. A higher Beneish M-score is an indication of greater likelihood of earnings manipulation. A Beneish M-score greater than -2.22 indicates a likelihood of earnings manipulation by the company. Firms with higher Beneish M-scores are more likely to be classified as manipulators (Kukreja et al., 2020). Firms with a high Piotroski F-score tend to have a Beneish M-score close to -2.22. As the Beneish M-score increases, the Piotroski F-score decreases because a higher M-score indicates a greater likelihood of earnings manipulation. This serves as an indication of lower financial health. Therefore, high M-score firms have lower Piotroski F-score thus lower financial health according to Table 8.

5. CONCLUSION

Fama and French (1992) shows that value stocks tend to outperform growth stocks. However, effectively identifying these value stocks and constructing a profitable investment strategy based on them can be challenging and time-consuming. To tackle this challenge, Piotroski developed a model in 2000 that helps identify potentially profitable stocks within the value investing framework. The Piotroski F-score, a key component of this model, serves as a tool for predicting future profitability of companies. Additionally, research by Turtle and Wang (2017) suggests that the F-score can also be used to assess whether the market accurately reflects fundamental information in stock prices. Piotroski F-score is used as a proxy for financial health of a company and financial health of the companies is one of the important factors that affects the investment decisions of the investors. Hence, determination of the financial health of the firms has been an important topic in finance literature. By including profitability, liquidity and operating efficiency variables, this score has been accepted as a favorite metric that determine the strength of a company's financial position. The current study uses Piotroski

F-score as a proxy for financial health and investigates the factors effective on financial health of the Borsa İstanbul manufacturing industry firms. The relevant literature related to Piotroski F-score either examine the impact of firm specific debt structure ratios on the score or investigate the financial performances of the related firms. However, this study fills an important gap in the literature by examining the financial determinants of Piotroski F-score.

According to the fixed effect panel regression with using Driscoll and Kraay (1998) standard error estimators results, the sample firms have higher financial health if they have higher Altman Z-score, higher roic, higher MB, higher Tobin and lower Beneish M-score. Therefore, the analysis results show that firms with higher financial distress will have lower financial health. Furthermore, if the sample firms have better return on invested capital and higher market to book ratios, they will end up with higher financial health as well. While firms with higher performance show higher financial health, the firms with greater likelihood of earnings manipulation have lower financial health. These results highlight the considerations that firms need to take into account to improve their financial health. One of the conclusions drawn is that financial distress should be kept as low as possible to enhance financial health. Additionally, firms should maintain high market value, growth potential, and performance. Lastly, the lower the likelihood of earnings manipulation, the higher the financial health of companies.

The time period, the focus on a single industry, and the consideration of only Borsa İstanbul firms are limitations of this study. The findings obtained will serve to assist investment decisions for both firms and existing and potential investors. Moreover, this study is innovative in that it associates the financial health of firms with the determinants of Piotroski F-score. It is also open to improvement because of the different period considered, the firms studied, the variables involved and the methodology used. For future research, this analysis can be conducted across different industries and countries. A comparison could also be made between the results of Turkish firms and those of foreign firms.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that they all equally contributed to all processes of the research.

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Recourse Relationship within the Framework of Legal Representatives' Liability for Tax Debts of Limited Liability Companies

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Abstract

In limited liability companies, legal representatives are held liable for tax debts in the event that tax duties are not duly fulfilled. In this study, we investigate the extent of the right of recourse available to legal representatives who, having been held accountable for the tax liabilities of a company, were compelled to settle such debts. Additionally, we explore the legal foundation of this right of recourse and identify the parties against whom the legal representatives may exercise this right. It is also explicitly regulated in the law that the legal representatives may file a recourse action against the company in case of payment to the tax administration. Although the wording of the legal regulation only includes the right of recourse for tax receivables, legal representatives have the right to apply to the company for other tax-related receivables and tax penalties. In addition to the main taxpayer company, legal representatives have the right of recourse to other legal representatives in accordance with the liability provisions of company law. Although it is not explicitly regulated in the law, since the economic benefit ultimately belongs to the shareholders due to the activities carried out by the company, the legal representative who pays the tax debt has the right of recourse to the shareholders of the company in proportion to their shares.

Keywords: *Legal representative, tax obligation, responsibility, recourse*



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<https://doi.org/10.30798/makuiibf.1479316>

Article Type	Application Date	Admission Date
Research Article	May 6, 2024	December 17, 2024

1. INTRODUCTION

Although legal entities have a separate and independent personality from the persons who incorporate them, due to the nature of their personality, they have to act through real persons in the legal world. In cases where legal entities are taxpayers due to their activities, the fulfilment of the material duty (payment of the debt) and formal duties must be realised through third party representatives.

Tax Procedure Law 10 ("TPL") contains a specific provision pertaining to the payment of tax debts attributed to legal entity taxpayers. This provision mandates that the tax obligations of legal entities shall be fulfilled by their legal representatives. The legal consequence of failing to fulfill this duty is addressed in the second paragraph of the same article, establishing the liability regime for legal representatives, who must pay the tax debts from their assets if the legal entity fails to fulfill its duty. In this context, the examination should focus on identifying against whom and to what extent the legal representative, who has had to pay the company's tax debt, has the right to seek recourse for the amount paid.

The only regulation concerning the right to seek recourse for legal representatives who pay the company's debts, in accordance with the law, is found in TPL Article 10, which allows legal representatives to seek reimbursement from the company for the tax paid. However, there are no specific regulations regarding the scope of this right to seek recourse, nor whether the legal representative can seek recourse against other legal representatives or partners.

In this study, the subject matter is analyzed in three parts. Firstly, the concept of a legal representative is examined. Secondly, the legal basis for the right of recourse available to legal representatives is explored. Finally, the scope of this right of recourse is evaluated.

2. CONCEPT OF LEGAL REPRESENTATIVE

2.1. The Concept of Legal Representative in Limited Liability Companies

While the execution of a legal transaction on behalf of and on account of another person and the ensuing legal ramifications of such actions delineate the relationship of representation (Tekinay et al., 1988: 220; Oğuzman & Öz, 2022a, p. 220; Candan, 1998, p. 7), legal representation specifically pertains to instances where authority of representation does not stem from the unilateral declaration of will of the represented party, but rather from the statutory provisions of law. In such instances, the person acting on behalf of the represented party is denoted as the legal representative (Kocayusufpaşaoğlu et al., 2014, p. 628; İnceoğlu, 2009, p. 40; Eren, 2022a, p. 943). Although the management bodies of legal entities have the authority of representation pursuant to the provisions of the law, it is generally accepted that the relationship between the legal entity and the body is not an ordinary representation relationship (Tekinay et al., 1998, p. 223; Eren, 2022a, p. 945, Gümüş, 2021, p. 377). The provisions of the Turkish Code of Obligations ("*TCO*") elucidate that the declaration of will of the representative is deemed to be their own declaration. Conversely, when an organ of a legal entity issues a declaration of will, it is not

considered the declaration of will of the third party but instead construed as the declaration of will of the entity itself (Oğuzman & Öz, 2022a, p. 221, Dn. 617; Gümüş, 2021, p. 377; Kocayusufpaşaoğlu et al., 2014, p. 629-630).

Although it is controversial whether the organs of legal entities qualify as legal representatives, it is necessary to clarify what is meant by the concept of legal representative within the scope of TPL 10 in terms of the tax obligations of the relevant legal entity. In this context, we posit that the concept of a legal representative refers the individuals who are authorised and held accountable for ensuring the fulfilment of the tax obligations incumbent upon the legal entity. In the case of limited liability companies, given that the company is represented and legally bound by the managers in accordance with the provisions of Turkish Commercial Code ("*TCC*") 623 et seq., it is imperative to acknowledge that the managers, comprising the governing body of the company, can indeed be regarded as legal representatives within the scope of TPL 10 (Şenyüz et al., 2022, p. 94; Tunç, 2021, p. 268; Akyürek, 2022, p. 50 et seq.). The judicial decisions consistently qualify the limited liability company managers as legal representatives within the scope of TPL 10. (see Yargıtay 11. HD, E. 2015/7444, K. 2016/2505, T. 7.3.2016; Yargıtay 11. HD, E. 2020/6946, K. 2022/4124, T. 26.5.2022. Kazancı Case Law Bank, Access: 24.03.2024.)

A similar approach is likewise embraced within German law. In this legal system, it is acknowledged that the managers of limited liability companies are to be deemed legal representatives pursuant to *Abgabenordnung* ("*AO*") 34/1, which stipulates that the tax obligations of legal entities are to be discharged by their legal representatives (Schmittmann, 2014, p. 443; Karabulut, 2014, p. 103). A decision of the German Federal Tax Court ("*Bundesfinanzhof*") provides that if several directors are appointed, each director is liable to discharge the tax obligations in the context of AO 34 (Bundesfinanzhof ("*BFH*"), Urteil vom 14. März 2012, XI R 33/09, N. 65).

2.2. Assessment Regarding the Transfer of Managerial and Representative Authorisations

In limited liability companies, pursuant to the provisions of TCC 577/1-i and TCC 625/1-d, the managerial authority may be delegated to one or more of the managers, or it may be delegated to third parties who do not hold the title of manager, provided that this is clearly permitted by the articles of association of the company (Şener, 2017, p. 701; Kendigelen & Kırca, 2022, p. 117). Although there are no special provisions on the delegation of representative authority within the provisions specific to limited liability companies, it is acknowledged that representative authority may be delegated in limited liability companies by the application of the provisions on the delegation of representative authority in joint stock companies by analogy pursuant to the reference made in Article 629 of the TCC (Şener, 2017, pp. 701-702; Akyürek, 2022, p. 64).

If the transferred authority relates to the discharging of tax obligations, divergent viewpoints exist within legal doctrine regarding the status of the transferors and transferees concerning the title of

legal representative. According to the first viewpoint, the term “legal representative” denotes an authority of representation governed by law. In instances of delegation of management or representation authority, the governing body will persist in holding the designation of “legal representative”, since the representation authority of the transferee derives from the articles of association, not directly from the law (Kaneti et al., 2021, p. 132; Bozkurt, 2008, p. 261; Bağdınlı, 1998, p. 62). According to the other view that has garnered prominence within the doctrine, if the management and representation authority is duly transferred, the transferees will likewise assume the designation of “legal representative” within the scope of TPL 10 (Çamoğlu, 2003, p. 142; Helvacı, 2001, p. 105,106; Yıldız, 2001, p. 782,783; Barlas, 2006, p. 89; Can, 2017, p. 75; Üstün, 2013, p. 35; Batı, 2023, 180; Karayalçın, 1994; Yaralı, 2011, p. 64).

According to the General Communiqué on Collection, which shows the administration's approach to the concept of legal representative, "*... if it is understood that the authority to represent the company is left to the executive member or members and third parties as managers, it is necessary to pursue and collect the public receivable from them, and in this case, no action should be taken against the other members of the board of directors.*", it could be inferred that in instances of the transfer of management and representation powers, it is plausible to adopt the stance that the transferees also assume the title of “legal representative” (Yanlı, 2013, p. 74).

Upon analysis of judicial rulings, it becomes evident that the prevailing consensus is embraced. For example, in a decision of the Council of State (“*Danıştay*”), the following statements are made "*...According to the provisions of the Turkish Commercial Code, in order to be able to talk about the legal representation authority of a person, the person in question must be a member of the board of directors, or a member of the board of directors appointed as a manager by the board of directors, or not a member of the board of directors, but appointed as a manager by the board of directors...*" (Danıştay 9. D, E. 2008/6275, K. 2010/51, T. 20.1.2010, Kazancı Case Law Bank, Access: 12.02.2024. In the same direction, see Danıştay 3. D, E. 2017/2259, K. 2021/1020, T. 23.2.2021, Council of State Case Law Data Bank, Access: 28.03.2024.).

The German law provides if the division of duties between the managers of a limited liability company is clearly and unambiguously determined and this process is carried out in accordance with the law, the liability of the managers will be limited, but not eliminated. The German law embraces that even if there is a division of duties, the supervision obligation of the company managers continues (Schmittmann, 2014, p. 444; Karabulut, 2014, p. 111; BFH, Urteil vom 23. Juni 1998 VII R 4/98).

In the event that the powers of the managers of limited liability companies are transferred, the transferees are primarily liable for the works subject to the transfer, only the supervisory obligations of the transferors continue within the scope of TCC 625/1-d provision (Altay, 2011, p. 286; Doğan, 2011, p. 278). In our opinion, it is difficult to reconcile the notion that directors' tax liability persists in its

entirety following the proper transfer of authority. The reason for this is that the directors may delegate their representation powers like their management powers, and some of the directors may not even have any representation authority. In this respect, as upheld by the prevailing view, in case of the transfer of management and representation authority, if the violated tax liability in question pertains to a delegated authority, it would be a more appropriate to acknowledge that the designation of “legal representative” pertains to the transferee, who holds the original ownership of the said authority. However, pursuant to Article 625/1-d of the TCC, even if the managers have delegated their managerial authority, since their supervisory obligations continue, it would be an accurate and equitable assessment to conclude that the delegation of authority does not eliminate the liability, but only limits it to the supervisory obligation. In other words, when considering the obligation of superior supervision, despite the considerable challenge for tax administrations to ascertain this in practical terms, it remains imperative to assert that company managers bear liability alongside the authorized individual who neglects to fulfill the tax obligation.

3. FOUNDATION OF THE RIGHT OF RECOURSE OF THE LEGAL REPRESENTATIVE

3.1. Foundation for the Right of Recourse to the Taxpayer Company

It is clearly regulated in the Law that the legal representative, whose liability is invoked pursuant to TPL 10 following the failure to discharge the tax duty properly and who settles the debt, has the right to seek recourse from the company, which is the true debtor of the tax, concerning the discharged tax obligation (TPL 10/3). According to the relevant regulation, legal representatives may seek recourse from the original taxpayers for the taxes discharged within the scope of TPL 10/2.

Regarding the scope of the legal representative's right of recourse, in addition to legal regulations, recourse claims arising from the legal relationship between the company and the representative may also come into question. In limited liability companies, the nature of the legal relationship between the managers and the company is a contractual relationship. In the contract to be concluded between the parties, it is also possible to incorporate specific provisions pertaining to the right of recourse in the event of payment of the tax debt. In legal proceedings initiated by the legal representative, it is possible to rely on the contractual provisions as well as the legal regulations.

Another issue to be examined in terms of the legal foundation of the right of recourse against the company is whether such recourse is permissible in the scenario where the legal representative makes a payment before their obligation to pay has arisen. Akyürek states that since, in limited liability companies, the legal relationship between the managers and the company is a contractual relationship, the provisions of the contract should be relied upon and the provisions of unjust enrichment or unauthorised performance of work provisions cannot be relied upon (Akyürek, 2022, p. 122). In our opinion, it is difficult to say that there is a contractual right of recourse regarding the tax debt paid directly by the legal representative when evaluated only within the framework of the managerial

relationship, unless there is a special arrangement in the contractual relationship between the limited liability company and the managers that the tax debt will be paid by the company manager when necessary and that the company has the right of recourse to the company after payment.

In the absence of any obligation to undertake specific tasks, if work essential for the business owner is carried out for the business owner in consequence of the business owner's need for assistance within the context of willingness to perform work for someone else, it is permissible to characterize such actions as genuine unauthorised performance of work (Gümüş, 2012, p. 219 et seq.). Even if there is a relationship of performance of work between the parties, it is acknowledged that exceeding the boundaries delineated in the contract constitutes unauthorised performance of work (Tandoğan, 1987, p. 678; Zevkliler & Gökyayla, 2021, p. 679; Gümüş, 2012, p. 220). For example, although it is not directly related to the subject, in a decision of the Court of Cassation concerning contract of construction, it is stated that if works other than those specified in the contract are undertaken, compensation for the work executed can solely be pursued based on the provisions governing unauthorised performance of work (15. HD, E. 2018/5055, K. 2018/5149, T. 19.12.2018, Kazancı Case Law Bank, Access: 04.04.2024).

If the legal representative does not currently bear any payment obligation, the payment made by them does not constitute a necessary and obligatory fulfillment of debt arising from the contractual relationship, unless explicitly specified in the contract between the company and the legal representative. Despite the absence of a payment obligation on the part of the legal representative, we contend that the settlement of a debt that the business owner is obligated to pay should be regarded as unauthorised performance of work within the framework of the provisions of TCO 526 et seq.

3.2. Foundation of Right of Recourse to Other Legal Representatives

If there is more than one legal representative and they are liable for the debt within the scope of TPL 10/2, there is no regulation in the Law on the nature of the relationship between these persons. The predominant opinion on the subject maintains that joint and several liability should be mentioned in this case (Şenyüz et al., 2022; Gerçek, 2005, p. 182; Pınar, 2021, p. 302; Can, 2017, p. 75; Balcı, 2021, p. 621; Yaralı, 2011, p. 183). One of the justifications for this viewpoint is that the TCC embraces the joint and several liability regime on the subject of liability of the members of the board of directors in joint stock companies (Candan, 1998, p. 135). According to the contrasting minority perspective, for the joint liability framework to be invoked concerning a debt, either a contractual clause or a statutory provision explicitly addressing this matter is requisite. Furthermore, in instances of joint indebtedness, joint liability, rather than joint and several liability, is deemed applicable (Yıldız, 2001, p. 794).

In a recent decision of the Council of State on the subject, it is stated that debtors are jointly and severally liable in cases where there is more than one legal representative, but the justification for this opinion is not included (Danıştay Vergi Dava Daireleri Kurulu, E. 2014/144, K. 2014/307, T. 30.4.2014,

Case Law Bank, Access: 07.02.2024). An old decision of the Council of State provides that the legal representatives are jointly and severally liable under TPL 10, and as a justification for this, the provision of the Abrogated Turkish Commercial Code ("ATCC") 336, which regulates that the members of the board of directors are jointly and severally liable to the company, its shareholders and its creditors is included. The relevant decision is as follows: "...On the other hand, in the subparagraph 5 of the first paragraph of Article 336 of the Turkish Commercial Code, which determines the liability of the members of the board of directors in joint stock companies, it has been explained that the members of the board of directors are jointly and severally liable to the shareholders ..." (Danıştay 7. D. E. 1989/1695, K. 1990/3503, T. 13.11.1990, Legalbank Electronic Law Bank, Access: 7.2.2024. For another decision in the same direction, see Danıştay, 11. D, 11th D, E. 1997/2550, K. 1999/224, T. 26.1.1999, Kazancı Case Law Bank, Access: 08.02.2024).

In a decision of the Court of Cassation on the subject, it is expressed that the foundation of joint and several liability originates from the provision of ATCC 336 as follows "... On the other hand, Article 317 of the TCC stipulates that "the representation and management of a joint stock company shall be carried out by the board of director..., ...all members of the board of directors will be jointly and severally responsible for unpaid tax debts in joint stock companies)." (Yargıtay 17. HD, E. 2014/18372, K. 2016/9085, T. 18.10.2016. In the same direction, see Yargıtay 11. HD, E. 2011/4753, K. 2011/7389, T. 14.6.2011, Kazancı Case Law Bank, Access: 12.02.2024).

In another ruling of the Court of Cassation concerning the stipulation of Article 35 of the Law on the Procedure for the Collection of Public Receivables ("LPCPR"), which parallels TPL 10 regarding the liability of legal representatives for public debts, reference is made to the provisions of the TCO concerning the joint and several liability regime and the presumption of solidarity outlined in the TCC 7 concerning commercial enterprises and it is concluded that legal representatives are subject to the joint and several liability regime concerning public receivables (Yargıtay 11. HD, E. 2016/12207, K. 2018/771, T. 5.2.2018, Kazancı Case Law Bank, Access: 12.02.2024).

In our law, in order to talk about joint and several liability, there must be a regulation in this direction in the law or the debtors must have accepted to be responsible for the entire debt in the legal relationship between the creditor and the debtor in accordance with TCO 162 (Eren, 2022b, p. 2711; Oğuzman & Öz, 2022b, p. 480; Gümüş, 2021, p. 1052). As a matter of fact, when the legislation on tax debts is analysed, it is seen that the joint liability regime is specifically foreseen for some cases of joint indebtedness. For example, Article 10/5 of TPL clearly stipulates that in the event that legal entities are liquidated and removed from the trade registry, the legal representatives for the pre-liquidation period and the liquidators for the post-liquidation period are jointly and severally liable for tax debts and penalties. In the sixth paragraph of the same provision, the joint and several liability regime is explicitly applied to the liability for tax debts and penalties in cases of the dissolution of legal entities and entities lacking legal personality, which fall outside the purview of the fifth paragraph.

Since the Article 10/2 of the TPL, which regulates the liability of legal representatives concerning tax debts, does not foresee a joint and several liability regime, it is necessary to determine the legal foundation for joint and several liability. The joint and several liability of the directors and managers of limited liability companies for the damages caused to the shareholders, the company and the creditors of the company is regulated under TCC 557 as per the reference made in TCC 644/1-a. Scholarly opinion acknowledges that the solidarity regime stipulated under TCC 557 may be applicable to all provisions of TCC 549 et seq. regarding legal liability (Altay, 2011, p. 324. In Swiss law, see Venturi and Bauen, 2007, p. 244; Corboz & Girardin, 2017: Art. 759, N. 13). In this case, it is imperative to assert that the solidarity regime stipulated under TCC 557 constitutes a comprehensive regulation in the lawsuits concerning the accountability of company managers, and will be applicable in situations where multiple individuals bear liability solely by virtue of their status as company managers. Therefore, it should be concluded that the company managers, held liable as legal representatives in limited liability companies under TPL 10, are subject to joint and several liability pursuant to TCC 557 (Akyürek, 2022, p. 129 et seq.).

The joint and several liability regulated under Article 557 of the TCC, which allows the responsible parties to claim individual reduction grounds in the external relationship against the injured party, is termed as the principle of differentiated solidarity (For detailed information, see Helvacı, 2013, p. 85; Çamurcu 2015, p. 105 et seq.). Since the only legal foundation for the joint and several liability of legal representatives in limited liability companies within the scope of TPL 10/2 is TCC 557, it is clear that the principle of differentiated solidarity will be applied in the event of joint and liability of company managers. However, while theoretically feasible for the tax authority, unable to recover tax receivables from the principle taxpayer company, to assess individual reduction grounds for each legal representative within the framework of the TCC 557 provisions and subsequently make requests accordingly, such a scenario appears unlikely in practice (Akyürek, 2022, p. 130 et seq.). For this reason, it is beneficial to adopt a specific regulation concerning an applicable solidarity regime appropriate to the nature of the business with respect to the liability of legal representatives in terms of tax receivables.

Since there is a differentiated solidarity relationship amongst the legal representatives within the scope of TCC 557, the legal representative who pays more than his/her share in the internal relationship should be entitled to apply to other legal representatives within the scope of TCC 557/3.

3.3. Foundation of the Right of Recourse to the Shareholders of a Limited Liability Company

According to LPCPR 35, the partners of limited liability companies are liable for the unpaid public debts of the company in proportion to their shares. Pursuant to this regulation, in order for the administration to resort to the partners of a limited liability company for the public debt of the company, it is necessary to first resort to the legal entity of such company and as a result of this application, the receivable must remain uncollected or it must be understood that it will not be able to be collected. In

other words, it is not possible to have recourse directly to the partners of the company for the public debt of the company (Gerçek, 2015, p. 49; Yasan, 2018, p. 476; Bakmaz, 2022, p. 19; Coşkun 2021, p. 378. For the relevant ruling, see Yargıtay 23. HD, E. 2014/8950, K. 2014/6998, T. 5.11.2014, Court of Cassation Precedent Decision Database, Access: 28.03.2024).

If a limited liability company's tax debts are not collected from the company, there are two different groups that the administration can resort to: legal representatives and partners. There is no provision in the law regarding whether there is any order of priority between these two groups, which have secondary responsibility for the company's public debts, in terms of liability for public debt. For this reason, there have been different judicial rulings on the subject, and finally, with the jurisprudence unification decision dated 11.12.2018 issued by the Council of State Assembly of the Unification on Conflicted Judgements (“*Danıştay İçtihadı Birleştirme Kurulu*”), it has been acknowledged that there is no priority-subsidary relationship between company partners and legal representatives and that the administration may request payment from one of the two responsible groups (Danıştay İçtihadı Birleştirme Kurulu., E. 2013/1, K. 2018/1, T. 11.12.2018, Lexpera Law Database, Access: 19.03.2024). In this case, it becomes necessary to evaluate whether the legal representative, initially resorted to for payment, has the right to seek recourse from the partners who are responsible for the same debt in accordance with the provision of 35/1 of the LPCPR subsequent to the legal representative’s settlement of the debt.

As explained above, the liability of legal representatives and partners of limited liability companies for unpaid tax debts is based on different legal provisions (TPL 10/2 and LPCPR 35/1). TCO 61 provides that the rules of joint and several liability shall be applied to the persons who are liable for the same damage for various legal reasons, and TCO 62, when regulating the recourse relationship between the liable parties, by stating "all circumstances and conditions, especially the gravity of the fault that can be attributed to each of them and the intensity of the danger they create, shall be taken into consideration", stipulates that the conditions of the concrete case shall be taken into consideration in the recourse relationship. In this case, if legal representatives and partners are liable for the same tax debt, the relationship between them is a joint and several liability relationship based on different legal reasons in terms of external relationship, and it is necessary to conclude that there may be a recourse relationship between these liables.

While examining the right of recourse of the legal representative to the company partners, it is useful to act on economic realities while assessing "*all circumstances and conditions*". Limited liability companies are established with the aim of achieving an economic objective like other commercial companies. The economic gains derived from the company's operations indirectly contribute to the interests of its partners. In other words, the profits accrued from the company's activities ultimately accrue to the partners (Akyürek, 2022, p. 214; Pınar, 2021, p. 308). As such, it would be a more accurate assessment in terms of equity to conclude that the shareholders of the company are ultimately

responsible for the tax liabilities arising from the activities of the company (For the contrary opinion, see Taş, 2019, p. 281). A ruling of the Court of Cassation on the subject maintains that the legal representative who has had to pay the company's debt has the right to seek recourse from the company shareholders by stating "*In the event that the payment is made by the legal representative, it is clear that, pursuant to the Repeated Article 35 of the Law No. 6183 and Article 147/2 of the Code of Civil Procedure No. 818, the legal representative must first seek recourse from the company, but if they fail to obtain a result, they may use their right to seek recourse from the company shareholders, otherwise they will be personally liable for the consequences of their act.*" (Yargıtay 11. HD, E. 2016/12207, K. 2018/771, T. 5.2.2018, Kazancı Case Law Bank, Access: 04.04.2024). However, it should be noted that in when representative acts negligently, the partners of the company have the right to initiate a lawsuit for the damages they have suffered in accordance with the provisions of TCC 553 et seq. In this context, if the tax debt of the partner arises due to the fault of the legal representative, the shareholder has the right to initiate a liability lawsuit against the legal representative.

4. SCOPE OF THE RIGHT OF RECOURSE

4.1. Scope of the Right of Recourse to the Taxpayer or Tax Responsible Company

The right of recourse for the payments made by the legal representative within the scope of TPL 10/2 is regulated in the third paragraph of the same provision and the relevant provision is as follows "*The representatives or administrators of the organisation may seek recourse from the principal taxpayers for the taxes remitted in this manner.*" When the provision of the law is analysed, it is seen that the right of recourse is regulated only for the "*taxes*" paid by the legal representatives. However, the responsibility of the legal representative within the scope of TPL 10/2 does not include just tax debt. Article 10/2 of the TPL, which regulates the liability of the legal representative, stipulates that legal representatives who fail to fulfil their tax obligations as required are also liable for tax-related receivables in addition to the tax debt. It is acknowledged that the notion of tax-related receivables pertains to receivables that do not directly constitute taxes, duties and fees, but are inherently intertwined with such fiscal obligations. These include default interest, postponement interest and delay interest (Candan, 1998, p. 84 et seq.). In addition to this, pursuant to TPL 333/2, it is clearly regulated that in case of violation of tax laws in the management of the company, the tax penalty will be imposed on behalf of the legal entity, and in case of non-payment of the penalties imposed, TPL 10 will be applied. In other words, in addition to the tax debt, tax-related receivables and tax penalties are also included in the responsibility of legal representatives (Candan, 1998, p. 88; Ürel, 2023, p. 99).

Since there is an explicit regulation in the Law regarding the taxes paid by the legal representative, the entitlement to seek recourse for taxes is unequivocal. In this context, it is stipulated that the assertion of the recourse claim remains unaffected by the negligence, or lack thereof, of the legal representative, and consequently, the primary taxpayer assumes the obligation to settle this debt (Candan, 1998, p. 132; Karahanlı, 2022, p. 104).

With regard to tax penalties, given the general reference to the TPL 10 in the TPL 333, it is imperative to construe this reference as encompassing the right of recourse. Consequently, it can be deduced that the right of recourse pertaining to tax penalties is firmly grounded in the Law. It is thus asserted that the legal representative, upon discharging the tax penalty, possesses the entitlement to seek recourse (Kaneti et al. 2021, p. 136; Ortaç & Ünsal, 2019, p. 79; Saban, 2019, p. 135; Taşkan 2020, p. 114; Çelik 2018, p. 115). However, in the doctrine, an opinion contends that a bifurcation must be made based on whether the legal representative bears fault concerning tax penalties. It is argued that it contravenes equity to invoke the right of recourse if the imposition of the tax penalty results from the legal representative's faulty conducts. Conversely, it is posited that the legal representative might be absolved from liability if they substantiate their lack of fault (Candan, 1998, p. 133). In addition, an alternative perspective in the doctrinal opinion posits that recourse to the principal taxpayer concerning the tax penalties remitted by the legal representative is unfeasible. This viewpoint contends that the absence of regulatory provisions in the law pertaining to the potential for recourse for tax penalties precludes such action (Karakoç, 2014, p. 225).

The deemed as legal representatives within the scope of TPL 10 are those identified as company directors or managers within the ambit of TCC 553. Notably, both the company and its partners retain the prerogative to initiate a liability lawsuit should these individuals, through their faulty actions, cause damage to the company. Given the legal provision delineating the right to institute a distinct liability lawsuit for company directors and managers, it is our contention that a flawed conduct does not categorically preclude the right of recourse. In the event of such misconduct, one may pursue reparation either as a counterclaim in the recourse lawsuit initiated by the legal representative who discharged the debt or by instituting a separate lawsuit.

There is no explicit legal regulation concerning the right of recourse to the principal taxpayer for tax-related receivables. In our opinion, such lack is not a conscious choice of the legislator. TPL 10/2 was revised with article 2 of the Law No. 3505, and in the first version of the text, only tax receivables were included in the scope of the liability of legal representatives. In terms of the recourse relationship regulated in TPL 10/3, the right of recourse was regulated only in terms of tax debts. When TPL 10/2 was revised with article 2 of Law No. 3505, the expression "*and related receivables*" was added to the concept of tax and the debt subject to liability was expanded (Candan, 1998, p. 79; Yıldız, 2001, p. 779; Yaralı, 2011, p. 186). While the scope of responsibility assigned to the legal representative has been expanded conceptually, no new regulations have been enacted regarding the right of recourse. In our assessment, this stance is not a conscious preference of the legislator to exempt tax-related liabilities from the recourse relationship. Consequently, it is imperative to acknowledge the existence of a recourse arrangement concerning tax-related receivables (delay interest, delay increase, etc.) (Bilici, 2020, p. 53; Karakoç, 2014, p. 225; Barlass, 2006, pp. 166-167). As a matter of fact, in the decisions of the Court of Cassation, it is clearly stated that the legal representatives have the right to claim the full

amount of the public receivables paid. A ruling of the Court of Cassation on the subject states as follows "*The representative has the right to seek recourse from the principal taxpayer for the tax paid (Tax Procedure Law No. 213 Article 10). Therefore, as stated above, the representatives of legal entities may claim the "whole" amount of the public receivables they have paid, primarily by seeking recourse from the principal taxpayer.*" (Yargıtay 11. HD, E. 2020/6946, K. 2022/4124, T. 26.5.2022. In the same direction, see Yargıtay 11. HD, E. 2021/6627, K. 2023/1270, T. 2.3.2023, Kazancı Case Law Bank, Access: 24.03.2024).

Furthermore, within doctrine, it is asserted that the right of recourse remains undefined concerning tax-related receivables. It is contented that the legal representative has no right of recourse against the company concerning these receivables, since these receivables arise as a result of the legal representative's negligent conduct (Candan, 1998, p. 133; Yaralı, 2011, p. 231; Özsüt, 1989; Narter 1994). The elucidations provided above regarding tax penalties hold applicability in this context as well. While avenues exist for both the company and its shareholders to pursue damages against the company separately, it is deemed inequitable to wholly nullify the right of recourse solely based on the presence of negligent behavior.

If the right to seek recourse is based on a contractual relationship, it is also possible to apply special arrangements provided for in the contract, such as special interest rate or penalty clause. Upon acknowledging that the foundation of the right of recourse against the company may be contractual in nature, it becomes imperative to assess the feasibility of preemptively waiving this right. Regarding the overarching joint and several indebtedness framework, one contention posits that the right of recourse may be waived ab initio through contractual agreement. This perspective draws upon the premise that the internal dynamics between debtors can be delineated by contract in accordance with TCO 167 (Kapancı, 2015, p. 561). While conducting an assessment on this matter, it is essential to consider the essence of the responsibility within the scope of TPL 10/2 and ascertain the true debtor of the debt subject to this responsibility. Although the liability of legal representatives is brought into consideration within the ambit of the pertinent provision, this statutory liability is established not to absolve the company's debt but rather to expedite the collection of tax obligations. Although the legal representatives are liable, the company remains liable as the principal taxpayer. In our opinion, it is not in accordance with the nature of the business and equity to include a provision in the contract to the effect that the legal representatives will not have the right to seek recourse from the principal taxpayer. For this reason, it is unfeasible to incorporate a clause in the contract concluded between the company and the legal representative stipulating ab initio the waiver of the right of recourse (Akyürek, 2022, p. 190). On the other hand, it is possible to waive this right partially or completely with the agreement to be made with the company after the right of recourse arises (Akyürek, 2022, p. 191).

4.2. Scope of Recourse to Other Legal Representatives

4.2.1. The Evaluation Regarding Whether There is an Obligation to Resort to the Principal Taxpayer Company in order to Exercise the Right of Recourse Against Other Legal Representatives

To enable the legal representative, who settles the tax debt, to assert the right of recourse against other legal representatives, it is imperative to assess whether there exists an obligation to first seek redress from the principal taxpayer. While one opinion in the doctrine posits that the right of recourse against other legal representatives necessitates prior utilization of this right against the principal taxpayer (Taş, 2019, p. 277), another opinion states that this obligation does not exist and it is possible to request payment directly from other legal representatives (Akyürek, 2022, p. 203).

The Court of Cassation made the following statement in one of its judgements on this issue "*...In order for the legal representatives to seek recourse from other liable parties other than the principal taxpayer, firstly, collection of this public receivable from the original taxpayer must have been impossible...*" (Yargıtay 11. HD, E. 2021/6627, K. 2023/1270, T. 2.3.2023. See in the same direction. Yargıtay 11. HD, E. 2020/6946, K. 2022/4124, T. 26.5.2022; Yargıtay 11. HD, E. 2015/11584, K. 2016/8347, T. 24.10.2016, Kazancı Case Law Bank, Access: 24.03.2024). As evident from the decision, the Court of Cassation states that a demand for payment should be initially directed towards the principal taxpayer company.

In our assessment, we cannot concur with the perspective or judicial rulings asserting that prior recourse to the principal taxpayer or the establishment of their inability to pay is a prerequisite for invoking the right of recourse against other legal representatives. Because the responsibility of the legal representatives within the scope of TPL 10/2 is a secondary responsibility, in order for the administration to request payment from the legal representative, it must first have applied to the principal taxpayer and as a result of this application, the receivable must remain uncollected or it must be understood that it will not be possible to collect such receivable.

In our view, insisting on the precondition of requesting payment from the principal taxpayer, particularly when their inability to pay is evident or established, before exercising the right of recourse against other legal representatives, serves no purpose other than prolonging the collection process of the recourse receivable for the legal representative.

4.2.2. Legal Nature of the Obligation Relationship within the Scope of the Right of Recourse

Regarding the recourse relationship, first of all, it should be noted that although the legal representatives are jointly and severally liable to the administration in the external relationship, the other legal representatives are not jointly and severally liable to the legal representative who pays more than his/her share in the internal relationship. In this case, a scenario of partial indebtedness arises, where the legal representative who covers a portion exceeding their equitable share will be able to seek

reimbursement from the other legal representatives for the extent of their respective shares (Eren, 2022b, p. 2768; Oğuzman & Öz, 2022b, p. 504; Kapancı, 2015, p. 59,60. In Swiss law, see Deschenaux and Tercier, 1982, p. 291; Engel, 1997, p. 567; Corboz & Girardin, 2017: Art. 759, N. 37).

4.2.3. Determination of the Amount of Liability in the Internal Relationship

When scrutinizing the decisions rendered by the Court of Cassation concerning the apportionment of debt in the internal relationship between debtors and legal representatives, and consequently, the extent to which the right of recourse will be exercised, two fundamental issues emerge. The first one is related to the use of the right of recourse against the legal representatives who are shareholders in limited liability companies. The Court of Cassation asserts that the liability of legal representatives in limited liability companies is contingent upon their partnership status. Consequently, when invoking the right of recourse, a claim can be pursued commensurate with the proportion of the relevant partner's stake (Yargıtay 11. HD, E. 2020/6946, K. 2022/4124, T. 26.5.2022; Yargıtay 11. HD, E. 2020/6946, K. 2022/4124, T. 26.5.2022, Kazancı Case Law Bank, Access: 24.03.2024).

In our opinion, it is not possible to agree with the decisions of the Court of Cassation regarding the amount of liability of legal representatives who are also partners in limited liability companies. As the titles of shareholder and legal representative are distinct from each other, and since there is no differentiation between partner and non-partner legal representatives in delineating their responsibilities under TPL 10/2, they are treated uniformly in matters concerning liability. In this context, it is sufficient to have the title of legal representative in order to be liable. A person who is both a partner and a legal representative is liable for the entire debt of the principal taxpayer company as a legal representative within the scope of TPL 10/2 (Şenyüz et al., 2022, p. 111; Ateşli, 2000), while as a partner they are liable for their share in the company within the scope of LPCPR 35/1. These two types of liabilities are independent of each other. In our opinion, it is not possible to combine these two provisions without any legal reason and accept that the liability of the legal representative, who is a partner of the company, is only liable in proportion to their share (Akyürek, 2022, p. 219). It is evident that attributing full liability for the entirety of a tax obligation to a legal representative who is not a partner, stands in contradiction to both legal principles and equitable considerations. Conversely, to suggest that a partner, who holds a substantial interest in the company's operations and actively participates in managerial decisions, would only bear liability proportionate to their share, would similarly contravene legal and equitable norms.

There is a special point to be mentioned regarding the scope of the right of recourse of the legal representative holding the title of partner. It has been asserted above that within the framework of the solidarity relationship between the legal representatives and the partners, ultimate responsibility rests upon the partners, with legal representatives retaining the right of recourse to the partners. In instances where a legal representative assumes the role of a partner, the pertinent shareholder bears ultimate responsibility for the tax debt paid in accordance with their respective share. Consequently, the partner

in question should possess the entitlement to seek recourse from other legal representatives for any portion of the debt surpassing their individual share.

Another issue to be addressed in the decisions of the Court of Cassation regarding the recourse mechanism is the distribution of the debt in the internal relationship. A ruling on the subject provides that "... a director who pays a public receivable may only have recourse to other directors equally, unless otherwise agreed in the articles of association. In other words, unless otherwise agreed, the aforementioned representatives in the internal relationship are equally liable to each other for public receivables." (Yargıtay 11. HD, E. 2014/8501, K. 2014/16502, T. 30.10.2014. In the same direction, Yargıtay 11. HD, E. 2011/4753, K. 2011/7389, T. 14.6.2011, Court of Cassation Precedent Decision Database, Access: 24.03.2024). We maintain the position that it is untenable to endorse the judgments of the Court of Cassation, which assert that the liability of legal representatives is uniformly equal within the internal relationship, barring any specific provisions to the contrary. Because the basis of the joint and several liability of the legal representatives against the administration in the external relationship is the provision of TCC 557, and the scope of the right of recourse and the amount of indebtedness in the internal relationship should be determined within the scope of this provision. Pursuant to TCC 557/3, in the context of the recourse relationship involving multiple obligors, the judge is tasked with determining the extent of liability for each obligor concerning the debt, considering all pertinent circumstances and requirements. In this scenario, the internal relationship among debtors may render all parties equally liable for the debt, contingent upon the circumstances. Alternatively, varying degrees of liability among debtors within the internal relationship may be assigned, factoring in considerations such as assessing the fault of the debtors' legal representatives regarding the debt or whether benefits were derived from the failure to fulfill tax obligations adequately (For detailed information on how to distribute the debt in the internal relationship in the differentiated succession relationship, see. Altay, 2011, p. 373 et seq; Çamurcu, 2015, p. 189 et seq. For the Swiss law, see Corboz and Girardin, 2017: Art. 759, N. 38-39).

4.3. Scope of the Right of Recourse to Limited Company Partners

The liability of the partners arising from tax debts is constrained proportionately to their respective shares in the company in accordance with LPCPR 35/1. For this reason, the right of recourse can only be asserted to the partners in proportion to their shares. Nevertheless, it is noteworthy that partners of the company, whose right of recourse is contested by the legal representatives, retain the option to lodge a counterclaim within the same legal action or to initiate a separate liability lawsuit against the legal representatives, adhering to the stipulations outlined in TCC 553 et seq. (Aksu Özkan, 2020, p. 259).

When share transfers occur between the utilization of the right of recourse and the incidence of the tax-generating event, it becomes imperative to scrutinize against which partner the right of recourse will be invoked. This matter directly hinges upon the determination of shareholders' liability in the event

of share transfers. The liability of the shareholders arising from tax debts in case of transfer of shares is clearly regulated in LPCPR (35/2) and according to this provision, in the event of transfer of shares in limited liability companies, the transferor and the transferee partners are jointly and severally liable for the payment of tax debts (Aksu, 2020, p. 228 et seq.; Akyürek, 2022, p. 156 et seq.). In this case, it should be accepted that the legal representative who pays the tax debt in question has the right of seek recourse from both the transferor shareholder and the transferee shareholder, who are jointly and severally liable for the said debt.

The prospect that the individual pursued by the legal representative under the right of recourse holds both the designation of legal representative and partner warrants additional scrutiny. In such instances, as elucidated previously, the individual subject to recourse is liable both as a partner pursuant to LPCPR 35/1 and as a legal representative in accordance with TPL 10/2. It remains feasible for the legal representative discharging the tax debt to invoke the right of recourse based on both legal provisions. Subsequently, the judge should possess the authority to adjudicate based on whichever provision favors the plaintiff.

5. CONCLUSION

In case the legal representatives of limited liability companies fail to fulfil their tax obligations duly, their liabilities arising from tax debts are regulated under TPL 10/2. Under the purview of this provision, while the concept of legal representative typically pertains to company managers, in instances where authority concerning tax obligations is transferred in accordance with legal stipulations and the company agreement, the designation of legal representative will be conferred upon the transferees.

In this study, we examined the legal foundation and scope of the right of recourse available to legal representatives held liable for settling tax debts under the aforementioned provisions. We thoroughly scrutinized the available literature on the subject and analyzed numerous court judgments. Additionally, we explored the approach of German law, which includes similar regulations regarding the liability of legal representatives. As a result of these examinations, the legal foundations and the framework for the scope of the right of recourse of legal representatives are established as follows.

Pursuant to TPL 10/3, the legal representative who pays the tax debt has the right of seek recourse from the principal taxpayer company. In this provision, only the concept of tax is mentioned. Based on the wording of the law, there are doctrinal opinions that the right of recourse is only related to the tax principal and that there is no right of recourse in terms of other tax-related receivables and tax penalties. However, it is necessary to accept that there is a right of recourse in terms of tax penalties in accordance with the reference to TPL 10 in the TPL 333 provision, and in terms of other tax-related receivables due to the nature of the work and the historical development of the TPL 10 provision.

If there is more than one legal representative, it is accepted that the legal representatives are jointly and severally liable within the scope of TPL 10/2. There is no clear regulation in TPL 10

regarding how to determine the liability of legal representatives for tax debts. However, pursuant to Article 557 of the TCC, which is a general regulation on the liability of company managers, legal representatives are jointly and severally liable to the tax administration. A legal representative who makes a payment within the scope of TPL 10/2 has the right to seek recourse from other legal representatives, as clearly stipulated in TCC 557/3.

Another entity to which the legal representative may seek recourse concerning tax debts paid is the shareholders of the limited liability company. In accordance with LPCPR 35, shareholders of a limited liability company bear responsibility for public debts commensurate with their stake in the company. Although explicit legal provisions in our jurisdiction do not delineate the right of recourse of the legal representative against the shareholder, it is pertinent to acknowledge that the shareholders of the company are the primary beneficiaries of the company's economic endeavors. Thus, it is reasonable to assert that the legal representative who settles the debt retains the right of recourse to the shareholders of the company, restricted to the respective shareholder's share.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The author declares that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article.

The entire work was carried out by its only, stated author.

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The Effect of Servant Leadership on Work Engagement: The Mediating Role of Person-Organization Fit

Gökhan KENEK¹

Abstract

This study aimed to explore the relationship between servant leadership and work engagement and investigate the mediating role of person-organization fit in this relationship. The research was conducted in July 2023 on blue-collar employees in the glass industry in the Marmara Region. A total of 266 employees participated in the survey. Confirmatory factor analyses (CFA) were conducted using the MPLUS7 package program, and hypotheses were tested using the SPSS26 program. The results of the analyses indicated that servant leadership positively influences person-organization fit and work engagement. Additionally, it was found that person-organization fit increases work engagement. Furthermore, it was revealed that person-organization fit partially mediates the effect of servant leadership on work engagement.



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Keywords: *Servant Leadership, Person-Organization Fit, Work Engagement.*

<https://doi.org/10.30798/makuiibf.1489564>

Article Type	Application Date	Admission Date
Research Article	May 24, 2024	December 20, 2024

1. INTRODUCTION

Radical transformations are a necessity, especially in today's organizational paradigm is very high and technological advances have reached incredible levels compared with the traditional centralized, standardized, and formalized bureaucratic organization based on fear, which has been the dominant organizational paradigm since the beginning of the industrial revolution (Fry, 2003). In today's rapidly changing and complex business environment, "work engagement" has become a highly emphasized topic for both researchers and organizations (Bakker et al., 2011). Research indicates that work engagement is closely linked to employee attitudes, behaviors, well-being, and performance (Dalal et al., 2012; Leiter & Bakker, 2010). Therefore, it is evident that work engagement plays a crucial role in determining organizational performance (Choi et al., 2015). Additionally, having a community of employees with high levels of work integration is considered can provide a competitive advantage over rivals (Saks et al., 2022; Rich et al., 2010). In this context, the main purpose of this study is to assess how effective management practices are in fostering employee engagement within the framework of servant leadership, a significant topic that has gained attention in recent times.

Undoubtedly, in these change and transformation-based competitive conditions, the servant leadership approach, which contributes positively to both working and social life, focuses entirely on the employee's welfare and tries to spread the spirit of cooperation through effective communication emerges as an effective practice (Bakan & Doğan, 2012; Barbuto & Gifford, 2010). Besides, the leader demonstrates this approach without expecting anything in return (Spears, 1998). This servant leadership approach, centered on giving and contributing, enables employees to integrate with the organization through effective communication and collaboration (Vondey, 2010). In this leadership approach, while there are no direct performance expectations in return, this method indirectly fosters the desired engagement phenomenon, which positively impacts business processes (Liden et al., 2014; Walumbwa et al., 2010). When employees are well engagement with their jobs, they are more effective and productive, thereby increasing their performance (Roberts & Davenport, 2002). As a matter of fact, what organizations expect from employees in accordance with the psychological contract is to fulfill the duties and responsibilities assigned to them during working hours in a willing, enthusiastic, and focused manner and to engage in actions that increase, improve, and develop the performance of the organization (Anderson and Schalk, 1998). Although this situation is examined as performance in behavioral terms, its attitudinal reflection is the employee's mental and psychological readiness towards work (Van Dyne & Pierce, 2004). The readiness to perform one's work, the energy, and the value placed on the work itself—in other words, the employee's engagement with their job—reflects the attitudinal orientation to contributive performance of employees (Macey & Schneider, 2008). Engaged employees are highly enthusiastic about their work and serve as a critical source of inspiration for others (De Clercq et al., 2014). The emergence of this positive work attitude is undoubtedly the result of an effective leadership style. Recently, the importance of servant leadership in creating this desired positive work environment

has been frequently emphasized (Roberts, 2018). This approach is considered vital for employees to better integrate with their work. This is because servant leadership reflects a philosophy that primarily values employees as human beings with its employee-oriented characteristics. It aims “to create a positive working environment by communicating effectively with followers, listening to their needs and desires, and helping them reach their potential” (Liden et al., 2008). In addition, with its principles of integrity and honesty, it creates an environment of trust that increases employees' loyalty and ensures the creation of a suitable environment for the desired performance. In this context, it can be stated that servant leadership is an important organizational resource that enables employees to engage with their work.

In this respect, the main purpose of this study is to examine the effect of servant leadership on job engagement. In addition, some perceptual mechanisms play an important role in managerial approaches affecting employee attitudes and behaviors (Baron & Kenny, 1986). Academic studies try to determine this situation with mediator variables. In this study, the mediating role of person-organization fit in the effect of servant leadership on work engagement was examined. This is because person-organization fit refers to a perceptual support system that makes the employee feel psychological well and indicates that they have similar values with the organization they are a member of. In workplaces, which occupy an important part of their daily lives, people wish to maintain their psychological well-being and welfare (Abrams, 2010). It is certain that an employee who does not feel suitable for their job or organization, who believes they do not belong to the organization they are in, and who does not share common characteristics with it cannot be psychologically well-being and cannot be expected to work willingly and meet the expected performance standards. On the other hand, employees who find themselves aligned with the organization's values integrate with the company's goals and are motivated to contribute positively to achieving a superior position to organization over competitors. At this point, it is possible to say that servant leadership is an effective type of leadership that facilitates employees' adaptation to their organizations with its person-oriented attitude and unifying and integrative orientation (Van Dierendonck, 2011). Accordingly, it is predicted that the servant leadership approach, will have a significant impact on the formation of person-organization fit and engagement with work. So, examining the mediating role of employees' fit with the organization in the relationship between servant leadership and job integration is another purpose of this study.

2. CONCEPTUAL FRAMEWORK

In this section, servant leadership, person-organization fit, and work engagement, which are discussed within the scope of the research, are briefly explained conceptually, and hypotheses are developed to examine the assumed relationships between the variables.

2.1. Servant Leadership

The servant leadership approach differs from traditional leadership approaches by prioritizing serving followers and making them the focal point. This approach emphasizes keeping personal interests in the background. Servant leaders view this as a crucial element in achieving success and strive to shape the organizational culture in this direction (Farling et al., 1999). The motivation of such leaders is not the desire for personal gain or power but rather the development and empowerment of their followers in both social and professional areas (Van Dierendonck, 2011).

Greenleaf, who is known to have first used the concept of servant leadership, was influenced by the novel "Journey to the East" in which he read and put forward the idea that leaders can also be servants (Greenleaf, 1977). In his seminal work "The Servant as Leader," Greenleaf (2003) asks: "Are those around the servant leader developing as individuals? Are they on their way to becoming healthier, wiser, more free and more independent and servants too? And what is the impact of this on the least privileged in society? Will they be able to benefit from this or at least avoid deprivation?" These questions highlight the leader's strong focus on the growth and well-being of their followers (Duyan & Van Dierendonck, 2014).

Servant leaders can address their followers' spiritual needs by offering guidance, skill development, encouragement, and motivation. They can also meet their physical needs by providing necessary resources (Bakan & Doğan, 2012). Additionally, servant leadership is characterized by an "ethical" approach, which involves open communication and fair, honest interaction with others (Chiniara & Bentein, 2016).

In his 1998 work on servant leadership, Spears describes several key attributes of this leadership style. These include: considering people's wishes and prioritizing communication (listening), accepting others by trying to understand their situations (empathy), making an effort to improve the emotional well-being of followers (healing), being conscious of events and staying alert (awareness), influencing others through individual skills rather than positional power (persuasion), having a future-oriented perspective (conceptualization), describing the current situation through intuition (foresight); prioritizing meeting the needs of others (stewardship), caring about personal, professional, and spiritual development of oneself and others (commitment to people's development), and emphasizing the importance of communities in individual life (building community) (Spears, 1998).

Patterson made significant contributions to the development of the concept by outlining servant leadership across 7 dimensions in the model he proposed (Cited in Bakan & Doğan, 2012; Aslan & Özata, 2011). These are *agapoo love* (representing an inner passion that drives the leader to prioritize meeting the wishes, desires, and needs of others as a primary necessity, ahead of factors such as efficiency and profitability), *humility* (reflecting the leader's ability to focus on others without considering themselves as superior), *altruism* (the commitment to the well-being of others without

expecting anything in return), *vision* (a long-term perspective that others can accept and believe in), *trust* (the honest stance that the leader inspires through fair and ethical behavior, gaining the faith of others), *empowerment* (ensuring the development of followers by strengthening them; and finally), *service* (the leader focuses entirely on their followers without considering his/her individual interests, acting solely to contribute to them).

Servant leadership emphasizes “the necessity and importance of valuing people, listening to them, empowering them, and possessing characteristics such as influence, vision, trust, reliability, competence, task sharing, integrity, honesty, modeling and transparency, service, stewardship, communication, belief, leading, appreciating others, encouraging, teaching, and empowering people” (Akgemci et al., 2019). Servant leadership is demonstrated through the use of knowledge and experience to exhibit behaviors that serve the needs of others and the community rather than prioritizing individual interests in decision-making and choices (Barbuto & Gifford, 2010).

2.2. Person-Organization Fit

The Person-Environment Fit Theory, proposed by Lewin in 1935, makes the basic assumption that outcomes are influenced by the interaction between individuals and their environment. Good adjustment is usually linked to positive outcomes for the individual. Person-environment fit is a multidimensional approach, encompassing the fit between person and group, person and organization, person and vocation, and person and person (Jansen & Kristof-Brown, 2006).

The concept of person-organization fit is a key component of the PE Fit Theory, which examines the compatibility of individuals with their work, the teams they engage with, their supervisors, and the organization they are part of (Caplan, 1987). The concept of person-organization fit focuses on the employee's perception of how well their own values align with those of the organization (Farooqui & Nagendra, 2014).

Kristof (1996) made significant contributions to the development of the concept of person-organization fit. She defines it as "the fit that occurs when at least one party of the person and organization meets the needs of the other or both have similar basic characteristics." Unlike person-environment fit “person-organization fit emphasizes the importance of the fit between employees and work processes and the creation of an organizational identity through the institutionalization of consistent values that permeate an organization's culture” (Morley, 2007).

Schneider, Goldstein, and Smith (1995) also focused on person-organization fit by examining the employee's career path during the recruitment and leaving process within the scope of the employee's organizational life from the attraction-selection-attrition perspective. People's preferences for a place to work are shaped by their assessment of how well their personal characteristics align with an organization's goals, business processes, and culture. Individuals are drawn to organizations they believe can help them achieve their specific goals and with which they feel a sense of compatibility. Following

this, organizations recruit candidates with the desired characteristics. However, if the expected harmony between the individual and the organization is not achieved, the employee may decide to leave the job. This process is linked to person-organization fit and influences various employee behaviors, including identification with the organization, work engagement, organizational commitment, and intention to leave (Schneider et al., 1995).

Bretz and Judge (1994) assessed person-organization fit from four distinct perspectives: (1) The alignment of individual knowledge, skills, and abilities with basic job requirements; (2) the harmony between individual needs and organizational structures; (3) the congruence between an individual's values and the organizational culture; and (4) the resemblance between an individual's personality and the perceived organizational image. These dimensions are interconnected and collectively contribute to understanding an employee's behavioral experiences within the organization. Of these dimensions, value fit, which is frequently discussed, signifies the alignment between organizational values and the personal beliefs and values of employees, irrespective of work (Kristof, 1996).

In their study Jansen and Brown (2006) evaluated the multidimensional approach to person-organization fit. This approach focuses on four dimensions: person-vocation fit, which refers to matching individuals with suitable career options based on career choice theories; person-job fit, which examines the relationship between one's abilities or desires and the demands or characteristics of a specific job; person-organization fit, which assesses the similarity between an individual and an organization, and their ability to meet each other's needs; person-group fit, which looks at the compatibility of skills and interpersonal relationships between individuals and work groups; and person-person fit, which emphasizes the compatibility between an employee and their colleagues.

Research indicates that person-organization fit is strongly linked to desirable employee behaviors such as job satisfaction, organizational citizenship behavior, psychological well-being, organizational identification, job performance, and organizational commitment (Chen et al., 2016; Farooqui & Nagendra, 2014; Pelealu, 2022; Silverthorne, 2004; Mete et al., 2016).

In this study, I discussed person-organization fit by focusing on the harmony between personality and values. I examined how the fit between servant leadership and work engagement is influenced by the intersection of personal and organizational values. The person-value fit perspective explores the cognitive alignment between personal characteristics and perceptions of the organizational profile. It is based on the assumption that employees have a mental representation of the organizational profile (Hoffman & Woehr, 2006).

2.3. Work Engagement

The concept of engagement, first cited in the literature in Kahn's article "Psychological Conditions of Personal Engagement and Disengagement at Work" (1990), is defined as the physical,

cognitive, and emotional expression of employees in their organizational roles within the framework of "Role Theory."

Roberts and Davenport (2002) briefly defined work engagement as "employee enthusiasm and participation in work". According to the researchers, employees who are highly engaged with their work identify with the work personally, and the work itself plays a role as a source of motivation for the employee. Although it is widely accepted that work engagement is caused by both personal and environmental factors, research on the subject shows that integration with work is examined as a reaction of the employee against the characteristics of the job (İnceoğlu & Warr, 2011).

The job demand-resource model plays a crucial role in defining the concept of work engagement (Bakker & Demerouti, 2007). According to the model, every job comes with physical and psychological demands that individuals must face. These demands are the challenges that individuals encounter in their work and stem from the nature of the job itself. Additionally, various job resources help individuals deal with these challenges, allowing them to learn and grow in the workplace. These resources include mentoring, leadership, meaningfulness of work, autonomy, and serve as a support mechanism that contributes to the well-being of the employee (Wan et al., 2018). It is believed that low job resources can lead to employee burnout, while high job resources can lead to work engagement (Schaufeli & Bakker, 2004). From this perspective, work resources can be seen as an intrinsic motivation tool that emphasizes personal development and psychological well-being, as well as an external motivation tool that encompasses the arrangements made for the work environment.

Factors such as social support, rewards, recognition by managers and colleagues, learning opportunities, and level of autonomy are considered to be the main drivers of work resources at the individual level (Bakker, 2011; Maslach et al., 2001; Saks, 2006). Work engagement, which is seen as a positive expression of employee motivation (Kahn, 2010), plays a critical role in facilitating many positive outcomes, including "productivity, organizational citizenship behaviors, and overall job performance".

2.4. Hypotheses Development

As a result of the understanding of the impact of the social side of the employee on business life, it can be said that employees act with a higher sense of commitment when their needs and wishes are handled more caringly by their managers or leaders (De Clercq et al., 2014). With a follower-driven approach such as servant leadership, a more intense sense of psychological security and meaningfulness emerges by understanding employees' unique characteristics, supporting their achievements, and establishing empathy. Humility, which prioritizes employees' interests, is a critical element of servant leadership (Van Dierendonck, 2011). In addition, servant leaders meet the needs of their followers through personal support and coaching. With this care, servant leaders can enhance psychological safety and meaningfulness, and by recognizing their unique and special qualities, they can generate positive

energy among followers (Liden et al., 2008; Schaufeli & Bakker, 2004). Thus, employees are more committed to their work, and work engagement increases (Brown & Leigh, 1996; Kahn, 1990). In this research, it was explored how servant leaders who set aside their self-interest for the benefit of their followers can stimulate work engagement among followers. According to past research findings that show a positive impact of servant leadership on work engagement (Zhou et al., 2022; Haar et al., 2017; Kaya & Karatepe, 2020), the following hypothesis has been developed.

H₁: Servant leadership has a positive effect on work engagement.

Piasentin and Chapman (2006) stated that in the majority of studies about person-organization fit that they examined in their meta-analysis study, person-organization fit is evaluated as an individual's perception of fit between their own values and the values of the organization. The servant-oriented behaviors displayed by managers go beyond this harmony by providing the opportunity for quality interaction with their followers. It has been suggested that the person-oriented attitude in the servant leadership approach enables employees to feel safe and to establish strong relationships within the organization (Van Dierendonck, 2011). Chatman (1991) stated that person-organization fit (P-O fit) focuses on how a person's values, when they intersect with an organization's value system, influence that person's behavior. In this case, servant leadership qualities encompass ethics, a follower-centric approach, and encouragement for development, facilitating the employees' acceptance of the organization's value system and fostering person-organization alignment. The servant leader “motivates followers, listens to them, understands their needs, and puts their needs above his/her own interests” which further increases the employee's person-organization fit (Kiker et al., 2019). In addition, the motivation to serve the followers, as well as the intense effort for their well-being, allows for deeper interactions between the leader and the followers. This allows the leader, who plays the role of a bridge between the organization and the employees, to convey his/her values, beliefs, and thoughts to followers more effectively (Li, 2006). Thus, it is possible to fit employee values with organizational values. In their research, Dahlez et al. (2021) provided substantial support for this conclusion. So, the second hypothesis developed in this direction is as follows:

H₂: Servant leadership has a positive effect on person-organization fit.

Along with the selection and placement processes, the skills and abilities of the employee recruited are suitable for the job requirements, which ensures high participation (Juhdi et al., 2013). With person-organization fit, employees unite around a common goal and increase the effectiveness of their job performance. Thus, a psychological security situation is created between the employee and the organization (Biswas & Bhatnagar, 2013). This psychological security situation is also seen as one of the most important prerequisites for the employee's commitment to work and engagement with work. (Biswas & Bhatnagar, 2013). Bono and Judge (2003) also suggested that employees who find organizational values compatible with their own values have higher work engagement rates. In addition

to matching the skills with the job requirements, the integrity of the values held by the employees and the organizational culture and values helps to create job satisfaction, job engagement, and some goal-oriented behaviors. According to Bakker et al. (2023), job resources such as supervisor support, appreciation, and organizational climate, which includes organizational value systems and work relations, are believed to play a significant role in fostering strong employee engagement with their respective organizations. The results of the studies reported that person-organization fit was related to work engagement (Ünal & Turgut; 2015, Hamid & Yahya, 2011). Thus, the following hypothesis was developed.

H₃: Person-organization fit has a positive effect on work engagement.

Person-organization fit examines how an employee's behavior is influenced by the organization's values (Chatman,1991). According to Field Theory, people's individual perceptions of their working environments and the special interactions they have are the most important determinants of their behavior. Thus, the perception of the working environment and job determines the direction of employee behavior. In this context, servant leadership, which exhibits a behavioral approach such as meeting the needs of its subordinates by developing emotional connections with its subordinates and dedicating itself to realizing their interests without expecting anything in return, without using any punitive power within the authority of its position, enables the employee to develop a positive relationship with the organization and by feeling compatible with the organization, it can play a role as a force that enables the employee to be more engaged in their work. This force triggers employees to perform their jobs effectively and integrate with the work towards the success of the organization's mission and vision (Hamid & Yahya, 2011). Responding to a strong belief in their organization, accepting organizational goals and values, and being prepared to make significant efforts to serve the organization are indicators of a high degree of engagement (Greguras & Diefendorff, 2009). At this point, it is evident that servant leadership stands out as an effective and impactful style of leadership. This leadership approach plays a significant role in aiding employees in their adaptation to organizational dynamics. Servant leadership is characterized by its person-centered attitude, which prioritizes the individual needs and growth of employees. Furthermore, it fosters a unifying and integrative orientation, emphasizing collaboration and inclusivity within the organizational framework (Van Dierendonck, 2011). In this context, the last hypothesis developed as follows:

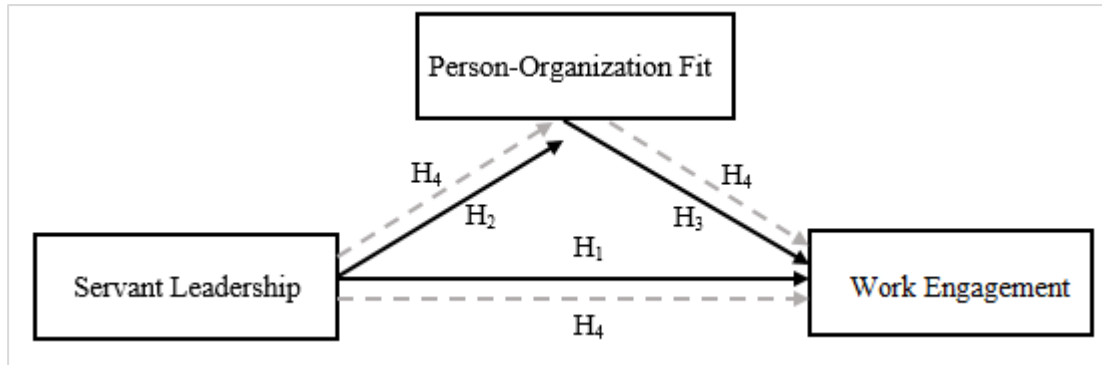
H₄: Person-organization fit has a mediating role between servant leadership and work engagement.

3. METHOD

The study aims to explore how servant leadership impacts work engagement and to determine if person-organization fit plays a mediating role in this relationship. To achieve this, a relational

scanning model, as depicted in Figure 1, was developed along with hypotheses based on the existing literature.

Figure 1. Research Model



3.1. Sample

For research purposes, ethical approval was obtained from the Gümüşhane University Scientific Research and Publication Ethics Board during a meeting dated 14/06/2023 and numbered 2023/3. The research was conducted in July 2023 and focused on blue-collar employees in the glass industry sector. A total of 278 employees participated in the research. After excluding incomplete and incorrectly filled questionnaires, the final sample size for evaluation was determined to be 266.

3.2. Measurement Tools

For servant leadership, which is the independent variable of the research, the servant leadership scale consisting of 7 items and one dimension belonging to Liden et al. (2015) was used. The Turkish adaptation of the scale was made by Kılıç and Aydın (2016). In order to measure the person-organization fit of the research participants, a scale consisting of 4 items developed by Netemeyer et al. (1997) was used. The Turkish translation of the scale was carried out by Turunç and Çelik (2012). Finally, in order to measure the engagement of employees with work, a short version consisting of 9 items developed by Schaufeli et al. (2006), tested for validity and reliability, published in many languages and Turkish, and made available for scientific studies, was used. The validity and reliability of the Turkish translation have been demonstrated by Kenek and Sökmen (2022). All scale statements were prepared in the form of a 5-point Likert scale as "1: Strongly disagree, 5: Strongly Agree".

3.3. Results

After the data was collected, it was examined that the scales met the validity and reliability criteria before conducting the regression analyses. In order to do this, confirmatory factor analysis is required. However, before doing that, it is performed the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity to assess the suitability of the scales for CFA. The Kaiser-Meyer-Olkin acceptable limit value of 0.60 indicates that the sample size is sufficient for factor analysis. The significance level sought from Bartlett's sphericity test indicates that the correlation

between the items in the scale is suitable for factor analysis (Gürbüz & Şahin, 2014). As a result of the tests carried out to check whether these preliminary values are met; for servant leadership, KMO= 0.883 and Bartlett's sphericity test result was significant ($p < 0.001$); for person-organization fit, KMO= 0.842 and Bartlett's sphericity test result was significant ($p < .001$) and finally, for work engagement the KMO value was 0.897 and Bartlett's sphericity test ($p < .001$) was found to give significant results. Thus, confirmatory factor analyzes for the scales were carried out.

3.3.1. Confirmatory Factor Analyzes

MPLUS 7 statistical program was used in confirmatory factor analyzes for the scales. The results of the CFA conducted for servant leadership, which was considered as the independent variable of the research, showed that the factor loading of the item "sl1" in the scale was lower than 0.3 and was removed from the scale. After taking into account the model modification indices and conducting CFA again, it was observed that the factor loadings of the remaining scale items ranged between 0.80 and 0.92. The fit indices also chi-square/degrees of freedom ($\chi^2/df = 2.25$; RMSEA= 0.069; CFI= 0.995; TLI= 0.988; SRMR= 0.012 were determined as. Thus, it was concluded that the items used were suitable for the current servant leadership measurement structure.

The CFA results for the person-organization fit scale show that the items used have excellent fit values with the scale structure, and their factor loadings are between 0.73 and 0.90. The obtained model fit values are as follows: chi-square/degrees of freedom (χ^2/df)= 1.38; RMSEA= 0.038; CFI= 0.999; TLI= 0.997; SRMR=0.008.

Finally, according to the CFA findings performed for the work engagement scale, factor loadings varied between 0.55 and 0.82, and model fit values were chi-square/degrees of freedom (χ^2/df)= 2.56; RMSEA= 0.077; CFI= 0.972; TLI= 0.948; SRMR=0.30 was observed to be at an acceptable level.

Table 1. Confirmatory factor analysis results of the scales

Variables	KMO	Barlett	χ^2/df	RMSEA	CFI	TLI	SRMR	AVE	CR	α
SL	.883	$p < .001$	2.25	.069	.995	.988	.012	.74	.94	.95
PO Fit	.842	$p < .001$	1.38	.038	.999	.997	.008	.71	.91	.90
WE	.897	$p < .001$	2.56	.077	.972	.954	.030	.52	.90	.91

3.3.2. Correlation Analysis

Correlation analysis was performed to examine relationships between research variables. "There is a weak relationship between variables if $.30 > r$ ", medium if $.30 \leq r < .50$ ", and strong if $.50 \leq r < 1$ " (Cohen, 2013). According to the analysis results, there are positive significant relationships between servant leadership and person-organization fit ($r = .459$; $p < .001$) and work engagement ($r =$

.398; $p < 0.001$). In addition, there is a positive significant relationship between person-organization fit and work engagement ($r = .398$; $p < .001$).

Table 2. The relationships between variables

	Variables	Mean	S.D.	1	2	3
1	Servant Leadership	2.93	1.08	---		
2	Person-Organization Fit	3.62	1.01	.459	---	
3	Work Engagement	3.73	0.71	.398	.422	---

Note: *Correlation is significant at the 0.01 level (two-sided).

3.3.3. Regression Analyzes

Simple linear regression analyses were carried out to test the first three hypotheses developed for the purpose of the research. Accordingly, as stated in Table 3, it was determined that servant leadership positively affects work engagement ($\beta = 0.398$; $p < .001$). Furthermore, research has revealed that servant leadership can explain 15% of the variation in work engagement ($R^2 = 0.159$), and H_1 (Servant leadership has a positive effect on work engagement.) was accepted. It was observed that servant leadership also positively affects person-organization fit ($\beta = 0.459$; $p < .001$) and can explain the 21% change in person-organization fit. Therefore, H_2 (Servant leadership has a positive effect on person-organization fit.) was accepted. In addition, the significant and positive effect of person-organization fit on work engagement ($\beta = 0.422$; $p < .001$) is another finding. Accordingly, it can be stated that person-organization fit can explain 18% of the variance in work engagement, and thus H_3 (Person-organization has a positive effect on work engagement.) was also accepted.

Table 3. Simple Linear Regression Analyzes

	Regression Analyzes	B	S.E.	β	p	Model Statistics
(H ₁)	Independent Variable: Servant Leadership Dependent Variable: Work Engagement	0.261	0.037	0.398	0.00	$R^2 = 0.159$ F= 49.781 $p < 0.000$
(H ₂)	Independent Variable: Servant Leadership Dependent Variable: Person-Organization Fit	0.430	0.051	0.459	0.00	$R^2 = 0.211$ F= 70.518 $p < 0.001$
(H ₃)	Independent Variable: Person-Organization Fit Dependent Variable: Work Engagement	0.295	0.039	0.422	0.00	$R^2 = 0.178$ F= 57.046 $p < 0.001$

Note: B: Unstandardized beta coefficient; S.E.: Standard Error; β : Standardized beta coefficient

After conducting simple linear regression analyses to test the first three hypotheses, a multiple regression analysis was performed using the SPSS Process macro to explore the mediating role of person-organization fit between servant leadership and work engagement. This analysis also used the Bootstrap ($n = 5000$) method, which involves repeated sampling from observed data to create the

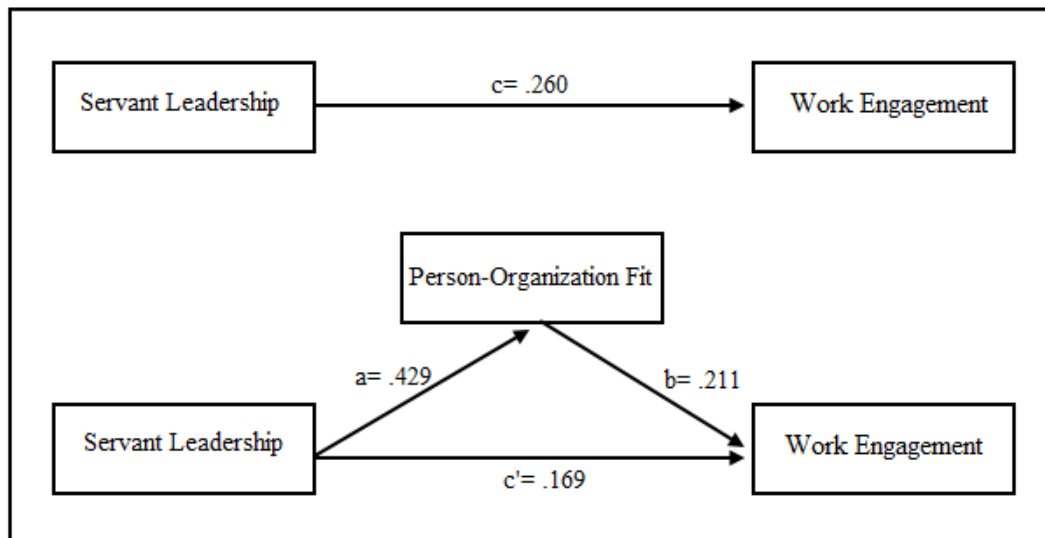
necessary sampling distributions and helps estimate the significance of indirect effects (95% confidence interval).

Table 4. Multiple Regresyon Analysis

		Conclusion Variables									
		M= Person-Organization Fit				Y= Work engagement					
Estimator Variables		B	S.E.	LLCI	ULCI		B	S.E.	LLCI	ULCI	
X	a path	.429	.051	.329	.530	R ² = .211 F= 106.5 p< .001	c' path	.169	.039	.091	.248
SL											
M	b path										R ² = .203 F= 39.4 p< .001
PO Fit											
							B	S.E.	LLCI	ULCI	
Total Effect							c path	.260	.037	.188	.333
Direct Effect							c' path	.169	.039	.091	.248
Indirect Effect							(a×b)	.090	.025	.045	.145

Note: *b*: Unstandardized beta coefficient; S.E.: Standard error; LLCI: Lower Limit Confidence Interval; ULCI: Upper Limit Confidence Interval, X: independent variable, Y: dependent variable, M: mediator variable

Figure 2. Direct, Indirect and Total Impact of Servant Leadership on Work Engagement



According to Table 4, which presents the results of the regression analysis conducted to investigate the mediating role of person-organization fit in the impact of servant leadership on work engagement, the indirect effect (a×b) of servant leadership, when examined combined with person-organization fit, on work engagement is statistically significant (p< 0.001; B= .090; S.E.= .025) (bootstrap 95% confidence interval LLCI= .045; ULCI= .145). In addition, the direct effect (c') of

servant leadership on work engagement continues to be significant ($p < 0.001$; $B = .169$; $S.E. = .039$; $LLCI = .091$; $ULCI = .248$). Based on the findings, it can be stated that person-organization fit partially mediates between servant leadership and work engagement. Thus, H_4 (Person-organization fit has a mediating role between servant leadership and work engagement.) was supported.

4. DISCUSSION

The findings of the analyses support the developed hypotheses. According to the results, servant leadership has a positive effect on work engagement and person-organization fit. Therefore, Hypothesis 1 and Hypothesis 2 were accepted. Additionally, person-organization fit positively influences work engagement, leading to the acceptance of Hypothesis 3. Finally, person-organization fit partially mediates between servant leadership and work engagement, resulting in the acceptance of Hypothesis 4 as well.

The significant impact of servant leadership on work engagement aligns with the results of similar studies. For instance, in separate studies involving public and private sector employees, Bao et al. (2018) found that servant leadership significantly impacts work engagement, with leader-member exchange mediating in this relationship. It is argued that servant leadership predominantly fosters employee participation through social exchange. In another study in the information technology area, it was concluded that servant leadership significantly influences work engagement, and this effect is further enhanced when there is a shared purpose between the leader and the followers (De Clercq et al., 2014). This suggests that when leaders and followers are aligned in their goals, their interactions reach higher levels, leading to positive employee behavior. In addition, the findings I obtained with the research support the relationship between servant leadership and person-organization fit. This result is in line with previous research of Romadhoni et al. (2023) and Dahleez et al. (2021), who finds a positive association between servant leadership and person-organization fit. The findings indicate that employees value practices that help them view their supervisors as supportive and service-oriented. However, relationship between person-organization fit and work engagement supports previous research findings of Hamid and Yahya (2011) and Ünal and Turgut (2015). These studies emphasize that employees who are compatible with their organizations can help them feel psychologically ready to devote themselves to work and expend high levels of energy.

Indeed, I have demonstrated that perceived person-organization fit serves as a partial mediator in the relationship. This clearly shows two positive associations: servant leadership positively influences person-organization fit, which in turn enhances work engagement.

4.1. Theoretical Implications

This study suggests that servant leadership can be a valuable organizational asset in mitigating the negative effects of job demands and promoting employee participation. According to the theory of Job Demand-Resources, managers who are competent, empowering, helpful, and willing to make

sacrifices without expecting anything in return can create the perception among their followers that they have sufficient personal and social resources and can serve as a support mechanism in their engagement with their work. This is the first implication drawn from the research findings.

In addition, this research shows that servant leadership has a role in facilitating employees' adaptation to the organization. As Piasentin and Chapman (2006) emphasize, person-organization fit is generally evaluated on the extent to which the person perceives engagement between own values and the values of the organization he/she works for. Leaders, on the other hand, are the representatives of the social side of the organization, with the role of ensuring that the culture, values, policies, and functioning of the organization are adopted by the employees, implementing the norms developed regarding these issues and monitoring whether they are fulfilled. In this context, the transfer of values and culture that servant leadership tries to provide with a humble approach without pressure can help facilitate employee acceptance. At the same time, person-organization fit reflects an attitude that can emerge not only as a result of the harmony of mutual values but also as a result of meeting mutual expectations (Kristof, 1996). Therefore, servant leadership, which is driven by a desire to serve and addresses the needs of its followers (Singhal & Chatterjee, 2006), is likely to enhance organizational fit. This occurs by making employees feel psychologically supported and valued by management.

The research findings indicate that person-organization fit positively influences employee work engagement as well as contributes to various organizational attitudes and behaviors (Yılmazar, 2016; Akbaş, 2011). Work engagement encompasses their cognitive, emotional, and behavioral orientation towards their work and is closely linked to their individual role performance (Kim et al., 2013). According to Field Theory, employees who perceive a positive fit with their job and organization may be influenced by this harmony (Memon et al., 2014). When an individual sees a similarity between their own values and those of the organization, it can lead to a sense of commitment to the organization (Cable, 1995). On the other hand, in the context of the Job Demand-Resource Theory, achieving value fit between the employee and the organization or enables positive work behaviors to emerge. In the context of this research, person-organization fit plays a resource role in the emergence of work engagement (Ünal & Turgut, 2015). The higher a person fits in with the organization and embraces its values, the more engaged they will be with their job. This idea is supported by Social Identity Theory (Ellemers & Haslam, 2012).

4.2. Managerial Implications

Employee engagement is crucial for the success of all organizations as it reflects the effectiveness and efficiency of the managers and human resources involved in organizational processes (Choi et al., 2015; Saks et al., 2022). Different leadership styles have an impact on increasing employees' levels of work engagement. Modern approaches such as transformational leadership (Breevaart et al. 2014), humble leadership (Tan & Photchanachan, 2021), ethical leadership (Engelbrecht et al. 2017),

paternalistic leadership (Öge et al. 2018), and spiritual leadership (Huang, 2022) focus on the social and psychological aspects of employees. Each leadership approach has specific behavioral tendencies to motivate employees. In addition to this, based on the research findings, it can be concluded that servant leadership is an effective approach to ensure that employees fulfill their duties and responsibilities in the organization with enthusiasm, focus, and energy. The analysis also indicates that servant leadership can enhance employees' engagement with their work by creating a good fit between the person and the organization. Servant leadership plays a crucial role in fostering this fit by emphasizing communication, integrity, persuasion over punishment, and the emotional and mental well-being of employees. In this way, the servant leader acts as a bridge for transmitting the organization's values to the employees and plays a significant role in aligning individual and organizational values (Chatman, 1991).

In practical, when selecting employees, it is important to consider not only their ability to meet job requirements but also their values and whether they can adapt to the organization. Because, sometimes resolving conflicts between the organization and its employees over values can be much harder than teaching job skills. In the workplace, addressing the needs of employees can significantly enhance their adaptation to the organization and encourage positive work behaviors (Luthans, 2002). It is crucial for organizations to prioritize fulfilling basic needs, such as competitive wages and safe working conditions, as this will foster psychological security among employees (Seubert et al., 2021). From a managerial perspective, providing opportunities for participation in decision-making and delegating authority in certain situations can enhance psychological empowerment and encourage constructive work behaviors (Van den Broeck et al., 2016; Richardson et al., 2021). Additionally, evaluating fatigue levels associated with various roles and scheduling regular breaks can assist employees in managing their energy throughout the day (Sahlin et al., 1998). These are all basic employee needs that are expected to be met by the organization. So, leadership, with its inherent prioritization of fulfilling follower needs, offers promise in fulfilling the expectations of followers” (Liden et al., 2014). This approach can ultimately lead to increased motivation and improved focus on their tasks. Moreover, servant leadership is considered to be an effective approach for guiding Generation Z employees who are entering or about to enter the workforce. They are perceived to have interactional needs, expect humanistic behavior from managers, and desire high levels of communication and feedback (Csobanka, 2016; Dolot, 2018). In this context, it is believed that managers who adopt a servant leadership approach in certain organizational processes, especially in job orientation and task assignment, will achieve successful outcomes.

4.3. Limitations and Further Research

The study has a few limitations that should be taken into account. One of the main limitations is that the data was collected through self-assessment questionnaires completed by non-managerial blue-collar employees. Moreover, the research was only focused on the glass industry. These factors restrict the generalizability of the findings. Additionally, since the study only focused on servant leadership,

person-organization fit, and job engagement, it may not allow for comprehensive managerial inferences based on the results. Therefore, it's crucial to conduct further research across different sectors and with diverse samples to gain a deeper understanding of the impact of servant leadership on employee attitudes and behaviors and to make substantial contributions to the existing literature.

Ethics committee approval for the study was obtained from the Gümüşhane University Ethics Committee on June 14, 2023, with document number E-95674917-108.99-182312.

The study has been crafted in adherence to the principles of research and publication ethics.

The author declares that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article.

The entire work was carried out by its only, stated author.

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An Investigation of the Relationship Between Banks' Use of Derivative Products and Sectoral and Macroeconomic Factors: An Application on the Turkish Banking Sector *

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* This study was produced from the doctoral thesis titled “Bankaların Türev Ürün Kullanımı ile Sektörel ve Makroekonomik Faktörlerin İlişki Düzeylerinin İncelenmesi: Türkiye’de Bankacılık Sektörü Üzerine Bir Uygulama”. The related thesis was prepared by Yusuf PALA under the supervision of Prof. Dr. Ali HEPŞEN at Istanbul University, Institute of Social Sciences, Department of Business Administration.

<https://doi.org/10.30798/makuiibf.1498572>

Abstract

This study aims to identify the factors determining the use of derivatives in the banking sector. The study sample consists of 23 deposit banks operating continuously in the Turkish banking sector between 2009 and 2022. Derivative products classified as forward foreign exchange transactions, swap currency transactions, swap interest rate transactions, futures transactions, and option transactions are analyzed in terms of selected financial indicators of banks, their characteristics, and their relationship with macroeconomic variables such as inflation. In the study, the random effect panel Tobit regression model is used as a method. The study's findings demonstrate that banks' derivative activities are significantly influenced by their on-balance sheet FX position. Size, capital, credit risk pressure, inflation, and foreign ownership strongly influence banks' use of derivatives. According to the study's findings, banks primarily use derivatives for hedging in over-the-counter market transactions and for speculation in organized market transactions. However, it has been observed that the drive for speculative trading is dominant in large banks. To counteract this trend, regulators could impose limits on how much banks can use derivative products, with the limits varying based on the bank's size, thereby reducing the incentives for large banks to engage in such practices.

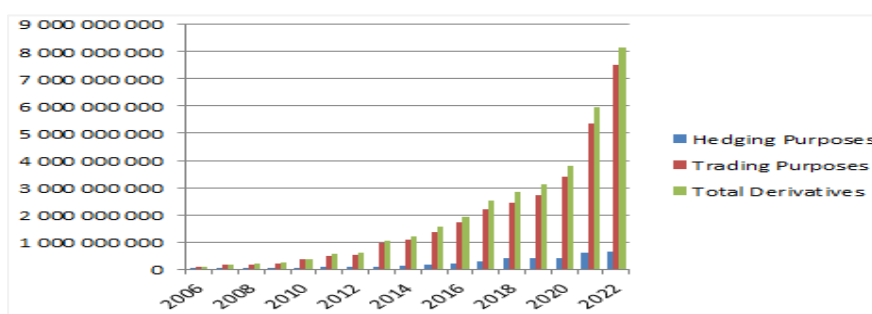
Keywords: *Turkish Banking Sector, Deposit Banks, Derivatives, Hedging, Speculation.*

Article Type	Application Date	Admission Date
Research Article	June 10, 2024	November 21, 2024

1. INTRODUCTION

Individuals, companies, and governments have utilized derivatives for many years. The significance of derivatives, particularly in financial markets, has grown due to developments following the Bretton Woods agreement. An important user of derivatives is banks. One of the purposes for which banks use derivatives is hedging. In addition, banks increase their commission income through derivative transactions or aim to increase their profits through speculative transactions. Criticisms regarding using derivatives for speculation and its potential to increase firm risks have intensified, particularly following the 2008 Global Mortgage Crisis. However, due to increasing competition and declining bank profits, derivatives have become increasingly important in the banking sector. The increased use of derivative instruments highlights its significance.

Graphic 1. Derivative Product Usage Volume in the Turkish Banking Sector



Note: Created by the authors with data received from the Banks Association of Türkiye (TBB)

Chart 1 illustrates the trend of derivatives utilization in the Turkish banking sector over the years. While the total value of derivative product utilization exceeded TL 8 billion in 2022, the highest utilization was observed in trading derivative transactions, accounting for approximately 92%.

This study seeks to uncover the key factors influencing derivatives transactions banks in Türkiye. The study's sample group includes 23 deposit banks that have operated without interruption from 2009 to 2022. Deposit banks hold an 85% share in the Turkish banking sector by asset size (BDDK, 2023). Deposit banks handle about 93% of derivative transactions in the Turkish banking sector (BDDK, 2024). It could be argued that it represents the banking sector due to the significant share of deposit banks.

The study analyzes deposit banks' derivative transactions for trading purposes. Derivative transactions are categorized as forward foreign exchange, futures, swap and option transactions. Due to the extensive use of swap transactions, they have been categorized into swap currency and interest rate transactions. Five classes representing derivative operations were created.

In Panel I, the determinants of derivatives are analyzed using five different models, each with 17 independent variables. Each derivative transaction is included as a separate dependent variable in the models. In Panel II, derivative transactions other than the dependent variable have been added as independent variables to each model constructed in Panel I. This section explores the influence of

derivatives on each other. Panel III analyzes derivative transactions of large banks. A new dummy variable has been generated to distinguish large banks. The variables in Panel I have interacted with this dummy variable. The study's final section involves interpreting the analysis findings and providing recommendations for the future.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

2.1. Hedging Theory

The primary purpose of using derivatives is to hedge risk. Derivatives provide firms, banks, and investors with protection against financial risks. Capital market imperfections caused by growth opportunities, higher tax rates, the possibility of financial distress and managerial incentives increase firms' incentives to hedge. Hedging theory suggests that a company can enhance its value by implementing a hedging program (Smith & Stulz, 1985).

Financial distress occurs when companies lack adequate cash flows to meet their current obligations (Wruck, 1990, p. 421). Firms facing difficulties in meeting their financial obligations have higher financial risk. The company may face bankruptcy as a result. The probability of financial distress associated with firms' leverage decisions increases at higher debt levels. Banks generally operate with high leverage. The probability of banks experiencing financial distress may be high. From this perspective, banks with high leverage levels may need to hedge more as the probability of financial distress will increase. Banks may be encouraged to use derivatives for hedging purposes.

2.2. Bank Capital

Capital financing in banks is a complex issue. High capitalization reduces the likelihood of financial distress and thus lowers external financing costs, suggesting a positive relationship between bank capital and bank earnings (Naceur, 2003). On the other hand, equity financing reduces the tax shield advantage of borrowing and reduces after-tax profits (Berger, 1995, p. 432). Managers may face increased pressure from shareholders as profits decline. Risky transactions by bank management to meet shareholder demands may lead to increased speculative derivative activities within banks (Khasawneh & Hassan, 2009, p. 11).

The capital's ability to reduce the likelihood of financial distress provides a safeguard against the risk of bankruptcy (Merton & Bodie, 1992, pp. 95-96). This function of capital enhances firms' creditworthiness in the eyes of third parties. However, it may also provide an alternative to the monitoring activities of investors who have assumed capital counterparty risk. These characteristics may provide an incentive for investors to deal with well-capitalized firms. High capitalization can give firms an advantage, especially in over-the-counter market transactions. High creditworthiness may enable banks to transact more easily, especially in derivative transactions in over-the-counter markets (Anbar & Alper, 2011, p. 86).

International banking regulations require banks to maintain a minimum capital for risky transactions. Within the Basel criteria framework, banks must maintain a minimum regulatory capital of 8% to cover market, credit, and operational risks. The recommendation is implemented through the domestic legislation of countries. The minimum regulatory capital requirement imposes an additional cost on banks. This cost also plays a role in stabilizing banks' risky transactions. According to the regulatory market hypothesis, the minimum regulatory capital requirement reduces the risk appetite of undercapitalized banks. Accordingly, a decline in speculative derivative activities of low-capitalized banks can be expected.

2.3. Deposit Insurance and Moral Hazard

Deposit insurance programs are designed to prevent depositors from rushing to banks to withdraw their deposits in a banking crisis. During times of crisis, these programs have a stabilizing effect (Anginer et al., 2014). Colomiris and Jaremski (2016, p. 98) acknowledge the benefits of deposit insurance but argue that these programs may incentivize banks to take excessive risks. The study by Kusairi et al. (2018) demonstrates the impact of deposit insurance on excessive risk-taking.

Carter and Sinkey (1998, p. 19) argue that banks may misprice risks due to deposit insurance, which may encourage banks to take excessive risks and direct them to speculative derivative activities. However, the authors of the same study also emphasize that the minimum regulatory capital requirement may reduce banks' incentives to engage in high-risk transactions. Banks with low capital adequacy may experience a more significant impact from this effect. Anbar and Alper (2011, p. 86) argue that undercapitalized banks may not want to hold risky assets to avoid regulatory supervision.

2.4. Risk Exposure

Banks encounter interest rate, credit, and foreign exchange risks due to their operations. The increase in these risks may prompt banks to act against them. Derivatives are an effective tool that banks can use to hedge these risks.

2.4.1. Interest Rate Pressure

Financial activities are closely linked to market interest rates. Deposits comprise a large portion of a bank's resources and are typically short-term. Loans, which make up the assets of banks, are typically long-term investments. This maturity mismatch between banks' assets and resources makes them vulnerable to an unexpected change in interest rates. An increase in short-term interest rates will cause banks' interest expenses to rise, while their interest income will not be affected to the same extent (Drechsler et al., 2021, p. 1091).

The income gap (GAP), which reflects the difference between banks' interest rate-sensitive assets and interest rate-sensitive liabilities at a given maturity, is used to measure banks' sensitivity to interest rates. Banks facing high income gap and significant pressure from interest rates can use

derivatives as a means of protection. Carter and Sinkey (1998), Sinkey Jr. and Carter (2000), and Shyu and Reichert (2002) provide evidence supporting the positive relationship between interest rate pressure and hedging derivative activity.

A significant portion of the bank's earnings comes from interest income. However, interest expenses are also a critical liability item for banks. Banks' profits increase when the net interest margin is positive, representing the difference between interest income and expenses. In this case, banks can use derivatives to lock in interest earnings. If the situation were reversed, banks' interest earnings would decrease. Banks may turn to speculative derivative transactions to compensate for reduced interest earnings in this case. Hudman (1999), Sinkey Jr. and Carter (2000), Shyu and Reichert (2002), and Sinha and Sharma (2016), find evidence that banks' declining interest earnings encourage the use of derivatives for speculative purposes.

2.4.2. Credit Risk Pressures

A significant portion of traditional banking activities consists of loans. Loans reflect banks' asset quality. Having a large loan portfolio is a sign of high asset quality. Banks with high asset quality also have higher creditworthiness. Creditworthiness can be an advantage for using derivatives, especially in over-the-counter markets. However, an expansion in the customer base of banks with high loan portfolios can also be expected. Since the cross-selling opportunities of banks with an expanding customer base will increase, banks with this potential may target an increase in commission earnings by directing their customers to derivative products. Khasawneh and Hassan (2009, p. 9-10) argue that a high loan portfolio may encourage banks' speculative derivative activities.

Expanding loan portfolios positively affects banks' asset quality but also increases banks' credit risk (Foos et al., 2010; Dang, 2019). If loan repayments do not materialize, it can lead to the bank's capital collapsing. The expansion in banks' loan portfolios increases the likelihood of this unfavorable scenario. Banks can use derivatives to hedge against this possibility. Credit derivatives are more attractive products for hedging credit risk. For this reason, banks may prefer credit derivatives instead of derivatives consisting of forwards, futures, options, and swaps. However, the relationship between loans and interest rates may also reveal the need to address credit and interest rate risks together. Sinkey Jr. and Carter (2000, p. 434) note that certain derivative banks use to hedge against interest rate risk may also be linked to credit risk.

Another indicator of banks' asset quality is non-performing loans. As the ratio of non-performing loans increases, the quality of banks' assets decreases (Yıldırım, 2024, p. 512). When non-performing loans increase, banks' credit risk also increases. Banks may increase their derivative activities for hedging purposes as a result of this. On the other hand, banks with high follow-up rates may face increased pressure from supervisory authorities. Banks may choose to avoid risky activities and decrease speculative derivatives trading to avoid supervisory pressure (Hundman, 1999, p. 86-87).

2.4.3. Exchange Rate Risk Pressure

One of the critical risk types affecting the Bank's operations in foreign exchange risk. Foreign exchange rate risk is the likelihood of financial loss resulting from exchange rates moving in the opposite direction of the banks' position. Exchange rate risk, which may increase bank costs, decrease profits, and cause capital loss, is related to banks' foreign currency positions (Cirlan, 2022, p. 82-83). When a bank has more foreign exchange (FX) liabilities than FX assets, it is said to have a deficit in its net FX position. Banks that have a shortage of foreign currency are negatively impacted by the increase in foreign currency exchange rates. Banks may prefer derivatives as a hedging instrument against exchange rate pressure. However, Yong et al. (2014) demonstrate that banks with low exchange rate risk may also experience an increase in derivative activities. Accordingly, low exchange rate risk may encourage banks' risk appetite and support speculative derivative activities.

2.5. Liquidity Management

Liquidity management involves finding a balance between low-yielding assets that offer high liquidity and high-yielding assets that offer low liquidity. Since banks holding highly liquid assets are less likely to default, they may have less motivation to hedge. High liquidity could serve as an alternative to hedging with derivative activities. Shiu and Moles (2010) obtained results that confirm this expectation. However, Sinha and Sharma (2016), and Yong et al. (2014) demonstrate a positive correlation between high liquidity portfolios and derivative activities. These results also suggest that a robust liquid asset portfolio may increase risk appetite and encourage speculative derivative activities in banks.

2.6. Dividend Payments

Carter and Sinkey (1998) argue that dividend payments may be one factor affecting banks' use of derivatives. By stabilizing cash flow volatility through derivatives, banks can pay higher dividends to shareholders or pay bond creditors. According to this approach, a positive relationship can be expected between high dividend payments and derivative activities. Shiu and Moles (2010), and Yong et al. (2014) also provide evidence supporting this approach.

2.7. Profitability

Banks, like other commercial firms, operate to maximize their profits. The use of derivatives for speculative purposes can be a factor in banks' realizing these objectives. Highly profitable banks may also have an impact on customer preferences. Khasawneh and Hassan (2009, p. 9) emphasize in their study that banks that announce high profits will become more reputable in customers' eyes. This reputation may attract customers who want to trade in derivatives markets to these banks. Hundman (1999, p. 87) states in his study that banks that reduce their risks through derivative products will have the opportunity to invest in high-risk projects with higher return potential, which may positively impact bank profitability.

Approaches explaining the relationship between bank profitability and derivative products generally point to a positive relationship. However, results contrary to expectations can be seen in empirical studies (Adkins et al.,2007; Akkaynak & Yıldırım, 2019).

2.8. Bank Size

The size of a bank is expected to have a positive impact on its use of derivative products. This positive effect may result from the high reputation of large banks among customers, the cost advantages brought by economies of scale, and their confidence in taking risks.

There is a belief that larger banks are more reliable. Large banks can take use this trust to trade more easily in over-the-counter markets. This advantage may positively the derivative activities of large banks (Anbar & Alper, 2011, p. 84).

Derivatives are inherently complex products. The transactions require a certain level of expertise. However, there is a need for a robust technical infrastructure and an audit system to ensure proper execution and monitoring of transactions. The requirements for derivatives transactions impose a certain level of cost on banks. Large banks are easily placed to absorb these costs. Large banks can take advantage of the benefits of economies of scale in this regard. Large banks' advantages are expected to positively impact their derivatives activities (Carter & Sinkey, 1998, p. 21; Hundman, 1999, p. 87).

Pais and Stork (2013) argue that the concept of "too big to fail" incentivizes large banks to take on excessive risks. Carter and Sinkey (1998, p. 19) emphasize that bank managers who believe they are too big to fail may aggressively engage in derivative transactions for speculative purposes. Accordingly, bank size may create a moral hazard problem, as in the case of deposit insurance.

2.9. Ownership Structure

TBB classifies deposit banks as publicly and privately owned banks according to ownership structure. Privately owned banks are divided into domestic privately owned or foreign privately owned. Yong et al. (2014, p. 439) argue that state-owned banks may be less sensitive to hedging due to their state guarantee. This may result in fewer hedging derivative transactions in state-owned banks. On the other hand, foreign privately owned banks may be more experienced in derivatives transactions due to their international banking experience. Taşkın and Sarıyer (2020) provide evidence of a positive relationship between foreign-owned banks and derivatives transactions.

2.10. Macroeconomic Factors – Inflation

An inflationary business cycle impacts the purchasing power of economic agents and reduces the incentive to save. These effects may hurt banks' on-balance-sheet and off-balance-sheet activities and may lead to a decline in the volume of derivative transactions (Khasawneh & Hassan, 2009, p. 11; Anbar & Alper, 2011, p. 86). On the other hand, inflation increases uncertainty about the future and raises risks. At this point, derivatives can be instruments that banks can turn to with their risk-reducing

effects. In this scenario, inflationary conditions might lead to an increase in banks' derivative activities for hedging (Oktar & Yüksel, 2016, p. 41; Şimşek, 2015, p. 81).

Table 1. Summary of the Literature

Author(s)	Sample	Conclusion
Carter and Sinkey (1998)	1990-1993 Asset size \$100 Million - \$1 Billion 279 US Bank	Capital and bank size are important factors for participation in interest rate derivatives. Interest rate pressure is also effective in interest rate derivative utilization.
Hundman (1999)	1995:IV-1997:III Asset size > \$500 Million 38 different countries	Bank size, capital and credit risk pressure are positively related to banks' derivatives activities, while net interest margin is negatively related
Sinkey Jr. and Carter (2000)	1996 Commercial banks operating in the US	Derivative activities of end-user banks are associated with riskier capital structure, higher maturity mismatch, lower net interest margin, and higher credit risk. Bank size is an essential determinant of derivatives activity.
Shyu and Reichert (2002)	1995-1997 7 Holding Banks and 25 International Banks operating in the US	Bank profitability negatively affects banks' derivative activities, while bank capital, asset size, maturity gap, and rating score have a positive impact.
Khasawneh and Hassan (2009)	1992:3-2008:11 Commercial banks operating in the US	Economic business cycles do not impact banks' use of derivatives. The size of the bank and loan placements have a positive effect on the derivative activities of banks.
Shru and Moles (2010)	1998:Q2-2005:Q1 34 banks listed on the Taiwan stock exchange	Banks' derivatives activities are effectively influenced by risk management, information, and economies of scale.
Anbar and Alper (2011)	1999-2010 7 Turkish Banks traded on the ISE	Net interest margin and return on equity have a positive impact on banks' derivative activities, while loan loss provisions, size, and interest rates have a negative impact on them.
Yong, Faff and Chalmers (2014)	2002-2003 Banks operating in the Asia-Pacific Region	The derivatives activities of banks in the Asia-Pacific region are significantly influenced by the probability of financial distress and the size of the banks.
Şimşek (2015)	2006-2014 Turkish Banking Sector	Off-balance sheet risks, inflation, market risk, central bank reserves, and the volume of TL deposits are critical factors affecting the use of FX swap transactions.
Sinha and Sharma (2016)	2013 46 Bank of India	Derivatives are effective tools for hedging against exchange rate and interest rate risks. Capital, low net interest margin, size, and high liquidity contribute to the increased use of derivatives.
Oktar and Yüksel (2016)	2003:1-2015:3 Deposit banks operating in Türkiye	The NPL ratio has a positive impact on banks' derivative activities, while specific provisions have a negative impact on them.
Khan, Arif ve Tahir (2018)	2004-2006 Banks in Pakistan	The presence of high capital has a positive impact on the use of derivatives but a negative impact on the loan portfolio.
Vo vd. (2020)	2017 17 Emerging Economies	Public expenditures and trade deficits increase derivative activity. Growth and inflation are less critical for derivative activity.
Akkaya and Torun (2020)	2002-2018 Turkish Banking Sector	Return on assets has a significant impact on derivative activities and can have a negative effect on their use.
Yenisu, Traş and Saygın (2021)	2005-2021 Turkish Banking Sector	Bank size, financial risk, and exchange rate risk increase the use of derivatives while return on equity decreases.
Zeddoun and Bendima (2022)	2006-2020 25 Gulf-Arab Banks	Derivatives are successful tools for mitigating financial risks.

(Table 1 cont.)

Author(s)	Sample	Conclusion
Pala (2023)	2014-2021 Deposit Banks and Development and Investment Banks Operating in Türkiye	Capital and non-performing loans have a positive impact on deposit banks' use of interest rate derivatives, while liquidity has a negative effect. The size factor is a key determinant of interest rate utilization by development and investment banks.
Lestari and Pratiwi (2023)	2016-2018 23 Foreign Exchange Banks Listed on the Indonesian Stock Exchange	Firm size, debt level, and cash flow volatility positively affect banks' hedging behavior, while liquidity negatively impacts it.
Coşkun and Gürbüz (2024)	2010-2020 104 Banks From 21 Developed Countries and 41 Banks From 12 Developing Countries	Interest rates and bank size are generally positively associated with FX derivative use. Deposit size increases the use of FX derivatives in developed countries, but it decreases in developing countries.

3. METHODOLOGY

3.1. Data Set

This study aims to identify the factors influencing the use of derivatives by deposit banks in Türkiye. In this study, 2009-2022 is used as the sample period. 23 deposit banks that continued their activities uninterrupted during this period are examined. Forward foreign exchange transactions, swap money transactions, swap interest transactions, futures transactions, and options transactions reported under the heading of banks' derivative transactions for trading purposes are modeled and analyzed separately.

Variables commonly used in the literature were used to select factors that potentially affect banks' use of derivatives. Studies analyzing the use of derivatives in the Turkish banking sector do not find income gaps, deposit insurance, or dividend payout ratios. This study analyzes these variables for the first time in the Turkish banking sector. Unconsolidated financial statements of banks published by the TBB are used to obtain data on variables. Inflation data is obtained from the EVDS data system of the Central Bank of the Republic of Turkey (TCMB). The definition and calculation methods of the variables are shown in Table 2.

Table 2. Variable Definitions and Calculation Method

Variable Code	Variable(s)	Calculation Method
VDİ	Forward Foreign Exchange Trading	$(\text{Forward Foreign Exchange Trading} / \text{Total Assets}) * 100$
SPİ	Swap Currency Trading	$(\text{Swap Currency Trading} / \text{Total Assets}) * 100$
SFİ	Swap Interest Rate Trading	$(\text{Swap Interest Rate Trading} / \text{Total Assets}) * 100$
TOİ	Total Options Trading	$(\text{Currency, Interest Rate and Security Options Trading} / \text{Total Assets}) * 100$
TFİ	Total Futures Trading	$(\text{Currency Futures and Interest Rate Futures} / \text{Total Assets}) * 100$

(Table 2 cont.)

Variable Code	Variable(s)	Calculation Method
LNAKT	Asset Size	Natural Logarithm of Total Assets
SYO	Capital Adequacy Ratio	(Equity/Total Risk Weighted Amounts)*100
KLD	Equity/Total Assets	(Equity/Total Assets)*100
BİDP	On-Balance Sheet Foreign Exchange Position	(On Balance Sheet FX Position/ Equity)* 100
KRED	Total Loans Ratio	(Total Loans/Total Assets)*100
TKRD	Non-Performing Loans	(Non-Performing Loans/Total Loans)*100
LKT	Liquid Assets Ratio	(Liquid Assets/Short Term Liabilities)* 100
NİM	Net Interest Margin	([Interest Income-Interest Expense]/Total Assets)* 100
ROE	Return on Equity	(Net Profit (Loss)/Equity)*100
ROA	Return on Assets	(Net Profit (Loss) for the Period / Total Assets) * 100
GAP12	Gap Analysis	(| Interest Rate Sensitive Assets up to 12 Months - Interest Rate Sensitive Liabilities up to 12 Months | / Total Assets)*100
TMTT	Dividend Ratio	(Dividend Payments/Total Assets)*100
MSİG	Deposit Insurance Ratio	(Total Deposits Covered by Insurance/Total Assets)*100
TÜFE	Consumer Price Index	Consumer Price Index Rate of Change Compared to the Previous Year*100
MYY	Ownership 1	Dummy Variable that takes the value “1” if there is a foreign share in the bank's capital or “0” otherwise
MKO	Ownership 2	Dummy Variable that takes the value “1” if there is a Public Share in the Bank's Capital or “0” otherwise
BBK	Bank Size Dummy	Dummy Variable that takes the value “1” if the Asset Size of a Bank is equal to or greater than the Median Value of Total Banks in the Relevant Year and “0” otherwise

Here are the descriptive statistics for the variables used in the study, as presented in Table 3. The total assets of 23 deposit banks reached a peak of approximately TL 2.311 Billion during the analyzed period. The highest average trading volume among the dependent variables was observed in currency swap transactions. This was followed by interest rate swaps, options, forward foreign exchange, and futures transactions.

Table 3. Descriptive Statistics

Variables	Number of Observations	Mean	Std. Deviation	Minimum	Maximum
AKT	322	145683.8	277065.2	895.765	2311665
LNAKT	322	10.45225	1.873563	6.797678	14.65348
KLD	322	11.72107	4.0456	2.881049	39.69888
SYO	322	18.33859	5.252743	12.57037	50.71908
BIDP	322	74.69301	67.90346	-137.338	384.8947
KRED	322	58.85989	12.97522	3.609701	84.71611
TKRD	322	4.510097	4.883282	0	48.58791
LKT	322	50.92489	24.99119	13.54083	164.3204
ROA	322	1.334609	1.515638	-.11.48341	8.026964
ROE	322	10.22853	25.07267	-398.5842	46.61223
NIM	322	4.119463	1.725114	0.1223414	19.28724
MSIG	322	12.15131	11.31061	0	147.9958
GAPI2	322	12.95391	10.34046	0	57.88303
TMTT	322	0.1382598	0.3857065	0	3.825218
TUFE	322	14.915	16.40858	6.25	72.31
GSYİH	322	23.21857	24.87433	0.36	106.88
MKO	322	0.1304348	0.3373053	0	1
MYY	322	0.4813665	0.5004303	0	1
BBK	322	0.5217391	0.5003047	0	1
VDI	322	10.52699	19.23755	0	194.972
SPI	322	38.93249	35.13986	0	212.6651
SFI	322	10.70931	15.16786	0	79.81931
TOI	322	10.5708	14.53559	0	95.62286
TFI	322	0.3903167	2.556005	0	34.87224

3.2. Research Method and Econometric Model

This study uses the random effect panel Tobit regression model to analyze the determinants of banks' use of derivative products. This method considers the amount of a bank's use of derivatives and allows banks that do not use derivatives to be monitored through independent variables. Thus, a bank that did not use derivatives for a certain period is not excluded from the sample group, and data loss is prevented. The Tobit model is one of the preferred models in studies of derivatives. Carter and Sinkey (1998), Sinkey Jr. and Carter (2000), Shu and Moles (2010), and Anbar and Alper (2011) investigated the factors influencing derivative product usage using the Tobit model.

Tobit models were first used by Tobin (1958). These models, known as censored or discrete models, were named Tobit models by Goldberger (1964) due to their similarity to probit models (Amemiya, 1984:3). The Tobit model can be considered a combination of the OLS and probit models.

In probit models, the dependent variable takes 0 and 1 values, while in tobit models, it can take any value, provided that it is greater than 0.

In the Tobit model, some dependent variable observations are censored because they are unobservable. These values are left-censored if they fall in the left tail of the parametric distribution and right-censored if they fall in the right tail. Tobit models can feature censoring on both ends.

In panel data sets, Tobit models are suitable when some dependent variable values are zero and others are positive. However, inconsistent parameter estimates occur when $T < N$ in models built with fixed effects assumption (Tatoğlu Yerdelen, 2020: 240). Panel Tobit models constructed with the fixed effects method are unsuitable because they cause random parameter problems and give inconsistent results. The random effect panel Tobit model, which is widely used in econometric analyses, is represented by the following equation (Saçıldı & Genç, 2018: 248-249):

$$y_{it}^* = \alpha_i + \beta' X_{it} + u_{it}, \quad i: 1,2,\dots,N \quad t: 1,2,\dots,T \quad (1.1)$$

$$u_{it} = v_{it} + \varepsilon_{it} \quad (v_{it} \sim N(0, \sigma_v^2)) \quad (\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2))$$

X_{it} , denotes the independent variables, β denotes the vector of unknown parameters, u_{it} denotes the error term, and the error term should be time-independent.

$$y_{it} = \begin{cases} y_{it}^* & \text{ise } y_{it}^* > 0 \\ 0 & \text{ise } y_{it}^* \leq 0 \end{cases}$$

The study involves creating 15 models that are grouped into 3 different panels. In Panel I, banks' use of derivatives is analyzed with five different models constructed according to five different derivative transactions.

In Panel II, derivative transactions other than the dependent variable are added as independent variables to the models constructed in Panel I. Panel II models, based on Carter and Sinkey (1998), and Shyu and Reichert (2002), investigate the impact of derivatives on each other.

Panel III analyzes the derivatives activities of large banks. A dummy variable is created with the code BBK to represent large banks. Interaction variables are created between the BBK dummy variable and the independent variables in Panel I models, and the effect of these interaction variables on derivatives transactions is analyzed. This study is based on Sinkey Jr. and Carter (2000), and Sinha and Sharma (2016). Since the correlation between the LNAKT variable used in Panel I and the BBK variable is high, the LNAKT variable is not used in the models constructed in Panel III. In addition, since the calculation could not be made for the interaction variable of BBK*MYO, this variable was excluded from the models.

4. EMPIRICAL FINDINGS

This section analyzes the results of the models examined. Models 1 through 5 are reported in Panel I, Models 6 through 10 are reported in Panel II, and Models 11 through 15 are reported in Panel III. There are 16 independent variables in Panel I, 20 in Panel II, and 30 in Panel III. All models include 322 observations. 26 observations in VDI models, 14 in SPI models, 107 in SFI models, 245 in TFI models, and 262 in TOI models censored from the left. In all models, Wald test results reject the null hypothesis H₀, which states that the model is statistically insignificant at the 1% statistical significance level. The Wald test results indicate that each model is significant. The LR test results in all models reject the null hypothesis H₀, which states no difference between the unit effect and standard error at the 1% level. Accordingly, the random panel Tobit regression model should be used instead of the pooled model in the analyzed models.

Table 4. Panel I Results

VARIABLES	VDI (Model 1)	SPI (Model 2)	SFI (Model 3)	TFI (Model 4)	TOI (Model 5)
LNAKT	-2,828104 [1440917] (0.050)**	0.7152758 [2.257635] (0.751)	4.46343 [1.498488] (0,003)***	2.065607 [0.6100717] (0,001)***	-1.328035 [1.362637] (0.330)
KLD	-0.9090744 [0.5449667] (0.095)*	-0.3987443 [0.7939908] (0.616)	0.0214098 [0.543439] (0.969)	0.7027822 [0.3817844] (0.066)*	0.1816143 [0.461289] (0.694)
SYO	-0.9707306 [0.3584574] (0.007)***	0.376609 [0.5434352] (0.488)	0.8420769 [0.3579971] (0,019)**	-0.0158095 [0.1853007] (0.932)	-1.317644 [0.3335737] (0,000)***
BIDP	0.0351324 [0.0171632] (0.041)**	0.1331984 [0.0264829] (0,000)***	0.0266369 [0.0147918] (0,072)*	0.0352852 [0.009639] (0,000)***	-0.0265424 [0.0135264] (0.050)**
KRED	-0.0734184 [0.1528326] (0,631)	0.5094025 [0.229985] (0,027)**	0.2464469 [0.1351956] (0,068)*	-0.1513385 [0.0880915] (0.086)*	0.043266 [0.1235713] (0.726)
TKRD	0.4925244 [0.268647] (0.067)*	0.8790508 [0.4191085] (0.036)**	-0.4938964 [0.4371775] (0.259)	0.2756299 [0.1718951] (0.109)	-0.2664881 [0.2490189] (0.285)
LKT	-0.0977519 [0.0656653] (0.137)	-0.0859164 [0.0921087] (0.351)	-0.1626138 [0.0589024] (0,006)***	0.027002 [0.0391714] (0.491)	-0.0171906 [0.0509739] (0.736)
ROA	6.72481 [1.511262] (0.000)***	3.71439 [2.313676] (0.108)	-1.269085 [2.037304] (0.533)	-2.248747 [1.467912] (0.126)	0.741935 [1.392282] (0.594)
ROE	-0.0845747 [0.059992] (0.159)	0.0194419 [0.0928379] (0.834)	0.0238852 [0.1356567] (0,860)	0.3063342 [0.1834196] (0.095)*	-0.0768341 [0.0477997] (0.108)
NIM	-1.779942 [0.8317563] (0.032)**	-2.641341 [1.267556] (0.037)**	-0.8774023 [1.059732] (0.408)	0.1150359 [0.4114168] (0.780)	-0.4147886 [0.9157654] (0.651)
MSIG	0.0131763 [0.102016] (0,897)	0.1314336 [0.1586159] (0.407)	0.0997364 [0.0773984] (0.198)	-0.0216391 [0.0365657] (0.554)	-0.0711946 [0.0777167] (0.360)
GAP12	0.0440861 [0.1078553] (0.683)	-0.1678437 [0.1661476] (0.312)	-0.081773 [0.104004] (0.432)	-0.0662721 [0.0563373] (0.239)	-0.1255631 [0.0929816] (0.177)
TMTT	5.348836 [2.864356] (0,062)*	3.615996 [4.302406] (0.401)	-6.761554 [5.691875] (0,235)	-1.125069 [1.736877] (0.517)	-4.980784 [3.235747] (0.124)

(Table 4 cont.)

VARIABLES	VDI (Model 1)	SPI (Model 2)	SFI (Model 3)	TFI (Model 4)	TOI (Model 5)
TUFE	0.2279996 [0.0757512] (0.003)***	0.2935795 [0.1160865] (0.011)**	-0.027781 [0.0707782] (0.695)	0.0126061 [0.037566] (0.737)	0.1314771 [0.0623984] (0.035)**
MKO	-7.405028 [9.605816] (0.441)	-19.40372 [15.40458] (0.208)	-10.43432 [9.97576] (0.296)	-2.931541 [2.969711] (0.324)	-16.39331 [9.543505] (0.086)*
MYY	1.565513 [4.22823] (0.711)	19.0187 [6.5404] (0.004)***	7.047594 [3.895984] (0.070)*	0.1144621 [1.866742] (0.951)	-6.61306 [3.459072] (0.056)*
C	65.87514 [21.06106] (0.002)***	-16.2412 [31.76327] (0.609)	-60.92026 [21.65284] (0.005)***	-32.87177 [12.2099] (0.007)***	52.50166 [19.17181] (0.006)***
Number of Observations	322	322	322	322	322
Number of Left-Censored Observations	26	14	107	245	262
Log Likelihood	-1255.6836	-1443.3571	-869.48965	-290.74098	-1048.1436
Wald chi2 (16)	69.24	73.52	99.83	37.58	49.87
Prob. > chi2	0.0000	0.0000	0.0000	0.0017	0.0000
LR chi2(01)	57.15	109.68	138.87	7.44	134.34
Prob. > chi2	0.000	0.000	0.000	0.003	0.000

Note: ***, **, * indicate statistical significance levels of 1%, 5%, 10% respectively. [] denotes standard errors, and () denotes probability values.

Panel 1 results are displayed in Table 4. In the VDI model, the variables SYO, ROA, and TUFE are found to be significant at the 1% statistical significance level, LNAKT, BIDP, and NIM are found to be significant at the 5% statistical significance level, KLD, TKRD, and TMTT are found to be significant at the 10% statistical significance level. The constant term C in the model is statistically significant at a 1% level and has a positive coefficient. Other independent variables did not produce statistically significant coefficients.

Based on Model 1, increases in banks' FX open positions, non-performing loan ratios, return on assets, cash dividend distributions, and inflation rates increase forward foreign exchange trading by banks. The BIDP variable supports the hypothesis of hedging exchange rate risk; the TKRD variable supports the hypothesis of hedging credit risk, and the TUFE variable supports the hypothesis of hedging uncertainty due to inflation. The ROA variable supports the hypothesis that banks that hedge their risks through forward foreign exchange transactions will be able to invest in more profitable projects. This result may also be related to customers preferring banks with high profitability to make Forward Foreign Exchange transactions. The positive result of TMTT variable's supports the hypothesis that banks reducing their risks through derivative transactions may distribute more dividends.

Model 1 shows that increased LNAKT, KLD, SYO, and NIM variables decrease forward foreign exchange transactions. This result of the LNAKT variable is inconsistent with expectations. In addition, Yong et al. (2014), and Khasawneh and Hassan (2009) obtained similar results. The results for the KLD and SYO variables support the probability of financial distress hypothesis. The NIM variable indicates that banks with low net interest margins tend to engage in forward foreign exchange transactions to increase their profitability.

According to Model 2's results, swap currency transactions are the dependent variable, and the BIDP and MYY variables are statistically significant at a 1% level. At the same time, the KRED, TKRD, NIM, and TUFE are statistically significant at a 5% level. The NIM variable with a negative sign indicates that banks with low net interest margins have increased currency swap transactions. Swap currency transactions have a positive relationship with the BIDP, KRED, TKRD, TUFE, and MYY variables. Accordingly, currency swap transaction volumes of banks with increasing FX open positions, expanding loan volume, and increasing loan follow-up rates increase. Similarly, rising inflation and foreign ownership also increase banks' currency swap transaction volumes. The TUFE variable indicates that banks' currency swap transactions increase with inflation. This finding can be considered a result of the motivation to hedge risk. The results unequivocally show that an escalation in risk pressure directly results in a surge in currency swap transactions, as indicated by the BIDP, KRED, and TKRD variables. However, the positive result for the KRED variable can also be explained by customer preferences and the expansion of cross-selling opportunities.

The dependent variable in Model 3 is the swap interest rate transactions. LNAKT, LKT, and the model's constant term are the variables found to be significant in Model 3 at the 1% level, SYO at the 5% level, and BIDP, KRED, and MYY at the 10% level. LKT has a negative sign, which implies that swap interest rate transactions are reduced in banks with highly liquid assets. This result supports the liquidity hypothesis, which suggests that highly liquid assets can serve as an alternative to derivatives for hedging purposes. LNAKT, SYO, BIDP, KRED, and MYY variables have positive signs. The BIDP and KRED variables indicate that swap interest rate transactions increase with rising exchange rate risk and credit risk pressure, supporting the risk pressure hypothesis. The positive sign of the KRED variable may be related to interest rate pressure as well as credit risk pressure. The MYY variable indicates that foreign ownership increases swap interest rate transactions. The result for the LNAKT variable supports the economies of scale hypothesis. The positive sign of the SYO variable indicates that banks with higher capital adequacy ratios increase swap interest transaction volume. This result supports the credibility hypothesis. It can also be explained by the fact that banks with high SYO are more willing to take risks. An alternative interpretation is that banks with low capital adequacy ratios avoid engaging in speculative derivative transactions. Accordingly, the regulatory market hypothesis is valid for swap interest rate transactions.

The dependent variable in Model 4 is the futures transactions. In Model 4, LNAKT, BIDP, and the model's constant term are statistically significant at the 1% level, while the KLD, KRED, and ROE variables are statistically significant at the 10% level. The KRED variable with a negative sign indicates that a decrease in credit volume increases the volume of futures transactions. This result is in line with Khasawneh and Hassan (2009) and is attributed by the authors to speculative use. LNAKT with a positive sign is consistent with the economies of scale hypothesis. The positive sign of the BIDP variable can be explained by exchange rate risk pressure. The positive result for the KLD variable is consistent

with the hypotheses of creditworthiness, regulatory market, and incentive to take additional risk. The positive sign of the ROE variable indicates that return on equity increases banks' futures trading volume. The results of Anbar and Alper (2011), and Özer (2020) are consistent with this result of the ROE variable.

According to the results of Model 5, where option transactions are the dependent variable, SYO and the model's constant term are statistically significant at the 1% level, BIDP and TUFÉ variables at the 5% level, and MKO and MYY variables at the 10% level. The positive sign of the TUFÉ variable implies that high inflation increases option transactions. This result points to hedging purposes. The negative sign of the SYO variable supports the hypothesis of the probability of financial distress. Accordingly, banks with low capital adequacy ratios increase option transactions due to bankruptcy risks. Contrary to other models, the BIDP variable produced a negative coefficient. Accordingly, banks with low FX open positions have higher option trading volumes. The speculative trading motive can explain this result. Banks with low foreign exchange (FX) open positions are more likely to take risks. The sign of the MYY variable indicates that foreign ownership reduces option utilization compared to swap transactions. The sign of the MKO variable similarly indicates that public ownership reduces option trading volume. This result can be explained by the fact that state-owned banks feel less need to hedge.

Table 5. Panel II Results

VARIABLES	VDi (Model 6)	SPI (Model 7)	SFI (Model 8)	TFI (Model 9)	TOi (Model 10)
LNAKT	-2.22084 [1.1255] (0.048)**	1.639055 [1.75317] (0.350)	5.080374 [1.355651] (0.000)***	2.449811 [0.7348144] (0.001)***	-0.8349183 [1.339466] (0.533)
KLD	-0.5075961 [0.4499699] (0.259)	-0.2778835 [0.6643089] (0.676)	0.3806555 [0.5339258] (0.476)	0.6937729 [0.3725272] (0.063)*	0.3877287 [0.4586667] (0.398)
SYO	-0.8925234 [0.3045624] (0.003)***	1.050555 [0.4615462] (0.023)**	0.640747 [0.3427943] (0.062)*	0.0051782 [0.187692] (0.978)	-1.378248 [0.3352137] (0.000)***
BIDP	-0.0030161 [0.0152769] (0.843)	0.0891712 [0.0228762] (0.000)***	0.0251666 [0.014815] (0.089)*	0.0279066 [0.0100162] (0.005)***	-0.0279551 [0.0139271] (0.045)**
KRED	-0.2524031 [0.1283678] (0.049)**	0.5724223 [0.1905633] (0.003)***	0.1452688 [0.1314516] (0.269)	-0.1498653 [0.0875841] (0.087)*	0.0120083 [0.1246621] (0.923)
TKRD	0.191485 [0.232276] (0.410)	0.4318685 [0.3648775] (0.237)	-0.2573267 [0.3814839] (0.500)	0.2168326 [0.1791429] (0.226)	-0.3170099 [0.2604491] (0.224)
LKT	-0.0698327 [0.0564266] (0.216)	0.0319709 [0.0786386] (0.684)	-0.1304181 [0.0555924] (0.019)**	-0.0005699 [0.0406677] (0.989)	0.0158472 [0.050366] (0.753)
ROA	4.984013 [1.291765] (0.000)***	-1.144852 [2.017147] (0.570)	-2.024198 [2.385275] (0.396)	-2.465987 [1.505621] (0.101)	0.3593555 [1.385766] (0.795)
ROE	-0.0854449 [0.0512732] (0.096)*	0.0678944 [0.0789203] (0.390)	0.0763355 [0.2114463] (0.718)	0.2975973 [0.1854757] (0.109)	-0.0866482 [0.0465457] (0.063)*
NIM	-0.8720578 [0.7037935] (0.215)	-0.4883427 [1.091741] (0.655)	-0.3209831 [1.01137] (0.751)	0.1790213 [0.4014201] (0.656)	0.0949268 [0.9204014] (0.918)

(Table 5 cont.)

VARIABLES	VDİ (Model 6)	SPI (Model 7)	SFI (Model 8)	TFI (Model 9)	TOI (Model 10)
MSIG	-0.011433 [0.0851532] (0.893)	0.0976989 [0.1317112] (0.458)	0.0992252 [0.0734361] (0.177)	0.0140289 [0.0364066] (0.700)	-0.0710588 [0.0755759] (0.347)
GAPI2	0.1100095 [0.0909515] (0.226)	-0.1204646 [0.1418337] (0.396)	-0.0415861 [0.0999914] (0.677)	-0.0695661 [0.0561726] (0.216)	-0.1073619 [0.0912069] (0.239)
TMTT	4.961743 [2.470213] (0.045)**	0.2606097 [3.614169] (0.943)	-5.082777 [5.14318] (0.323)	-1.581361 [1.696218] (0.351)	-5.337121 [3.134747] (0.089)*
TÜFE	0.1171457 [0.0635223] (0.065)*	0.0822039 [0.0976927] (0.400)	-0.0386539 [0.0655434] (0.555)	-0.0025848 [0.0389882] (0.947)	0.0991158 [0.0614176] (0.107)
MKO	0.8209425 [6.598562] (0.901)	-8.097236 [10.20515] (0.428)	-8.186355 [8.78935] (0.352)	-5.06408 [3.639618] (0.164)	-13.97831 [9.459576] (0.139)
MYY	-2.361146 [3.490361] (0.499)	12.34781 [5.459944] (0.024)**	5.963032 [3.68948] (0.106)	0.4569643 [2.097101] (0.828)	-7.059881 [3.436929] (0.040)**
VDI		0.8463951 [0.0771787] (0.000)***	-0.0572026 [0.1055097] (0.588)	-0.0041113 [0.035527] (0.908)	0.151149 [0.0626277] (0.016)**
SPI	0.345894 [0.0319981] (0.000)***		0.0926488 [0.0347979] (0.008)***	0.0223921 [0.0224286] (0.318)	0.0085405 [0.0336611] (0.800)
SFI	-0.1273005 [0.0812464] (0.117)	0.4715349 [0.1237988] (0.000)***		-0.1553609 [0.0504335] (0.002)***	0.0871964 [0.0722566] (0.228)
TFI	-0.305329 [0.3143328] (0.331)	0.7882904 [0.4948147] (0.111)	-1.034812 [0.2871018] (0.000)***		-0.5097217 [0.3026124] (0.092)*
TOI	0.1300379 [0.0701685] (0.064)*	0.0638872 [0.1092928] (0.559)	0.1202747 [0.0685901] (0.080)*	-0.0450254 [0.0528005] (0.394)	
C	54.2661 [18.00198] (0.003)***	-56.69136 [26.87372] (0.035)**	-69.84919 [21.11336] (0.001)***	-33.09575 [13.43317] (0.014)**	42.5087 [18.99752] (0.025)**
Number of Observations	322	322	322	322	322
Number of Left-Censored Observations	26	14	107	245	60
Log Likelihood	-1203.1755	-1384.373	-856.64264	-284.62847	-1040.5865
Wald chi2 (20)	222.59	257.59	136.70	45.21	67.77
Prob. > chi2	0.0000	0.0000	0.0000	0.0010	0.0000
LR chi2(01)	29.96	41.11	93.31	7.08	101.74
Prob. > chi2	0.000	0.000	0.000	0.004	0.000

Note: ***, **, * indicate statistical significance levels of 1%, 5%, 10% respectively. [] denotes standard errors, and () denotes probability values.

Table 5 reports Panel II results. Shyu and Reichert (2002) explain that positive outcomes in derivatives transactions result from the substitution effect, while adverse outcomes stem from the alternative relationship. According to Model 6, a positive relationship exists between forward foreign exchange transactions and swap currency and options transactions. Accordingly, SPI and TOI are substitutes for forward foreign exchange transactions. According to Model 7, there is a positive relationship between swap currency transactions, forward foreign exchange transactions and swap interest rate transactions. VDI and SFI can be used interchangeably for currency swap transactions. In Model 8, there is a negative relationship between swap interest rate transactions and TFI. A positive

relationship exists between swap interest rate transactions, SPI and TOI. According to these results, futures are an alternative to interest rate swaps. Swap currency and option transactions are substitutes for swap interest rate transactions. In Model 9, there is a negative relationship between TFI and SFI. Accordingly, interest rate swaps are an alternative to futures. In Model 10, there is a negative relationship between TOI and TFI and a positive relationship between TOI and VDI. According to these results, futures transactions are an alternative to option transactions, and forward foreign exchange transactions are an alternative to option transactions.

Table 6. Panel III Results

VARIABLES	VDİ (Model 11)	SPI (Model 12)	SFI (Model 13)	TFİ (Model 14)	TOİ (Model 15)
KLD	-0.4962368 [0.5502209] (0.367)	-0.5195766 [0.7626276] (0.496)	-0.7340686 [0.5867534] (0.211)	0.0310006 [0.4233522] (0.942)	0.7624572 [0.4841244] (0.115)
SYO	-1.813973 [0.3931435] (0.000)***	-0.0179715 [0.574245] (0.975)	0.4412701 [0.4604981] (0.338)	0.4026905 [0.3017352] (0.182)	-1.826932 [0.3871898] (0.000)***
BIDP	0.0690679 [0.0202954] (0.001)***	0.1293307 [0.0311708] (0.000)***	0.0702608 [0.017407] (0.000)***	0.0313998 [0.0149002] (0.035)**	-0.000308 [0.0164702] (0.985)
KRED	-0.3630762 [0.1769464] (0.040)**	0.3770001 [0.2576071] (0.143)	0.326854 [0.1529004] (0.033)**	-0.1435907 [0.1205877] (0.234)	-0.1074087 [0.1454014] (0.460)
TKRD	0.4249738 [0.2851135] (0.136)	0.6198826 [0.4415985] (0.160)	-0.9977348 [0.5354661] (0.062)*	-0.389461 [0.4712001] (0.409)	-0.2953978 [0.3027678] (0.329)
LKT	-0.1098283 [0.0784744] (0.162)	-0.048457 [0.1015358] (0.633)	-0.0538519 [0.0631366] (0.394)	-0.0313745 [0.0776956] (0.686)	-0.0779788 [0.0631346] (0.217)
ROA	7.958281 [1.658635] (0.000)***	3.739779 [2.518028] (0.137)	5.590359 [3.176671] (0.078)*	-0.4884396 [2.034622] (0.810)	-0.4447877 [1.687501] (0.792)
ROE	-0.1268668 [0.059198] (0.032)**	0.0031596 [0.0911534] (0.972)	-0.1388069 [0.258262] (0.591)	0.1387418 [0.2716528] (0.610)	-0.0675636 [0.0498893] (0.176)
NIM	-0.7436062 [0.8893224] (0.403)	-0.7056404 [1.336269] (0.597)	-2.678685 [1.389291] (0.054)*	0.1439462 [0.7257527] (0.843)	0.4246946 [1.128666] (0.707)
MSIG	0.1837328 [0.5194986] (0.724)	1.145851 [0.7626105] (0.133)	2.168768 [0.4488672] (0.000)***	0.3076805 [0.3465217] (0.375)	-0.8928094 [0.4008748] (0.026)**
GAPI2	0.013758 [0.1397168] (0.921)	-0.1865659 [0.214934] (0.385)	-0.2315954 [0.1597022] (0.147)	-0.2027353 [0.1142942] (0.076)*	-0.2520822 [0.1267725] (0.047)**
TMTT	6.782968 [2.961626] (0.022)**	5.782224 [4.446328] (0.193)	-11.73241 [16.96589] (0.489)	-9.283967 [7.675132] (0.226)	-6.088448 [3.909311] (0.119)
TUFE	0.4053183 [0.0946502] (0.000)***	0.5771734 [0.1423115] (0.000)***	-0.0610154 [0.0960706] (0.525)	0.0389527 [0.0741073] (0.599)	0.2441824 [0.0787935] (0.002)***
MKO	-11.72488 [10.89199] (0.282)	-23.65443 [18.10116] (0.191)	-25.35963 [8.598651] (0.003)***	0.8377677 [2.850276] (0.769)	-20.56723 [10.18778] (0.044)**
MYY	3.274914 [5.095301] (0.520)	25.9265 [7.877288] (0.001)***	14.27981 [4.43258] (0.001)***	3.339458 [3.68636] (0.365)	-5.812427 [4.158646] (0.162)
BBK	-58.02794 [38.85479] (0.135)	73.8564 [60.03206] (0.219)	74.81742 [29.72768] (0.012)**	0.9288615 [20.75083] (0.964)	-47.61668 [30.73523] (0.121)

(Table 6 cont.)

VARIABLES	VDİ (Model 11)	SPI (Model 12)	SFI (Model 13)	TFİ (Model 14)	TOİ (Model 15)
BBK*KLD	-0.0783428 [1.614521] (0.961)	0.1777808 [2.47225] (0.943)	-2.855654 [1.159834] (0.014)**	1.663524 [0.74783] (0.026)**	-2.236458 [1.227871] (0.069)*
BBK*SYO	2.584876 [0.9157591] (0.005)***	-0.4230801 [1.409582] (0.764)	1.184142 [0.7251185] (0.102)	-0.6692725 [0.4677038] (0.152)	1.777861 [0.7445441] (0.017)**
BBK*BIDP	-0.0836981 [0.042946] (0.051)*	0.0439691 [0.0663372] (0.507)	-0.1526838 [0.0305707] (0.000)***	0.0334469 [0.0231277] (0.148)	-0.0774397 [0.0328446] (0.018)**
BBK*KRED	0.5760501 [0.3541583] (0.104)	-0.1130349 [0.5425064] (0.835)	-0.0405978 [0.259966] (0.876)	-0.1129449 [0.1850127] (0.542)	0.6082618 [0.2813965] (0.031)**
BBK*TKRD	-0.5011219 [1.169831] (0.668)	2.050157 [1.82771] (0.262)	1.648213 [0.9389182] (0.079)*	1.631269 [0.6422895] (0.011)**	-1.06174 [0.9301536] (0.254)
BBK*LKT	0.1406097 [0.1488343] (0.345)	-0.2531741 [0.2225424] (0.255)	-0.1228224 [0.1064224] (0.248)	0.0738704 [0.0935388] (0.430)	0.1575599 [0.1166399] (0.177)
BBK*ROA	-7.413887 [7.271592] (0.308)	13.24738 [11.27707] (0.240)	-0.5160324 [5.660238] (0.927)	-2.790994 [3.304221] (0.398)	7.19317 [5.595544] (0.199)
BBK*ROE	0.2224169 [0.7520172] (0.767)	-0.5993236 [1.166072] (0.607)	-0.6047032 [0.5616227] (0.282)	0.2894438 [0.39403] (0.463)	-0.7714346 [0.5698421] (0.176)
BBK*NIM	-1.072803 [2.193307] (0.625)	-11.07381 [3.385858] (0.001)***	1.163748 [1.921467] (0.545)	-1.29834 [1.152542] (0.260)	0.7129363 [1.885827] (0.705)
BBK*MSIG	-0.2037718 [0.5357553] (0.704)	-1.162053 [0.7862277] (0.139)	-2.279647 [0.4580644] (0.000)***	-0.315709 [0.3484154] (0.365)	0.8373559 [0.4117248] (0.042)**
BBK*GAP12	0.0128877 [0.2332893] (0.956)	-0.2977824 [0.3611595] (0.410)	-0.1031665 [0.2015501] (0.609)	0.233999 [0.1394527] (0.093)*	0.1762207 [0.188984] (0.351)
BBK*TMTT	-6.450488 [8.682065] (0.458)	-17.51373 [13.41387] (0.192)	2.519735 [17.85706] (0.888)	10.21206 [8.340579] (0.221)	2.962742 [7.49839] (0.693)
BBK*TUFE	-0.3894609 [0.149814] (0.009)***	-0.5213051 [0.2297802] (0.023)**	0.1053479 [0.1237257] (0.395)	0.10758 [0.0880386] (0.222)	-0.2464739 [0.1191311] (0.039)**
BBK*MYY	-1.02059 [8.519136] (0.905)	-16.03524 [14.02601] (0.253)	-14.73685 [6.542435] (0.024)**	-5.091584 [4.210906] (0.227)	1.98745 [6.941217] (0.775)
C	54.77734 [17.5068] (0.002)***	-14.63703 [25.7486] (0.570)	-35.57991 [18.12763] (0.050)**	-12.82847 [13.7937] (0.352)	55.0394 [15.2352] (0.000)***
Number of Observations	322	322	322	322	322
Number of Left-Censored Observations	26	14	107	245	60
Log Likelihood	-1239.4771	-1427.6189	-832.72916	-274.77485	-1036.0928
Wald chi2 (30)	110.70	115.10	209.93	53.05	77.09
Prob. > chi2	0.0000	0.0000	0.0000	0.0058	0.0000
LR chi2(01)	52.51	87.17	91.06	7.00	113.79
Prob. > chi2	0.000	0.000	0.000	0.004	0.000

NOTE: ***, **, * indicate statistical significance levels of 1%, 5%, 10% respectively. [] denotes standard errors, and () denotes probability values.

Table 6 reports Panel III results. The dummy variable BBK, a proxy for bank size, is significant and positively signed at the 5% statistical significance level in Model 13, where only swap interest rate

transactions are the dependent variable. Accordingly, bank size is a factor that increases swap interest rate transactions.

In Model 11, the variables $BBK*SYO$, $BBK*BIDP$, and $BBK*TUFE$ are significant at 1%, 10%, and 1% statistical significance levels, respectively. The positively signed variable $BBK*SYO$ indicates that large banks with high capital adequacy ratios have high forward foreign exchange transaction volumes. High creditworthiness or the appetite for additional risk-taking by well-capitalized large banks could explain this result. The negatively signed variable $BBK*BIDP$ indicates that large banks with low foreign exchange deficits increased the volume of forward foreign exchange transactions. This result points to speculative use. The negatively signed $BBK*TUFE$ variable indicates that low inflation increases the use of VDI in large banks. This result can be explained by the speculative use.

In Model 12, $BBK*NIM$ is statistically significant at the 1% level, and $BBK*TUFE$ is statistically significant at the 5% level. The negatively signed $BBK*NIM$ variable indicates that large banks with low net interest margins have rising swap transaction volumes. The negatively signed $BBK*TUFE$ variable indicates that low inflation increases the swap currency transactions of large banks.

According to Model 13's results, $BBK*BIDP$ and $BBK*MSIG$ are interaction variables that are significant at 1%, $BBK*KLD$, $BBK*MYY$, and constant term C at 5%, and $BBK*TKRD$ at the 10% statistical significance level. The positively signed $BBK*TKRD$ variable implies that swap interest rate transactions of large banks increase as the NPL increases. The credit risk or interest rate pressure hedging hypothesis could explain this result. The negatively signed variable $BBK*BIDP$ indicates that large banks with low foreign exchange deficits increased the volume of swap interest rate transactions. The negative sign of the variable $BBK*MSIG$ indicates that large banks with low insured deposit rates increase swap interest rate transactions. The variable $BBK*KLD$ has a negative sign and supports the hypothesis of the probability of financial distress for large banks. The negative sign of the variable $BBK*MYY$ indicates that large banks with foreign ownership have low swap interest rate transactions.

According to Model 14's results, the interaction variables $BBK*KLD$ and $BBK*TKRD$ are significant at 5% and $BBK*GAP12$ at 10% statistical significance level. The positively signed $BBK*KLD$ variable indicates that large banks with high capital have high futures trading volume. The positively signed $BBK*TKRD$ variable supports the credit risk pressure hypothesis. The positive sign of the variable $BBK*GAP12$ is consistent with the interest rate pressure hypothesis. Accordingly, the futures trading volume of large banks with high-interest rate gaps increases.

According to Model 15's results, the constant term is significant at 1%. The variables $BBK*SYO$, $BBK*BIDP$, $BBK*KRED$, $BBK*MSIG$, and $BBK*TUFE$ are significant at 5%, and $BBK*KLD$ is significant at the 10% statistical significance level. The negative sign of the variable

BBK*KLD supports the financial distress hypothesis. The negative sign of the BBK*TUFE variable can be explained by speculative use. A positively signed BBK*SYO indicates that well-capitalized large banks have increased option transactions. The variable BBK*KRED indicates that the option utilization of large banks increases as credit risk increases. The number of credit-dependent customers and cross-selling opportunities may also be the reason for the relationship. The sign BBK*MSIG indicates that large banks with high insured deposits have high option transactions. This result can be considered as a sign of moral hazard.

5. CONCLUSION

This study has analyzed the derivative activities of 23 deposit banks operating in the Turkish banking sector and continuing their operations uninterruptedly during 2009-2022. We investigated the motivation behind the use of derivatives by banks and the factors affecting this motivation, categorized as forward foreign exchange transactions, swap currency transactions, swap interest rate transactions, futures transactions, and options transactions.

The study's findings show that on-balance sheet FX position is the most effective determinant of banks' derivative activities. Banks' on-balance sheet FX position indicates that derivatives are used in order to hedge in four models and speculation in one model. Other influential factors in derivative utilization were asset size, capital adequacy ratio, loan placement, inflation, and foreign ownership. Factors such as deposit insurance and interest rate gaps, examined for the first time in studies on derivatives transactions in the Turkish banking sector, are not influential in determining banks' derivatives activities. Dividend payments were significant in only one equation.

The study reveals that derivatives impact each other's use. This effect can occur through the substitution effect or the effect of being an alternative. This finding reveals the importance of analyzing derivative products by grouping them.

The analyses show that banks use over-the-counter market transactions primarily for hedging purposes and organized stock market transactions mostly for speculation purposes.

The on-balance sheet FX position is found to be influential in determining the derivative transactions of large banks. Capital and inflation are other influential factors. The motive of speculation is predominant in large banks' derivatives transactions, which is evident in forward foreign exchange, currency swap, and options transactions. Derivatives, which have risk-protective features, can also be a source of risk depending on their usage characteristics. Therefore, speculative activities of large banks in derivatives may impact the banking sector. Therefore, banks' derivative activities are carefully monitored by the competent authorities.

In response to unexpected fluctuations in exchange rates, the BDDK has taken measures between 2018 and 2022 to restrict banks' use of derivatives. These regulations stipulate that derivative

transactions must be scaled according to the bank's equity, with this ratio not exceeding the ceiling rates set for various maturities.

This study shows that the tendency to use derivative products for speculative purposes is dominant in large banks. It might be considered to introduce a factor related to the bank's size when setting rules limiting how much banks can use derivatives based on their equity. This approach could be more effective in curbing the speculative derivative activities of large banks.

In the Turkish banking sector, deposit banks are classified as publicly owned, domestic privately owned, and foreign privately owned banks. This study analyzes the effect of banks' ownership structure on derivatives use using dummy variables. The findings suggest that foreign ownership is an influential factor in derivatives use. For more detailed analyses, related bank groups can be examined separately in future studies. In addition, banks' use of derivatives in the context of corporate governance principles such as banks' free float ratios, the number of female members on boards of directors, the number of directors on risk committees, and the remuneration and commission income of executives, which are outside the scope of this study, may also be the subject of future research.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that AI tools are only used for enhancing spelling and grammar, and augmenting the overall readability of the article.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that the contribution of authors of the study is 60% and 40%, respectively.

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The Importance of Resource-based View Related Abilities and Financial Performance of SMEs for Their Sustainable Practices *

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* This paper was presented by Mehmet Civelek in 16th International Congress on Eurasian Economies that was hold in Bishkek/Kyrgyzstan between the dates of 26th to 28th of June, 2024; under the title “*The Impacts of Innovative and Technological Abilities of Small and Mediumsized Enterprises on their Financial Performance*”.

<https://doi.org/10.30798/makuiibf.1510554>

Abstract

Financial performance has always been a major concern of Small and Medium-sized Enterprises (SMEs) for their survival and sustainability practices. However, SMEs’ innovation and technological capabilities included in Resource-Based View (RBV), might stimulate their financial outcomes. Hence, this research aims to investigate the effects of innovation and technological capabilities on the financial performance of SMEs. The researcher applies a stratified random sampling method to create the research sample. Then 479 firm executives have fulfilled this survey. Furthermore, the researcher has performed Ordinal Logistic Regression tests for analysis purposes. The results confirm the negative impact of technological (patent-trademark ownership) and innovation capabilities (R&D alliances, investments and subsidies) on financial performance. R&D financing options of policy-makers, innovation and technology-related educational, and training activities of governments, universities, and certification institutions, and firms’ selection of innovative partners can stimulate firms’ innovative, technological, and financial performance and make them become more sustainable.

Keywords: *Small and Medium-sized Enterprises, Financial Performance, Sustainability, R&D Investments, Patent Ownership, Innovation, Technology, Resource-based View*

Article Type	Application Date	Admission Date
Research Article	July 4, 2024	December 5, 2024

1. INTRODUCTION

Entrepreneurship is a crucial factor that increases income and job opportunities (Gil-Soto et al., 2022). According to the World Bank (2023a), around 90% of businesses are SMEs, and they not only provide the majority of employment but also make substantial contributions to the GDP of emerging countries in the world. However, SMEs lack assets and face fierce competition in various markets, therefore, they are more likely to fall behind their larger-sized rivals in competition. Due to having such a disadvantage, their financial performance becomes their primary concern in their survival. To cope with this issue, SMEs can use their innovation and technological capabilities based on Resource-based View (RBV). In this regard, this paper analyzes the impacts of innovation and technological capabilities on financial performance of SMEs. Therefore, the research questions can be set as follows: “What are the effects of technological capabilities on SMEs' financial performance?” and “What are the effects of innovation capabilities on SMEs' financial performance?”

According to Barney who is the founder of RBV, firms' valuable, rare, difficult to imitate and unique resources provide competitive advantages for them (Barney, 1991). This theory also highlights the importance of firms' tangible and intangible resources, and capabilities that improve their sustainability and performance (Zhang et al., 2022). While innovation capability is an example of firms' intangible resources, technological capability belongs to a tangible resource of RBV.

To measure technological and innovation abilities of SMEs, this paper considers gained patents and trademarks, obtained R&D subsidies, alliances, and R&D investments. Patent (Son & Zo, 2023; Yuan & Hou, 2023), and trademark ownerships belong to the technological and tangible capability or resources that are based on Resource-based View (RBV) (Peng, 2009). Moreover, R&D subsidies, investments (Chung, 2022), and alliances (Martinez-Noya & Narula, 2018) are included in an intangible capability of RBV, namely, innovation.

Various researchers have been also used gained patents and trademarks, R&D subsidies, alliances, and investments when measuring firms' innovation performance. These researchers have also already confirmed the positive association between some of these variables and innovation (Hsu et al., 2022; Block et al., 2023; Chen et al., 2018), innovation performance, (Martinez-Noya & Narula, 2018; Kraus et al., 2021), firm productivity (Soriano & Huarng, 2013), and growth (Le et al., 2024). Firms having innovation and technological capabilities can also effectively use their finite resources for greater financial and production outcomes, therefore, they can make effective activities for the sustainability of their businesses and the satisfaction of their primary and secondary stakeholders' interests. Thus, the demands of their customers, workers, and shareholders can be fulfilled by firms having these substantial abilities. By doing so firms can also achieve the sustainability goals of the United Nations, including “the usage of affordable and clean energy”, making contributions for “decent work and economic growth”, and supporting “innovation, industry and infrastructure”.

Le et al. (2024) also elucidate that the usage of technology provides easier credit access for SMEs. Gained patents, trademarks, R&D subsidies, investments and alliances of enterprises are also crucial for business survival and growth. Financial performance is also crucial for enterprises since increases in financial outcomes such as revenues, income, and profits decrease the financial risk concerns of these businesses (Kölbel et al., 2017). Some researchers also emphasize the importance of increases in profits when evaluating financial performance of enterprises (Dai et al., 2019; Yuan & Hou, 2023; Son & Zo, 2023).

Firms' innovation abilities not only improve their productivity, revenues (Brown et al., 2022), profits (Usman, 2016), and income (Yankson et al., 2022), but also provide a cost advantage for them. Moreover, these abilities increase financial (Singh et al., 2019; Dzomonda, 2022; Le & Ikram, 2022) and operational performance of enterprises (Aboelmaged, 2014). Firms having innovation capability also create new products and services that make them differ from their rivals (Usman, 2016). These facts not only improve their competencies to compete with their rivals (Mochkabadi et al., 2024) but also increase their access to external financial sources (Le et al., 2024), therefore, they can survive in the long term (Cucculelli & Peruzzi, 2020). Innovation activities also improve the technological capabilities of enterprises and increase firms' earnings and their market position (Zhang et al., 2022). Firms' usage of information and communication technologies also develops their technological capabilities that increase their productivity, performance, and credit access (Mushtaq et al., 2022).

1.1. Research Gap

Although the studies mentioned above investigate the impacts of technological and innovation capabilities on financial performance, they separately analyze the impacts of tangible and intangible capabilities. On the other hand, some studies examine the relationship between innovativeness and financial performance, risk management, and bankruptcy (Singh et al., 2019, Markus & Rideg, 2020; Le & Ikram, 2022; Yankson et al., 2022). However, these studies do not include R&D subsidies, investments, and alliances when measuring firms' innovation capabilities. Even though some studies analyze the financial performance of enterprises, they mainly focus on sales income, operating income, or sales growth (Sircar et al., 2015; Lee & Wu, 2016; Son & Zo, 2023). Unlike these researchers, this paper evaluates the last 5-year profitability of businesses from the perspective of firms' executives.

Therefore, this paper becomes unique and makes various theoretical and practical contributions. First, this paper brings a tangible capability (technology) and an intangible capability (innovation) of businesses based on RBV. This paper also conceptualizes various R&D activities such as R&D subsidies, investments, and alliances into intangible resources of RBV. This research also broadens opportunities for SMEs to increase their financial performance. Since the research data includes SMEs from Türkiye where most of firms are in the SME segment, the results of this paper might also draw the attention of academicians, policy-makers, SMEs, and financing institutions.

The remaining sections are as follows: The research hypotheses will be set in the Literature Review and Hypotheses Development section by mentioning empirical arguments of related studies. Then, the methodological methods, the details regarding research models, data, and the research sample will be mentioned in the Methodology section. While the empirical findings will be explained in the Results section, the results will be compared with other research in Discussion section with Policy Recommendations. Finally, the author will provide the crucial points of this paper and explain some limitations and recommendations for new studies in the Conclusion.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

A patent secures firms' inventions (Hsu et al., 2022) and provides legal protection for those inventions. It also stimulates the success of enterprises in innovation and R&D activities (Zhang et al., 2022). A patent has also been a quality signal that enables firms to represent their quality and innovativeness to lenders when receiving credit access (Di Novo et al., 2022) since it minimizes information asymmetry problems between creditors and loanees (Lv et al., 2018). Patent ownership also allows enterprises to become more competitive and continue their activities in the long term (Ahlers et al., 2015). Moreover, Yuan and Hou (2023) examine some firms from the telecommunication industry and confirm the positive impact of patent propensity on the financial performance of firms. This is because firms taking actions for patent ownership apply new technologies and create new products that increase their profits. Furthermore, Zhang et al. (2022) emphasize the importance of patents for firms' profitability and sustainable environmental and economic performance by analyzing firms in SME segment. Rahko (2016) investigates patent applications from the European Patent Office and highlights the impact of patents on economic values. For these reasons, first research hypothesis can be as follows:

H1: Patent ownership positively affects the financial performance of SMEs.

Similar to patents, trademarks signal firms' quality and reduce information asymmetries between lenders and borrowers when firms apply for external financing (Li et al., 2019). As patents, trademarks are used as collaterals to receive credit (Nikitenko et al., 2017). While firms gain patents in the earlier stage of innovation, trademarks are received by firms at the end of the innovation process. This is because while a patent signals firms' inventions, a trademark is a brand enabling firms to gain legal protection that secures their images, symbols, and marks against their competitors or imitators. Trademarks also make businesses to differentiate themselves from their rivals, therefore, it increases the competitiveness of enterprises (Hsu et al., 2022). By analyzing some firms from Russia, Nikitenko et al. (2017) corroborate the positive effect of trademark ownership on the revenues of businesses. Faurel et al. (2019) investigate 1500 firms from S&P and verify that trademarks positively affect firms' future sales, future cash flows and return on assets. Hsu et al. (2022) examine firms in US and substantiate the positive impact of trademark registrations on firm profitability and firm value. The results of these studies make this study set another hypothesis as presented below:

H2: Trademark ownership positively affects the financial performance of SMEs.

R&D alliances enable businesses to set innovation-related relationships with two or more partners. Firms having these alliances can use each other's resources to achieve their mutual goals. These alliances can be formed in different types or names including R&D contracts, technology sharing, licensing, joint-development agreements, cooperative R&D, strategic technology partnering, technological cooperative agreements, or vertical R&D collaborations. Vertical R&D collaborations occur when firms in the same industries operating for the same value chain activities have agreements with each other (Martinez-Noya & Narula, 2018). In this regard, this paper focuses on vertical R&D collaborations since the survey question that evaluates R&D alliances considers this type of agreement. R&D alliances are also innovation capabilities of enterprises (Son & Zo, 2023), and they include various actions such as performing mutual and interrelated tasks and improving relationships and knowledge sharing between partners (Martinez-Noya & Narula, 2018). (Zhang et al., 2022). Technological collaborations of businesses are also related to their innovation capacity that stimulates their R&D activities including applications of information and communication technologies by firms (Jin & Lee, 2020).

R&D activities can be perceived as costly processes for businesses, thus, they can also collaborate with other businesses to share the cost of R&D activities. Firms agreeing with larger enterprises can also have a better market value (Lv et al., 2018), and become able to enter various markets that their partners operate (Wasiuzzaman et al., 2020). When having alliances with leading firms in the same industry, firms can send a strong signal to the lenders and increase their probability of receiving credits (Wasiuzzaman et al., 2020; Ahlers et al., 2015). This is because such a potent signal enables firms to overcome information asymmetry issues that are the main problem of credit obstacles (Courtney et al., 2016).

Moreover, R&D alliances provide some other advantages for businesses such as accessing complementary resources and capabilities of partners (Son & Zo, 2023) to improve products and services, access to various markets, grow in existing markets, reduce risks and costs of R&D (Zhu et al., 2021; Zhang et al., 2022), and internationalization operations, increase labor productivity, productivity performance (Martinez-Noya & Narula, 2018). Firms also become able to learn from their partners, thus, they transfer some knowledge and innovative and technological capabilities for their purposes and business operations (Howard et al., 2016; Martinez-Noya & Narula, 2018; Son & Zo, 2023).

Due to these advantages, R&D alliances increase sales, the performance of businesses (Martinez-Noya & Narula, 2018), and firms' growth (Aristei et al., 2016; Zhang et al., 2022). R&D alliances and cooperation with other businesses enable them to overcome their resource constraints and improve their intangible investments, so their performance (Chung, 2022). Moreover, R&D

collaborations have positive effects on innovation (Garcia Martinez et al. 2014) and financial performance (Son & Zo, 2023). In this regard, the third hypothesis can be shown as indicated below:

H3: R&D alliances positively affect the financial performance of SMEs.

R&D investment is another indicator that determines firm innovativeness (Yuan & Hou, 2023), and increases firms' usage or application of new technologies (Hoffmann & Kleimeier, 2021). R&D investments are also financial resources for enterprises to use for R&D activities (Son & Zo, 2023). Firms making R&D investments can also send signals regarding their quality to policymakers and financing institutions to receive R&D incentives and external credits (Pereira & Suárez, 2018). Thus, firms making R&D investments can reduce credit obstacles (Ughetto, 2008). Regarding the effect of R&D investments on financial performance, many researchers state the positive impact (Caldas et al., 2019; Chung, 2022; Son & Zo, 2023).

According to Zhang et al. (2022), firms making investments for R&D activities become informed about current technologies and new knowledge, therefore, they can use new and unique resources to increase their profitability and economic performance. Similar to Zhang et al. (2022), Son and Zo (2023) also emphasize the importance of R&D investments for technological purposes that positively affect the performance of enterprises. Niño-Amézquita et al. (2017) also declare the fact that firms making effective R&D investments, can not only increase their sales but also increase their income that provides benefits for their growth and survival (Niño-Amézquita et al., 2017). Since R&D investments also include technology investments, firms using new technologies can create new products or develop their existing goods that increase their income (Ughetto, 2008; Pang & Gai, 2022). Leung and Sharma (2021) also observe Chinese firms and report that R&D investments positively affect innovation. These researchers corroborate that innovation performance mediates in the association between R&D intensity and financial performance. For these reasons, the researcher sets a new hypothesis as follows:

H4: R&D investments positively affect the financial performance of SMEs.

R&D subsidies are substantial sources for policymakers to stimulate innovation activities and strategies of enterprises. (Meuleman & De Maeseneire, 2012; Son & Zo, 2023). R&D subsidies can also be identified as a financial resource (Plank & Doblinger, 2018). Firms receiving R&D subsidies can indicate good quality since governments provide these opportunities for businesses that have the potential to make effective innovation activities (Egger & Keuschnigg, 2015). This fact can also increase firms' probability of receiving credits (Guo et al., 2022) since R&D subsidies can be perceived as quality signals minimizing information asymmetry problems among borrowers and lenders (Li et al., 2019). Thus, firms gained R&D subsidies encounter reduced financing obstacles (Takalo & Tanayama, 2010). R&D grants and funds can also be categorized under R&D subsidies. This is because these options are also indicators of governments' support to increase innovative activities of businesses. For instance,

when firms receive R&D funds, they can hire more qualified R&D workers, build new R&D laboratories with quality equipment and increase the quality of their products, and services. In this regard, firms can increase their reputation and they become more likely to cooperate with quality suppliers, competitors, and research centers (Plank & Doblinger, 2018). For these reasons, businesses indicate better financial performance (Son & Zo, 2023), and long-term success (Clancy & Moschini, 2013; Plank & Doblinger, 2018). Moreover, governments provide R&D grants that increase the growth of enterprises (Meuleman & De Maeseineire, 2012). All these R&D sources positively affect firm growth (Nason & Wiklund, 2018) and financial performance (Chen et al., 2020; Son & Zo, 2023). The positive effect of R&D subsidies on sales and profitability of Korean SMEs has been also confirmed by Oh and Hwang (2024). Furthermore, Plank and Doblinger (2018) verify the positive relationship between R&D funding and performance. Due to these arguments, this paper sets another hypothesis that is presented below:

H5: Gained subsidies by SMEs positively affect their financial performance.

3. METHODOLOGY

This paper aims to investigate the impacts of innovative and technological capabilities of SMEs on their financial performance. To achieve this research goal, the researchers generated an internet mediated questionnaire and sent it to the respondents. The researcher used this random sampling method by considering the geographical regions in which SMEs operate. Thus, the researcher applied the stratified random sampling method. Before applying the random sampling method, the researcher gained e-mail addresses of SMEs from several Chambers of Commerce in Türkiye. Then the authors specified the prospective respondents of the questionnaire when directing the e-mails. In this regard, the researcher implied a purposive sampling method too. Finally, 479 owners or managers of Turkish SMEs fulfilled the survey. The survey includes different survey questions asking firms' and survey participants' characteristics, financial performance, entrepreneurial abilities, and firms' financing approaches.

Regarding the sample profile, while 29.9% (143 firms) of the entire sample consists of microenterprises, the remaining 336 firms (70.1% of the sample) are small and medium-sized enterprises. Moreover, most of these enterprises (337 SMEs, 70.4% of the sample) have been operating for more than 10 years while other firms have less than 10 years of operating experience (142 SMEs, 29.6% of the entire sample). Moreover, most of the analyzed firms operate in the manufacturing industry, while other firms operate in various sectors including, trade, service, transportation, construction, real estate and financial services. Concerning the respondents' characteristics, the majority of survey respondents (375 firm executives) are well educated, and having a minimum bachelor's degree. Furthermore, most of the survey respondents (284 respondents) are younger than 46 years old.

The researcher evaluates financial performance by asking the following question: "Please evaluate the net profit of your business over the last 5 years?" The responses of the survey participants were scaled by a Five-point Likert Scale as follows: "1-Declined significantly" to "5-Improved

significantly” Thus, lower values from this question’s replies indicate lower financial performance of SMEs.

The independent variables of the 1st, 2nd, 3rd, 4th, and 5th research models are patent ownership, trademark ownership, R&D alliances, investments, and subsidies, respectively. All these variables are measured by a dichotomous question (Yes, No). In this regard, the researcher has asked whether the firms that the executives work for have received any patents, trademarks, R&D subsidies, have made any R&D investments, and have had any R&D alliances with leading firms in their sectors. “No” response to these questions indicates the nonexistence of gained patents, trademarks, subsidies, R&D investments, and R&D alliances and vice versa.

The researcher applies Ordinal Logistic Regression Test to achieve the research targets and for analysis purposes. This is because the dependent variable of the research models, namely, financial performance is measured by a Five-point scale and it includes ordinal data. The researcher used logit function when performing regression analyses. The basic research model is presented as follows:

$$\text{“Logit (P(Y}\leq\text{j})) = } \beta_{j0} + \beta_{j1} X_1 \text{”}$$

Y= dependent variable (financial performance)

j= categories

X₁ – Independent variable (patent ownership for 1st research model, trademark ownership for 2nd research model, R&D alliances for 3rd research model, R&D investments for 4th research model and R&D subsidies for 5th research model)

“β₁ – Regression coefficients”

“β₀ – Constant or intercept term.”

“P- predictor”

Concerning the hypotheses testing, the researcher uses a 5% significance level. Thus, p-values values lower than the level of significance enables the researcher to support research hypotheses. Moreover, null hypotheses assume the nonexistence of the effects of the independent variables on financial performance of SMEs.

4. RESULTS

Before explaining the results, it is crucial to explain some details regarding Ordinal Logistic Regression analyses. The algorithm of ordinal regression measures a continuous latent variable (Harrell, 2015). Since the dependent variable of this paper, namely, financial performance is measured by a Five-points Likert, it has four cut-offs (levels). This algorithm represents the changes in four levels of financial performance. In this regard, while “Financial Performance = 1” represents the cut-off value between the replies of “Completely disagree” to “Disagree”, “Financial Performance=4” explains the

cut-off value between the responses of “Agree” to “Completely agree”. As stated in the Methodology section, while the volume of independent variables (gained patent, trademark and subsidies and R&D alliances, and investments) is zero, it means the firms that do not have gained patents, trademarks, subsidies and, R&D alliances, and investments.

Corresponding to the results of this paper, Table 1 depicts the findings regarding 1st and 2nd research models. According to Table 1, p-values for all the cut-off values for the dependent (Financial Performance=1,2,3,4) and the independent variables (gained patents and trademarks) are less than a 5% significance level, thus, they are significant. However, since all coefficients (“Estimate” in the table) are negative in the table, lower values from independent variables are associated with an increase in the dependent variable. Thus, lower scores from independent variables are more likely to indicate greater volumes in the dependent variable.

Table 1. The Findings of 1st and 2nd Models

Variable	Estimate	S.E.	Wald	df	P- values	95% CI [Lower Upper]
MODEL-1						
Fin. Perform. = 1	-2.544	0.177	205.930	1	0.000	[-2.891 -2.196]
Fin. Perform. = 2	-1.596	0.132	146.346	1	0.000	[-1.855 -1.338]
Fin. Perform. = 3	-1.120	0.119	88.950	1	0.000	[-1.353 -0.887]
Fin. Perform. = 4	-0.285	0.107	7.100	1	0.008	[-0.494 -0.075]
Patent own.=0	-0.451	0.183	6.066	1	0.014	[-0.809 -0.092]
Patent own.=1	0*			0		
MODEL-2						
Fin. Perform. = 1	-2.607	0.180	208.834	1	0.000	[-2.960 -2.253]
Fin. Perform. = 2	-1.655	0.136	149.122	1	0.000	[-1.920 -1.389]
Fin. Perform. = 3	-1.174	0.122	92.311	1	0.000	[-1.414 -0.935]
Fin. Perform. = 4	-0.239	0.109	4.815	1	0.028	[-0.453 -0.026]
Trademark own=0	-0.558	0.178	9.839	1	0.002	[-0.907 -0.209]
Trademark own=1	0*			0		

Source: Own Processing. Note: * This parameter is set to zero because it is redundant.

In case of having a-unit decrease on the independent variables, namely patent and trademark ownerships, there will be predicted rises of 0.451 (The coefficient estimate of patent ownership) and 0.558 (the coefficient estimate of trademark ownership) in the log-odds of being greater level in financial performance. For these reasons, since firms that have not gained patents or trademarks have lower score from these independent variables, they are more likely to indicate greater financial performance. In other words, SMEs that gained patent and trademarks become less likely to have higher financial performance level than their counterparts having no patents and trademarks. This fact makes this paper fail to support the H1 and H2 hypotheses that assume the positive effects of patents and trademark ownerships on the financial performance of SMEs, respectively.

When it comes to the results for the 3rd, 4th, and 5th research models, Table 2 is presented below. As already stated, while financial performance is the dependent variable of these models, the independent variables of the 3rd, 4th, and 5th models are R&D alliance, investments, and subsidies,

respectively. This table shows that all financial performance scores and the independent variables scores except for the cut-off “Financial Performance=4”, are significant. This is because of having p-values that are lower than a 5% significance level. However, similar to the results of gained patents, and trademarks, the coefficients for R&D alliances, R&D investments, and R&D subsidies are negative. A negative estimate means that greater volumes in financial performance occur when the volumes of the independent variables are lower.

When there is a unit decrease in R&D alliances, investments, and subsidies, their ordered log odds of having greater financial performance rise by 0.447, 0.760, and 0.626, respectively. This is because the coefficient values (“Estimate” in the table) are -0.447, -0.760, and -0.626 for these independent variables. Thus, SMEs having lower values from R&D investment, subsidies, and alliances are more likely to indicate better financial performance. For this reason, this paper confirms the negative effects of R&D alliances, investments and subsidies on the financial performance of SMEs and this fact makes this research fail to support the H3, H4, and H5 hypotheses assuming the opposite effects.

Table 2. The Findings of 3rd, 4th and 5th Models

Variable	Estimate	S.E.	Wald	df	P-values	95% CI	
						[Lower	Upper]
MODEL-3							
Fin. Perform. = 1	-2.719	0.213	163.451	1	0.000	[-3.136	-2.302]
Fin. Perform. = 2	-1.771	0.176	101.242	1	0.000	[-2.115	-1.426]
Fin. Perform. = 3	-1.294	0.166	60.978	1	0.000	[-1.619	-0.969]
Fin. Perform. = 4	0.109	0.154	0.500	1	0.480	[-0.193	0.411]
R&D Alliances=0	-0.447	0.182	6.050	1	0.014	[-0.804	-0.091]
R&D Alliances=1	0*			0			
MODEL-4							
Fin. Perform. = 1	-2.724	0.185	217.123	1	0.000	[-3.087	-2.362]
Fin. Perform. = 2	-1.766	0.140	158.805	1	0.000	[-2.041	-1.492]
Fin. Perform. = 3	-1.280	0.126	102.441	1	0.000	[-1.538	-1.032]
Fin. Perform. = 4	0.158	0.111	2.025	1	0.155	[-0.059	0.374]
R&D Invest.=0	-0.760	0.176	18.559	1	0.000	[-1.106	-0.414]
R&D Invest.=1	0*			0			
MODEL-5							
Fin. Perform. = 1	-2.853	0.216	174.414	1	0.000	[-3.277	-2.430]
Fin. Perform. = 2	-1.900	0.180	111.803	1	0.000	[-2.252	-1.547]
Fin. Perform. = 3	-1.420	0.169	70.418	1	0.000	[-1.752	-1.088]
Fin. Perform. = 4	-0.006	0.156	0.002	1	0.969	[-0.311	0.299]
R&D subsidies=0	-0.626	0.184	11.578	1	0.001	[-0.986	-0.265]
R&D subsidies=1	0*			0			

Source: Own Processing.

5. DISCUSSION

This paper observes the negative impacts of the gained patent, trademark, and R&D subsidies and R&D alliances and R&D investments on the financial performance of SMEs. Thus, unlike other studies that emphasize the positive impacts of gained patents (Rahko, 2016; Zhang et al., 2022; Yuan & Hou, 2023), gained trademarks (Faurel et al., 2019; Hsu et al., 2022), gained subsidies (Plank &

Doblinger, 2018; Chen et al., 2020; Oh & Hwang, 2024; Son & Zo, 2023), R&D alliances (Garcia Martinez et al. 2014; Chung, 2022; Son & Zo, 2023). and R&D investments (Niño-Amézquita et al., 2017; Leung & Sharma, 2021; Pang & Gai, 2022) on financial performance of businesses.

On the other hand, this paper finds compatible results with the arguments of Artz et al. (2010), Sohn et al. (2010), Duran et al. (2016), Entezarkheir (2019), Brown et al. (2022), Yuan and Hou (2023), since these researchers also substantiate the negative impact of patent thickets (Entezarkheir, 2019; Yuan & Hou, 2023), patent ownership (Sohn et al., 2010), R&D investments (Duran et al., 2016), and innovative actions (Brown et al., 2022) on firms' innovativeness, economic or financial performance.

The reasons for the results that this paper verifies might be related to firm-level, executive level, and country-level characteristics. Concerning the firm-level characteristics firm size can be a strong argument. This is because patent and trademark ownerships require costly and long procedures (Zhang et al., 2022). Innovation activities are also costly and risky processes since they require adequate financial investments (Lee & Brown, 2017; Brown et al., 2022). Although large firms make costly R&D investments this fact can be negatively perceived by financing institutions when making credit decisions (Belas et al., 2017). Firms having fluctuating returns from innovative activities can also discourage prospective investors from providing some financial options for them (Lee & Brown, 2017). Since larger firms have greater financial power, they can invest more money in R&D actions that can cause negative outcomes from financial indicators. The majority of the respondents from the research data of this study are from larger firms while 30% of the entire sample consists of smaller firms such as microenterprises. In this regard, microenterprises in the research data might not have invested a greater amount of money in R&D, they could have saved their resources for more effective investments that improve their financial performance.

Moreover, R&D cooperation is a complex and risky activity since a partner firm might use another partner's resources, and create common goals. Partners might not only share their technological capabilities and knowledge but also their know-how. This fact also causes an opportunistic behavior which partners can receive unfair advantages. Since this paper focuses on vertical alliances that enable firms to coordinate with firms in the same industry, partners can also be their rivals. For these reasons, lack of trust, and behavioral uncertainties between partners can also cause failures in such a collaboration (Martinez-Noya & Narula, 2018), and this issue might be another reason why this paper confirms the negative impact.

The role of founders who manage the innovation and technological activities of enterprises can be an argument for the different results of this paper from other studies. This is because firms having founders that make fewer investments in innovation activities gain greater output from these actions (Block et al., 2023). Since the majority of firms in the research data of this study are managed by firms'

founders, this might be the reason why firms making lower investments in R&D, technology, and innovation activities indicate better financial performance levels.

The reason why this paper finds different results from other studies (Rahko, 2016; Zhang et al., 2022; Yuan & Hou, 2023; Son & Zo, 2023; Oh & Hwang, 2024; Plank & Doblinger, 2018; Garcia Martinez et al. 2014; Chung, 2022; Niño-Amézquita et al., 2017; Leung & Sharma, 2021; Pang & Gai, 2022) that verify the positive effects of gained patents, trademarks, subsidies, R&D alliances and R&D investments might be related to country-level differences. This is because these studies analyze firms from various markets including Germany, the UK, Italy, Spain, China, Malaysia, South Korea, and the USA that have greater R&D expenditures than Türkiye. According to the World Bank, the percentages for R&D expenditures in % of GDP of these countries are greater than in Türkiye (World Bank, 2023b). This fact might not only be the reason why this paper differs from other studies but also might be the reason of the negative effect of innovation and technological capabilities on financial performance.

5. 1. Policy Recommendations

As highlighted in the previous paragraph, the lower amount of R&D expenses including R&D funds, subsidies, and incentives in Türkiye can also make firms ineffectively use these sources for innovation and technological activities. Since patents and trademark ownerships and, R&D investments are costly activities, the funds that the policymakers and other institutions provide might even not help businesses to afford the costs of these actions. For this reason, policymakers and institutions should provide more resources for enterprises in this specific market to make firms receive patents and trademarks and to stimulate R&D investments that increase firms' financial performance. Firms receiving R&D subsidies, funds, and incentives can hire talented workers who have already experienced patent, trademark, and R&D funds applications. Firms can also create departments for the application of patents, trademarks, and other quality certifications and R&D funds and monitor the activities of such a department to motivate department members.

As already mentioned, the developments in innovation and technological capabilities are very costly and complex procedures for firms. Besides providing more R&D funding for them, governments can also organize some events including workshops, or conferences to increase awareness of firm executives. Moreover, institutions that provide patents, trademarks, and subsidies can also generate educational activities to ease the application procedures of these opportunities. These institutions can also collaborate with universities to educate prospective entrepreneurs, regarding the details and importance of these opportunities. These institutions can also create several competitions to stimulate the technological and innovation capabilities of firm executives and prospective entrepreneurs. Winners of these competitions can receive free guidance services to adequately make their applications for patent, trademark, and R&D subsidy or incentive applications. Since R&D alliances can cause firm failures, firms also need to be trained for effective partner selections. In this regard, some courses should be

created to share information regarding how to make effective contracts with partners, how to protect and secure know-how, and intellectual properties, how to communicate with prospective and existing partners, and how to terminate the agreement between partners.

6. CONCLUSION

The majority of SMEs encounter various obstacles to improving their financial performance. This is not only because of competing with large enterprises, but also having lower amount of assets compared to their rivals. However, their tangible and intangible resources and capabilities included in RBV, namely, technological and innovation can make them increase their financial performance. In this regard, this paper aims to investigate the effects of technological and innovation capabilities on the financial performance of SMEs.

This paper applies Ordinal Logistic Regression analysis to analyze these impacts. The results indicate that technological and innovation capabilities of SMEs negatively affect their financial performance. The reasons for these results might stem from firm size, firms' partners, owners' role in technological and innovation activities, and the percentage of R&D expenses in the Gross Domestic Product of the country where the research data comes from. Policymakers' role in R&D financing, educational and training activities regarding technological and innovation activities, firms' role in partner selection and organizational structure, and the role of other institutions such as universities and other certification institutions such as patent office in educational and training activities might be some implications to achieve better innovation, technological and financial performance of enterprises.

Since this paper combines various resources and capabilities of RBV in a study, it expands the scope of RBV theory. This paper also categorizes R&D subsidies, alliances, and investments into a group of innovation capabilities. Moreover, this paper separately analyzes the impacts of these RBV capabilities of firms located in an emerging country. Thus, this paper makes significant contributions to this theory. The implications that the researcher presents also bring new sights for the practical contribution of the paper.

However, this paper has some limitations. The first limitation of this paper is related to the evaluation of financial performance. Since this paper only considers firms' executives' perception of the last 5-year profitability of enterprises, it does not consider any financial statements, tables, and ratios. Moreover, this paper is only limited to the tangible and intangible capabilities of RBV. This paper also investigates firms only from Türkiye and the SME segment. Further studies can evaluate the financial performance of enterprises by focusing on hard data such as financial statements, and reports. On the other hand, they can include various tangible and intangible capabilities of SMEs and large enterprises from different countries. Furthermore, firm-level and executive-level characteristics can be included in the analyses. For these reasons, they can make country-level, firm-level, and executive-level

comparisons in the effects of various tangible and intangible capabilities of businesses on their financial performance.

Research data was collected in 2019. Thus, this paper does not need the approval of Ethics Committee.

The study has been crafted in adherence to the principles of research and publication ethics.

The author declares that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article.

The entire work was carried out by its only, stated author.

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An Analysis of the Relationship Between Investor Risk Appetite and CDS Premiums in Turkey Using Asymmetric Methods

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<https://doi.org/10.30798/makuiibf.1511420>

Abstract

In this study, the asymmetric relationship between the Risk Tendency Indices calculated for each investor type and Turkey's CDS premium is investigated. The data set of the study consists of weekly frequency data covering the period April 2010-December 2023. Nonlinear ARDL (NARDL) method and Hatemi-J and Roca (2014) asymmetric causality test was used in the empirical analysis of the study. The findings show that in the long run, positive changes in the CDS premium have a greater impact on REKS Domestic and REKS Qualified indices than negative changes, while negative changes in the CDS premium have a greater impact on REKS Domestic Real, REKS Domestic Corporate and REKS Domestic Funds indices than positive changes. These findings reveal that the effects of market risks and uncertainties on investor groups are asymmetric.

Keywords: *The Propensity to Risk Taking, Asymmetric ARDL, Asymmetric Causality.*

Article Type	Application Date	Admission Date
Research Article	July 5, 2024	December 20, 2024

1. INTRODUCTION

Although the structure, characteristics, functioning, asset price formation, and the relationship between risk and return in financial markets can be theoretically and systematically explained, the volatilities and fluctuations in asset prices in financial markets can lead to significant differences in portfolio returns. Changes and developments in financial asset prices reflect shifts in investors' willingness to assume different types of risks. An increase in the overall demand for risky assets (risk appetite or inclination) leads to a rise in the demand for these assets, consequently driving up their prices. One of the most crucial determinants of asset prices is the investor's risk-taking propensity. Risk-taking propensity can be defined as the willingness of investors to assume financial risk with the expectation of achieving potential returns. Conceptually, risk-taking propensity differs from risk aversion and risk itself. Risk aversion is a highly specific concept related to investors' preferences to eliminate the likelihood of loss, including the utility function. Risk, on the other hand, refers to the loss or damage that may occur in the event of an occurrence. Risk-taking propensity or risk appetite reflects market participants' subjective assessments regarding potential developments in risks or investment opportunities and threats. Several factors influence investors' risk-taking propensity, including financial stability, market liquidity, and asset prices. Particularly in foreign exchange markets, which arguably come closest to a perfect competition market structure and never close globally, the predictability of asset returns associated with investor risk-taking propensity has been explained through hypotheses related to investor behavior or expectations (Fama, 1984, pp. 520-525). Fama and Bliss (1987, pp. 689-690) emphasize that investor expectations and systematic and unsystematic risks influence the difficulty in predicting returns. In this context, during periods of financial instability, deteriorating economic expectations, increasing macroeconomic problems such as inflation and current account deficits, narrowing market liquidity, and falling asset prices, increases in risk premiums are observed. Changes in CDS premiums are associated with market expectations and investor perceptions.

When the risk-taking propensity is high, it is expected that the portfolio will yield positive returns. In contrast, if the risk-taking propensity weakens, the portfolio's returns are likely to be negative. Consequently, when risk-taking is high, investors tend to replace less risky assets in their portfolios with riskier ones. Conversely, when the risk-taking propensity decreases, or in other words, when investors' risk aversion increases, investors prefer to sell their riskiest assets and replace them with risk-free assets such as government bonds.

As the Central Securities Depository of Turkish Capital Markets, Merkezi Kayıt Kuruluşu A.Ş. (MKK) and Özyeğin University calculate the Risk Appetite Index (REKS) separately for all investors, as well as for domestic investors (segmented into domestic individual and institutional investors), foreign investors, qualified investors, and domestic investment funds. These indices serve as indicators to measure the risk perception of investors in financial markets. They are used to determine the risk-taking tendencies (risk aversion or risk appetite) of market participants and investors. The REKS index

values, which explain investor risk appetite, along with the Credit Default Swap (CDS) premiums that secure against the default or insolvency risk of states or corporate entities issuing financial assets, can be used to monitor the risk perception in financial markets, determine investment strategies, gain insights into the state of the economy or financial structure, and for portfolio diversification.

The Credit Default Swap (CDS), standardized by the International Swaps and Derivatives Association (ISDA) and defined as a "credit default swap," is an insurance mechanism that protects the buyer or investor against risks arising from the inability of a country or company issuing securities in international markets to repay its debt. Therefore, it is also used as an indicator in financial markets for investors' financial decisions and in determining country or company risk (Fettahoğlu, 2019, pp. 268-269). CDS contracts can be bought and sold in credit derivative markets and are priced according to countries and businesses' creditworthiness and repayment risk. Consequently, CDS premiums are also considered a credit risk indicator reflecting investors' views on foreign economies and financial markets (Kılıcı, 2017, p. 145).

After the 1980s, when the process of financial globalization and liberalization began, financial markets encountered various financial risk elements, primarily exchange rates and interest rates. Systematic and unsystematic risks increased extreme volatility and uncertainties in financial markets. Following financial crises in many economies, some states or companies faced the risk of being unable to pay their debts on time due to poor risk management, and some even fell into bankruptcy. CDS products, designed to hedge against the default or bankruptcy risk of countries or companies, have gradually become indicators of country risk and economic and financial stability (Yapraklı & Güngör, 2007, p. 212). The CDS premiums of countries or firms are influenced by various factors such as the credit risk of the debtor entity, economic and financial structure, market conditions, interest rates on the relevant debt instrument, and liquidity. Therefore, instead of examining numerous macroeconomic indicators individually for every financial decision, investors can guide their investments by evaluating developments in investor risk appetite or CDS indicators.

This study aims to empirically examine the asymmetric relationship between the Risk Appetite Indices (REKS), calculated separately for different investor types by the Central Securities Depository (MKK), and Turkey's CDS premium. Using weekly data from April 9, 2010, to December 31, 2023, the analysis employs the nonlinear ARDL (NARDL) method by Shin, Yu, and Greenwood-Nimmo (2014) and the asymmetric causality test by Hatemi-J and Roca (2014). The NARDL method allows for the decomposition of positive and negative changes in the independent variable to measure their asymmetric effects on the dependent variable. Additionally, the Hatemi-J and Roca (2014) asymmetric causality test, used to detect asymmetric causality relationships between variables, separates shocks in the variables into positive and negative and considers their potential impacts separately. As a critical indicator of country risk, the CDS premium is closely monitored by investors to evaluate a country's risk perception. Continuously fluctuating based on market conditions, the CDS premium encompasses

all risk factors that may influence financial markets and reflects current market dynamics daily. Changes in CDS premiums—whether increases or decreases—can significantly influence financial markets, resulting in price fluctuations of financial assets. Country-specific favorable or unfavorable developments play a pivotal role in shaping CDS premiums. An increase in CDS premiums is often interpreted as a signal that financial market participants may face heightened risks. Within this framework, this study employs asymmetric methods to estimate the effects of changes in CDS premiums on the Risk Appetite Indices (REKS), which are calculated separately for different types of investors by the Central Securities Depository (MKK). The main objective of this study is to analyze the asymmetric relationship between CDS premiums and risk appetite indices in Turkey and to make an original contribution to the existing literature. This study contributes significantly to the literature by encompassing an extensive data set period, starting from the initial calculation of risk appetite indices for different investor types. Furthermore, the use of up-to-date econometric techniques in the analyses distinguishes this study from existing literature and provides a methodologically innovative approach. Due to these contributions, the work is anticipated to have a distinctive position in literature. The study is structured as follows: introduction, a review of the empirical literature related to the research topic, the data set, the econometric methodology, the empirical findings, and finally, the conclusion.

2. INVESTOR RISK APPETITE AND CREDIT DEFAULT SWAPS: A THEORETICAL FRAMEWORK

The Efficient Market Hypothesis (EMH) asserts that financial asset prices promptly and fully reflect all available information, and that investors make rational decisions. According to this hypothesis, market participants cannot achieve returns beyond market averages, known as abnormal returns, by utilizing newly accessible information. Nonetheless, these assumptions have been criticized from the perspective of behavioral finance. Behavioral finance emphasizes that individuals often do not act as rational agents and examines the impact of irrational behaviors on financial asset pricing. It argues that psychological biases, emotional responses, and decision-making errors can lead to deviations from the principles of the Efficient Market Hypothesis. The Efficient Market Hypothesis (EMH) posits that financial markets fully incorporate all available information, suggesting that variations in CDS premiums should respond promptly and precisely to shifts in market risk appetite or credit risk perceptions. However, behavioral finance challenges the assumptions of EMH by highlighting factors that influence investor behavior, such as psychological biases like overconfidence and loss aversion. These biases can cause investors to deviate from rational decision-making processes, leading to market inefficiencies and anomalies in CDS pricing.

Market participants closely monitor investors' risk-taking propensity (risk appetite or willingness to take risks) as it is associated with fluctuations in financial markets or changes in asset prices. Various indicators are developed globally and in Turkey to determine investors' risk-taking tendencies, and studies are conducted to identify the determinants of investor risk perception.

Investor risk-taking propensity is sometimes referred to as "risk appetite," "investor confidence," or "investor sentiment" (ECB, 2007). Despite the different terminologies, the aim is to measure the risk-taking propensity of investors. The first index to determine risk appetite or risk propensity globally was created by Hamilton (1989) using the Markov Switching Model.

Today, various indices developed to measure investor risk propensity are generally prepared using two different approaches. In the market-based approach, investor risk propensity is measured using indices created by statistical methods based on data obtained from market prices. In this approach, the price volatilities or price differences of fixed-income or variable-income financial assets are differentiated according to the type of financial instrument or market structure to determine investor risk propensity. The most important risk perception (appetite) indicators calculated using this method include the Chicago Board Options Exchange's VIX volatility index, JP Morgan's Risk Tolerance indices, UBS's FX Risk Index, and Bank of America's Risk Appetite Monitor.

The second approach used to measuring risk propensity involves structured indicators prepared based on the correlation between volatilities and returns, using a financial or economic model applied to a single financial market. The Bank of England Index, the Goldman Sachs Risk Aversion Index, and the Credit Suisse Global Risk Appetite Index are examples of risk perception scales created using this approach (ECB, 2007, pp. 168-169).

One of the most important indicators prepared and announced to measure investor risk perception in Turkey is the Risk Appetite Index (REKS) calculated by the Central Securities Depository (MKK). The REKS indices are calculated based on investor portfolio changes. To determine the investor portfolio threshold value, the natural logarithm of factors such as the "USD exchange rate," "unemployment," "USD-based annual GDP growth rate," and "average portfolio values in Turkish Lira" is taken. The hypothesis that these factors have no effect on the threshold value is tested using linear regression methodology. The data of investors exceeding the defined threshold value are then examined to identify the factors affecting risk appetite. The REKS index calculates the change in investors' risk appetite by considering the number of stocks and stock umbrella funds held by investors as of the calculation date and their past data, adjusting for market returns.

A Credit Default Swap (CDS) is an insurance contract typically involving two parties, a buyer and a seller, where the buyer is protected against losses resulting from a credit event related to the underlying reference entity (Amato, 2005, p. 56). In a CDS contract, the buyer pays a premium to the seller in exchange for protection against adverse events such as the default or bankruptcy of the debtor associated with a specific debt instrument (bonds, stocks, etc.) or entity (a company or government).

CDSs are primarily used by investors to protect against the risk of non-payment of principal or interest at maturity of a financial asset or the risk of a firm's bankruptcy. Investors, especially those investing in public or private sector bonds, prefer to purchase CDSs to cover potential losses in case the

issuing institution defaults. CDSs can be used as a tool for diversifying portfolios, protecting against specific risks, and for speculation. As such, CDSs are one of the most important instruments traded in derivative markets, used for gaining profit from price fluctuations or hedging against risk. Moreover, CDSs are closely monitored in financial markets as they are considered an important indicator reflecting a company or country's creditworthiness or bankruptcy risk.

Interest rate risk and economic uncertainty significantly impact CDSs and risk appetite. Since CDS premiums are also evaluated as an indicator of market perception regarding a country's creditworthiness, an increase in CDS premiums indicates a deterioration in investors' perception of the country's credit risk. Therefore, governments and policymakers monitor CDS prices to gauge market sentiment and assess the effectiveness of economic policies. Increases in a country's CDS premiums are considered early warning signals of potential financial crises or macroeconomic vulnerabilities, supporting the implementation of preventive policies by economic management. Lastly, as CDS premiums indicate investor confidence and financial stability, they facilitate or hinder countries' ability to raise funds in international money and capital markets by affecting the cost of borrowing.

The relationship between CDS premiums and risk appetite is important because it provides valuable information, primarily for foreign investors making investment decisions in another country and for policymakers implementing economic policies related to liquidity conditions in a financial market.

3. LITERATURE REVIEW

Internationally, various instruments are used to measure risk appetite and some major investment banks developed their own risk appetite indices. However, the most widely used risk appetite indicator in the world is the Chicago Board Options Exchange Volatility Index (VIX), which is derived from S&P options, while in Turkey, the REKS indices prepared by the Central Registry Agency stand out in this field. In the literature, studies that measure risk appetite, analyze the determinants of risk appetite or CDS premiums, or examine the relationship between different risk appetite indicators and CDS premiums fall into three main categories. The first category includes studies that examine the determinants of risk appetite or CDS premia, while the second category focuses on the relationship between risk appetite and asset returns or CDS premia and asset returns. The third category analyzes the interactions between various risk appetite indicators and country risk or CDS premia.

Numerous studies focus on the causal relationship between CDS premiums and various variables, such as financial markets, asset prices, stock prices, interest rates, exchange rates, volatility indices, country credit ratings, national income, current account deficits, portfolio investments, and investor risk perception, in Turkey and around the world. Table 1 below summarizes some selected studies from the national and international literature in this field, providing information on their scope, models, data sets, findings, and other relevant details.

Risk-taking or risk-aversion propensity is an unobservable phenomenon that can change over time. Risk-taking propensity increases with the returns on risky assets but decreases with equity volatility. Since the risk-taking or risk-aversion propensity of investors can vary according to the type of assets and markets, it is impossible to create a single index with the same structure on a global scale. Therefore, results obtained from studies using different economic tests based on different countries, investor groups, or different assets provide a framework supporting the development of this subject.

The increasing trends of globalization and financial liberalization following the implementation of neo-liberal economic policies since 1980, along with the rapid development of communication technologies, have brought financial markets closer globally. As a result, the savers or investors of one country have started allocating resources to cross-border investments. This situation has necessitated the consideration of various market-driven, economic, or political risk factors, primarily interest rate and exchange rate risks, in such investment decisions. However, the production of indicator indices based on different variables by many public and private sector financial institutions, both domestically and internationally, has become an important tool for investors in making investment decisions (Gemici et al., 2023, p. 2).

As mentioned in the second section above, numerous indices have been created as indicators of market fluctuations and asset or country risks related to investor risk propensity. In recent years, many studies have been conducted, both nationally and internationally, to investigate the determinants of these indices and financial indicators and their relationships with other macroeconomic variables.

Studies in this field have examined the determinants of investor risk appetite created by various financial institutions or organizations, and the determinants of derivative instruments like CDSs that insure against country or security default risks. They have also investigated the effects of macroeconomic variables such as GDP growth rate, inflation, stock prices, exchange rates, interest rates, current account balance, central bank foreign exchange reserves, money supply, oil prices, and more on investor risk propensity or CDS premiums. Below, some important similar studies are listed, detailing the variables used, data sets, models applied, and empirical findings.

The literature summarized below indicates that studies generally focus on the macroeconomic or financial determinants of CDS premiums and risk appetite indicators. Research on CDS premiums (Hull & White, 2000; Tang & Yan, 2009; Kargı, 2014; Galil et al., 2014; Jopp, 2023) identifies a negative relationship between macroeconomic variables, such as GDP and interest rates, and CDS premiums. Studies investigating the macroeconomic variables influencing risk appetite (Gai & Vaus, 2005; Cipollini et al., 2018) reveal that interest rates and exchange rates negatively affect risk appetite. In the Turkish context, studies analyzing the relationship between CDS premiums and the MKK risk appetite index (REKS) (Çelik, Dönmez, & Acar, 2017; Fettahoğlu, 2019; Çiftçi & Reis, 2020; Alptürk et al., 2021; Kaya et al., 2024) report a significant relationship between investors' risk appetite indicators

and CDS premiums. Furthermore, the analyses demonstrate that the CDS premium and risk index are crucial indicators for understanding investor behavior and measuring investor sentiment, highlighting a close relationship between these two measures.

Table 1. Literature Summary

Author(s)	Scope, Period, Model Variables	Model, Findings, Conclusion, and Recommendation
Hull & White (2000)	This study assumes that the amount bondholders would claim in case of default depends on the difference between the post-default market value of the bond and its nominal value.	One of the first studies on CDS premiums. This study examines the risk-neutral default probabilities obtained from market prices for a series of bonds from the same issuer, under the assumption that debtor's default risk is zero and that the risk is on the CDS issuing institution, along with swap values and the shape of the yield curve.
Gai & Vause (2005)	The concepts of risk appetite, risk aversion, and risk premium are explained. A new risk appetite measurement model is proposed by relating the risk premium expected by investors to the returns for taking that risk.	The model assesses the risk-neutral probabilities of future returns, differentiates risk appetite from risk aversion, and shows that risk appetite fluctuates within a narrow range during 'normal' times but drops sharply during crises.
Tang & Yan (2010)	The impact of macroeconomic variables on countries' CDS premiums was investigated.	A negative relationship was found between GDP and a country's CDS premiums, and it was determined that market-level investor sentiment is the most important determinant of credit spreads.
Kargı (2014)	The causality relationship between CDS premiums, GDP, and interest rates was determined using data from the period 2005:01–2013:03 and five different tests.	The research concluded that there is a bidirectional causality between CDS and market interest rates. Although there is a long-term relationship with GDP, it does not exist in the short term. CDS spreads in the Turkish economy are mostly affected by market interest rates.
Galil, et al., (2014)	The study proposes four different models for analyzing the determinants of CDS premiums and premium changes using data from 718 US firms, including stock returns, volatility, and rating scores, covering 2002-2013.	The findings suggest that market variables have explanatory power for CDS premiums, all three variables perform well, the models can be improved with additional variables. Credit rating scores are statistically insufficient in explaining CDS spreads.
Kaya, et al., (2014)	The relationship between the BIST 100 index and political risk (International Country Risk Guide (ICRG) "Political Risk Index") was analyzed using data from the period 1998-2012.	The findings indicate a long-term relationship between the political risk index and the BIST 100 index, with political risk fluctuations affecting the stock index. A negative relationship was found between the two variables.
Gatumel & Lelpo (2015)	A new measure of risk appetite based on the cross-sectional behavior of extreme returns in financial markets is proposed.	Empirical tests using different data sets and models suggest that a data set consisting of asset allocation and related assets provides reliable measurement and predictions of risk aversion among various alternatives.
Çelik, et al., (2017)	The macroeconomic factors determining the MKK risk appetite index were investigated using data from the period 2008-2017 and time series regression analysis.	The analysis concluded that increases in interest rates and exchange rates negatively affect the MKK indices determining investor risk appetite in Turkey. In contrast, increases in money supply and CBRT foreign exchange reserves have a positive impact. GDP and current account balance data have no impact on investor risk appetite.

(Table 1 cont.)

Cipollini, et al., (2018)	The interconnectedness of risk aversion, vulnerability, and systemic risk aversion among five European countries was examined using variance risk premia over the period 2000–2013. The analyses were performed using a FIVAR model for long-term memory and a VAR model for short-term memory.	A long-memory VAR model is found to produce more accurate linkage estimates than short-memory models. It is found that risk aversion indices peaked during the collapse of Lehman Brothers and the 2010-2011 European debt crisis, with Germany contributing the least to systemic risk aversion and the Netherlands and the United Kingdom contributing the most. In addition, the Netherlands was found to be the least exposed country to systemic risk, while Switzerland was the most exposed country.
Fettahoğlu (2019)	The relationship between Turkey's 5-year CDS premiums for the period November 2013-February 2018 and the Risk Appetite Index calculated by MKK was examined. Control variables include EUR/TRY and USD/TRY exchange rates, the BIST 100 Index, and 2040 Eurobond prices.	The study found that the risk appetite indicators of both foreign and domestic investors were significant in explaining CDS premiums. There was a negative and significant correlation between CDS premiums and the risk appetite index for all groups of foreign, domestic, and institutional investors. CDS premiums decrease as investor risk appetite increases.
İskenderoğlu & Balat (2019)	The causality relationship between MKK risk appetite index and oil prices, exchange rates, gold prices, and interest rates was investigated using weekly data from the period 2008-2015 and Granger and Breitung-Candelon Frequency Causality Tests.	The results of the analysis indicate a long-term relationship from oil prices to MKK risk appetite index, a short, medium, and long-term relationship from exchange rates to risk appetite, and a short-term unidirectional causality relationship from changes in gold prices and interest rates.
Çifçi & Reis (2020)	The relationship between the risk perceptions of investors investing in Borsa Istanbul and capital market liquidity was investigated using Toda-Yamamoto causality analysis. Risk appetite was measured with the MKK Risk Appetite Index, and Borsa Istanbul market index liquidity was measured with the Amihud illiquidity ratio.	The causality analysis concluded a unidirectional relationship between market liquidity to the MKK investor risk appetite index.
Kaya (2021)	The correlation between the Risk Appetite Indices created by MKK for different investor types was examined using weekly data from the period 04.01.2008-07.08.2020.	The VAR models analysis found that MKK Risk Appetite Indices move together in the long term, have mutual causality, and all investor types are approximately 80% influenced by foreign investor risk appetite.
Köycü (2021)	The relationship between the Risk Appetite (RISE) Index and the BIST 100 index was investigated using weekly data from the periods before (15.03.2019-13.03.2020) and after (13.03.2020-13.03.2021) COVID-19.	The study concluded that there is an equilibrium relationship between Risk Appetite and the BIST 100 index before and after COVID-19, investor risk appetite is affected by the BIST 100 index value, and investor risk appetite increases during periods when the BIST 100 index is in an upward trend.

(Table 1 cont.)

Alptürk, et al., (2021)	The relationship between geopolitical risk and CDS premium in Turkey was investigated using data from the period 2010-2020, examining the existence of causality.	It was found that increases or decreases in Turkey's geopolitical risk index affect CDS premiums, but CDS premiums do not have an impact on Turkey's geopolitical risk index.
Dai & Chang (2021)	The predictability of time-varying risk aversion on U.S. stock return volatility was investigated using intraday close price data of the S&P 500 index over the period 1986–2019, employing the risk aversion measure developed by Bekaert et al. (2019).	The findings indicate that time-varying risk aversion significantly impacts the volatility of stock returns. Out-of-sample forecasting results show that incorporating this measure into the baseline model enhances prediction accuracy while maintaining robustness across various lag structures and evaluation periods. Furthermore, this new predictor significantly improves forecasting performance for the volatility of other stock indices and crude oil types. These results underscore the importance of volatility risk in asset pricing processes, emphasizing its relevance for financial market participants.
Gemici, et al., (2023)	The predictability of risk appetite in Turkey, represented by the MKK Risk Appetite Indices, was investigated using weekly data from the period 2008-2022, with 4 local variables (2-year government bond yields, 5-year government CDS spreads, USD/TRY exchange rate, and TRY gold prices) and 5 global variables (global geopolitical risk index (GPR), CBOE crude oil volatility index (OVX), financial stress index from emerging markets (FSI), CBOE volatility index (VIX), and safe haven index).	The analysis concluded that both local and global factors significantly impact the risk appetite indices under various market conditions. However, local factors are the primary drivers of these indices. Changes in bond yields, CDS spreads, FSI, GPR, and VIX indices were the most effective factors in terms of causality. It was highlighted that monitoring fluctuations in local factors is crucial when measuring investors' preferences regarding various market conditions.
Jopp (2023)	The relationship between the CDS spreads of 131 businesses operating in Europe and the credit risk premium is investigated using data for the period 2012-2021 using panel data analysis. This study incorporates risk appetite into the model as a factor of the credit risk premium, which is determined based on the risk premium itself.	The study indicates that risk appetite escalated during periods of near-zero interest rates in the Euro Area and the implementation of expansionary fiscal policies. However, no significant effect was observed in periods when the ECB announced its purchase program due to the pandemic. On the other hand, there is a positive relationship between credit risk premiums and the risk-free interest rate.
Kaya, et al., (2024)	The relationship between MKK domestic and foreign investor risk appetite indices and Turkey's 5-year CDS premium, representing country risk, was examined using Hatemi-J cointegration and Hatemi-J asymmetric causality tests.	The analysis found that CDS premiums affect both domestic and foreign investor risk appetite. There is a cointegration between CDS and the risk appetite variables of domestic and foreign investors. Positive causality from increases in investor risk appetite to CDS premiums and negative or positive causality from decreases were determined.

4. METHODOLOGY

4.1. Data Set of the Research

In this study, the asymmetric relationship between the Risk Appetite Indices (REKS), calculated separately for different types of investors by the Central Registry Agency (CRA) Data Analysis Platform (DAP), and Turkey's CDS premium was investigated using weekly frequency data covering the period from 09.04.2010 to 31.12.2023. The information regarding the variables used in the empirical analyses of the study is presented in Table 2.

Table 2. Information on Variables

Variable	Definition	Data Source	Frequency	Period
CDS	Turkey Credit Default Swap	Bloomberg HT	Weekly	2010:04-2023:12
REKS All	All Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Foreign	Foreign Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Domestic	Domestic Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Domestic Individual	Domestic Individual Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Domestic Corporate	Domestic Corporate Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Domestic Funds	Domestic Funds Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12
REKS Qualified	Qualified Investors Risk Appetite Index	Central Registry Agency	Weekly	2010:04-2023:12

Source: Turkey's CDS data were provided by Bloomberg HT, and the weekly data for the Risk Appetite Index were obtained by the authors from the Central Registry Agency's data platforms.

In the study, descriptive statistics of the series were first examined, and the results are presented in Table 3.

Table 3. Descriptive Statistics of Variables (2010-2023)

	<i>CDS</i>	<i>REKS All</i>	<i>REKS Foreign</i>	<i>REKS Domestic</i>	<i>REKS Domestic Individual</i>	<i>REKS Domestic Corporate</i>	<i>REKS Domestic Funds</i>	<i>REKS Qualified</i>
Average	309.39	53.16	51.88	65.53	66.96	62.07	72.76	57.12
Median	258.68	53.13	53.41	64.99	66.80	61.23	72.65	56.02
Maximum	874.40	64.84	72.93	88.39	90.25	92.44	103.14	75.30
Minimum	111.62	45.13	30.29	50.26	45.61	38.94	42.44	40.47
Std. Deviation	155.56	3.25	6.82	7.57	7.92	9.48	13.19	6.41
Skewness	1.194	0.38	-0.80	0.72	0.36	0.53	-0.10	0.52
Kurtosis	3.957	3.77	4.44	3.90	3.67	3.65	2.39	3.64
Jarque-Bera	197.99 (0.000)	35.96 (0.000)	139.22 (0.000)	86.28 (0.000)	29.30 (0.000)	46.84 (0.000)	12.22 (0.000)	44.91 (0.000)
Number of Observations	717	717	717	717	717	717	717	717

Source: Created by the authors.

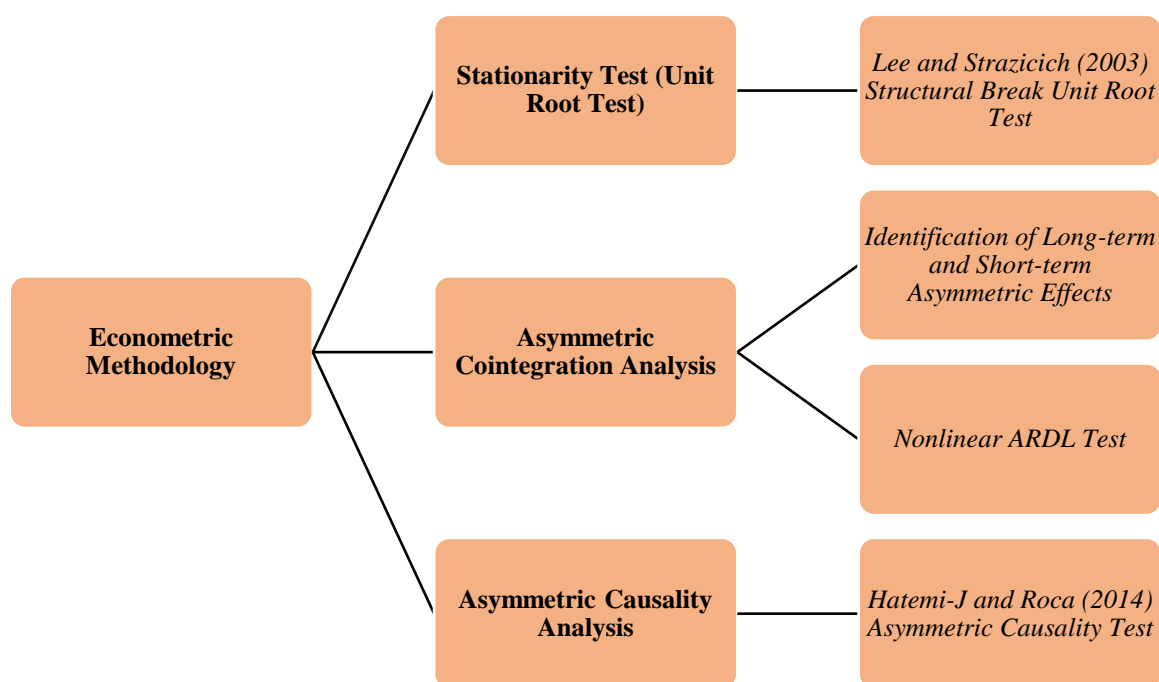
When examining the standard deviation values presented in Table 3, it is observed that the series with the highest variability are the CDS premium, REKS Domestic Funds, and REKS Domestic Corporate Investors Risk Appetite Indices, respectively. Conversely, the series with the lowest standard deviations are the REKS All Investors, REKS Qualified Investors, and REKS Foreign Investors Risk Appetite Indices. Regarding the maximum and minimum values within the Investor Risk Appetite Index categories, the highest (lowest) values are attributed to the REKS Domestic Funds variable. The statistically significant Jarque-Bera test statistics indicate that the series do not conform to a standard normal distribution.

4.2 Econometric Methodology and Empirical Findings

In this study, the cointegration relationship between Turkey's CDS premium and the REKS indices, calculated separately for different types of investors, was investigated using nonlinear ARDL models. In the first stage of the analyses, the stationarity levels of the series were tested using the unit root test allowing for two endogenous breaks introduced to the literature by Lee and Strazicich (2003).

After determining the stationarity levels of the series, the second stage of the analyses examined the existence of a long-term cointegration relationship between the series using the nonlinear ARDL test of Shin et al. (2014), one of the nonlinear cointegration tests. The causality relationship between the series was investigated using the asymmetric causality test of Hatemi-J and Roca (2014). The econometric methodology of the study is presented in Figure 1.

Figure 1: Econometric Methodology



Source: Created by the authors.

4.2.1. Lee and Strazicich (2003) Unit Root Test

The traditional unit root tests of the Dickey-Fuller type are known for their weakness due failure to reject the null hypothesis when structural breaks are not considered during the testing processes. In this context, a time series with structural breaks may be incorrectly identified as following a unit root process due to the use of conventional unit root tests (Hepsağ, 2022, p. 19). To achieve statistically significant relationships in the econometric analyses of this study, the Lee and Strazicich (2003) LM unit root test, which accounts for potential structural breaks in the series, was employed to determine the stationarity levels of the series.

The Lagrange Multiplier (LM) unit root test developed by Lee and Strazicich (2003) is based on the LM test developed by Schmidt and Phillips (1992). In the Lee-Strazicich unit root test, the data generation process considers the three structural break models (Model A, B, and C) described by Perron (1989) as follows (Lee & Strazicich, 2003, pp. 1082-1083).

$$y_t = \delta'Z_t + e_t, \tag{1}$$

$$e_t = \beta e_{t-1} + \varepsilon_t, \quad (2)$$

In Equation (1), Z_t is a vector of exogenous variables, allowing for two breaks in level for Model AA:

$$Z_t = [1, t, D_{1t}, D_{2t}] \quad (3)$$

For $t \geq T_{Bj} + 1, j = 1, 2, D_{jt} = 1$; otherwise, it takes the value of 0.

To obtain the dummy variable that takes the value of zero, Z_t should be replaced with $[1, t, D_t, DT_t]'$.

For Model CC, which allows for two breaks in both level and trend:

$$Z_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}] \quad (4)$$

For $t \geq T_{Bj} + 1, j = 1, 2, D_{jt} = t - T_{Bj}$; otherwise, it takes the value of 0

The data generation process under the null hypothesis includes breaks ($\beta = 1$), while the alternative hypothesis is ($\beta < 1$). The LM unit root test statistic is calculated using the regression specified in Equation (5):

$$\Delta y_t = \delta' \Delta Z_t + \phi \tilde{S}_{t-1} + u_t \quad (5)$$

In the equation, $\tilde{S}_{t-1} = y_t - \tilde{\psi}_x - Z_t \tilde{S}_{t-1}$, for $t = 2, \dots, T$; $\tilde{\delta}$ are the coefficients of the regression of Δy_t of ΔZ_t . $\tilde{\psi}_x$ is obtained as $y_1 - Z_1 \delta$ (Yılancı, 2009, p. 330).

The unit root null hypothesis is defined as $\phi = 0$ and the LM test statistics are obtained as $\tilde{\rho} = T\tilde{\phi}$. The test statistic obtained from the calculations is compared with the critical values. If the calculated test statistic exceeds the critical values, the null hypothesis of a unit root with structural breaks will be rejected. In the LM unit root test with two breaks, the breakpoints (T_{Bj}) are determined endogenously, and the points where the $\tilde{\tau}$ test statistic is minimized are selected to identify the break times (Lee & Strazicich, 2003, p. 1083).

$$LM_p = \inf \tilde{\rho}(\lambda), \quad (6)$$

$$LM_\tau = \inf \tilde{\tau}(\lambda). \quad (7)$$

In the study, the Lee and Strazicich (2003) unit root test with structural breaks was applied to the level values and first difference values of all series to determine whether they contain a unit root. The results are reported in Table 4.

Table 4. Lee-Strazicich Unit Root Test Results

Variable	Model AA			
	Test Statistic	Result	TB1	TB2
CDS	-3.245	I(1)	2018M07	2022M08
REKS All	-2.903	I(1)	2020M08	2022M06
REKS Foreign	-2.139	I(1)	2020M11	2022M06
REKS Domestic	-3.078	I(1)	2018M06	2020M11
REKS Domestic Individual	-3.139	I(1)	2012M03	2018M06
REKS Domestic Corporate	-3.067	I(1)	2018M01	2020M11
REKS Domestic Funds	-3.013	I(1)	2016M03	2019M03
REKS Qualified	-3.066	I(1)	2018M01	2020M08
Δ CDS	-10.818*	I(0)		
Δ REKS All	-11.538*	I(0)		
Δ REKS Foreign	-9.855*	I(0)		
Δ REKS Domestic	-8.205*	I(0)		
Δ REKS Domestic Individual	-7.888*	I(0)		
Δ REKS Domestic Corporate	-8.973*	I(0)		
Δ REKS Domestic Funds	-7.750*	I(0)		
Δ REKS Qualified	-8.904*	I(0)		
<i>Critical Values</i>	<i>1%</i>		<i>-3.9977</i>	
	<i>5%</i>		<i>-3.4044</i>	
	<i>10%</i>		<i>-3.1155</i>	

Note: Δ denotes the first difference operator. The symbols *, **, and *** indicate that the null hypothesis of the series containing a unit root is rejected at the 1%, 5%, and 10% significance levels, respectively. TB1 and TB2 denote the break dates.

According to the results of the unit root test with structural breaks presented in Table 4, the calculated test statistics are, in absolute terms, smaller than the critical value at the 5% significance level. Consequently, the null hypothesis that the series contains a unit root cannot be rejected. Based on this result, the series is not stationary. However, the unit root test results for the first differences of the series indicate that the series are stationary. Therefore, it can be concluded that the series are integrated of order one.

4.2.2. Nonlinear ARDL (NARDL) Model

The asymmetric ARDL method developed by Shin et al., (2014) is known in the literature as the Nonlinear ARDL (NARDL) method. The linear ARDL approach, developed by Pesaran et al., (2001), is based on the assumes that explanatory variables symmetrically affect the dependent variable when testing for the existence of a long-term relationship through a cointegration test (Berke, 2023, p. 413). The method introduced by Shin et al., (2014) extends the traditional ARDL method and bounds testing by considering the decomposed positive and negative changes of the independent variable. This proposed method allows for the measurement of the asymmetric effect of the independent variable on the dependent variable by decomposing it into positive and negative changes (Hepsağ, 2022, p. 99). The asymmetric long-term model proposed by Shin, Yu, and Greenwood-Nimmo (2014) is calculated using the regression in Equation (8) (Shin et al., 2014, pp. 285-293):

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + u_t, \quad (8)$$

$$\Delta x_t = v_t, \quad (9)$$

In the long-term model formulated in Equation (8), it is assumed that the variables y_t and x_t are stationary of the first order I(1). β^+ and β^- represent the asymmetric long-term parameters. The variables x_t^+ and x_t^- in the equation represent the partial sums of the positive and negative changes of the independent variable, respectively, and are obtained as follows:

$$x_t^+ = \sum_{j=1}^t \Delta x_j^+ = \sum_{j=1}^t \max(\Delta x_j, 0), \quad x_t^- = \sum_{j=1}^t \Delta x_j^- = \sum_{j=1}^t \min(\Delta x_j, 0). \quad (10)$$

The partial sums of the positive and negative changes of the independent variable are obtained cumulatively. Similar to the traditional ARDL method, the asymmetric ARDL model also includes an unrestricted error correction model (UECM) formulated in Equation (11) (Hepsağ, 2022, pp. 99-100):

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{p-1} \alpha_{1i} \Delta y_{t-i} + \sum_{i=0}^{q-1} (\omega_i^+ \Delta x_{t-i}^+ + \omega_i^- \Delta x_{t-i}^-) + \alpha_3 y_{t-1} + \alpha_4 x_{t-1}^+ + \alpha_5 x_{t-1}^- + \varepsilon_t \quad (11)$$

In Equation (11), the unrestricted error correction model is estimated using the ordinary least squares method. Before testing for cointegration with the unrestricted error correction model, it is necessary to test for long-term and short-term asymmetry. To test for long-term asymmetric effects, the null hypothesis, which states that there is a long-term symmetric effect, is tested against the alternative hypothesis, which indicates the presence of long-term asymmetric effects.

$$H_0: (-\alpha_4/\alpha_3) = (-\alpha_5/\alpha_3) \rightarrow \text{The long - term symmetric relationship}$$

$$H_1: (-\alpha_4/\alpha_3) \neq (-\alpha_5/\alpha_3) \rightarrow \text{The long - term asymmetric relationship}$$

In this test, which follows a χ^2 distribution, if the calculated χ^2 test statistic is greater than the χ^2 table value with 1 degree of freedom, the null hypothesis is rejected, indicating the presence of a long-term asymmetric relationship. On the other hand, to test for short-term asymmetric effects, the null hypothesis, which states that there is a short-term symmetric effect, is tested against the alternative hypothesis, which indicates the presence of short-term asymmetric effects.

$$H_0: \omega_i^+ = \omega_i^- \rightarrow \text{The short - term symmetric relationship}$$

$$H_1: \omega_i^+ \neq \omega_i^- \rightarrow \text{The short - term asymmetric relationship}$$

Similar to testing for long-term asymmetry, the test for short-term asymmetry also follows a χ^2 distribution. If the calculated χ^2 test statistic is greater than the χ^2 table value with 1 degree of freedom, the null hypothesis is rejected, indicating the presence of a short-term asymmetric relationship.

After identifying at least one of the long-run or short-run asymmetric effects, the null hypothesis of no cointegrated relationship is tested against the alternative hypothesis of the existence of a cointegrated relationship using the unrestricted error correction model in Equation (11):

$$H_0: \alpha_3 = \alpha_4 = \alpha_5 = 0 \rightarrow \text{No cointegration}$$

$$H_1: \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq 0 \rightarrow \text{Cointegration exists}$$

In testing for the existence of a cointegrated relationship, the F_{PSS} test statistic is calculated using the bounds testing approach developed by Pesaran et al., (2001) as follows:

$$F_{PSS} = \frac{(ESS_R - ESS_{UR})/3}{ESS_{UR}/(n-k)} \quad (12)$$

In Equation (12), ESS_R represents the sum of squared residuals for the restricted model, ESS_{UR} represents the sum of squared residuals for the unrestricted model, n denotes the number of observations, and k denotes the number of parameters in the unrestricted model. After estimating the unrestricted error correction model in Equation (11), the long-term coefficients for positive and negative changes are calculated as follows:

$$-a_4/a_3 \rightarrow \text{Long - term Positive Coefficients}$$

$$-a_5/a_3 \rightarrow \text{Long - term Negative Coefficients}$$

The asymmetric ARDL method and cointegration analysis developed by Shin, Yu, and Greenwood-Nimmo (2014) suggest that the impact of an increasing or decreasing series on the dependent variable may vary in direction or magnitude depending on the existence of an asymmetric relationship between the series in the long-term and/or short-term (Çeştepe & Güdenoğlu, 2020, p. 245). Therefore, to perform cointegration analysis and estimate long-term coefficients, it is necessary to first identify at least one of the long-term or short-term asymmetric effects. In this context, the study first conducted an analysis of long-term and short-term asymmetry between the series, and the results are presented in Table 5, Panel A.

Table 5. Results of Long-term and Short-term Asymmetry Tests

Panel A: Results of Long-term and Short-term Asymmetry Tests			
$W_{LR} = H_0: (-\alpha_4/\alpha_3) = (-\alpha_5/\alpha_3)$ $W_{SR} = H_0: \omega_i^+ = \omega_i^-$	Long-term Asymmetry (W_{LR})	Short-term Asymmetry (W_{SR})	Result
REKS All - CDS	1.9470(0.162)	0.0907(0.763)	Long-term and Short-term Symmetric Effect
REKS Foreign - CDS	1.9122(0.166)	26.9779(0.000)	Short-term Asymmetric Effect
REKS Domestic - CDS	10.0214(0.001)	4.4731(0.034)	Long-term and Short-term Asymmetric Effect
REKS Domestic Individual - CDS	11.3688(0.000)	0.3875(0.533)	Long-term Asymmetric Effect
REKS Domestic Corporate - CDS	24.8528(0.000)	4.5974(0.032)	Long-term and Short-term Asymmetric Effect
REKS Domestic Funds - CDS	33.2830(0.000)	3.0363(0.081)	Long-term and Short-term Asymmetric Effects
REKS Qualified - CDS	5.4319(0.019)	1.3475(0.245)	Long-term Asymmetric Effect

Note: The χ^2 table value with 1 degree of freedom at the 5% significance level is 3.84 for both long-term and short-term asymmetry. LR denotes long-term, while SR denotes short-term.

When comparing the test statistics calculated for the presence of long-term asymmetric effects presented in Table 5 with the χ^2 table value of 3.84 at 1 degree of freedom, the null hypothesis of a long-term symmetric effect is rejected for REKS Domestic, REKS Domestic Real, REKS Domestic Institutional, REKS Domestic Funds, and REKS Qualified with the CDS premium. Based on this result, it is possible to affirm the validity of long-term asymmetry. On the other hand, according to the long-term asymmetry results in Table 5, the null hypothesis of a long-term symmetric effect cannot be rejected for REKS All and REKS Foreign with the CDS premium. Additionally, when comparing the test statistics calculated for the presence of short-term asymmetric effects presented in Table 4 with the χ^2 table value of 3.84 at 1 degree of freedom, the null hypothesis of a short-term symmetric effect is rejected for REKS Foreign, REKS Domestic, REKS Domestic Institutional, and REKS Domestic Funds with the CDS premium, indicating the presence of short-term asymmetric effects as well. Evaluating the results where both long-term and short-term asymmetric effects were identified, the REKS indices, calculated separately for different types of investors, respond to positive and negative changes in the CDS premium with varying magnitudes.

In the asymmetric ARDL method developed by Shin et al. (2014), after identifying at least one of the long-term or short-term asymmetric effects, the cointegration test between REKS Foreign, REKS Domestic, REKS Domestic Real, REKS Domestic Institutional, REKS Domestic Funds, REKS Qualified, and the CDS premium was conducted. The cointegration test results are reported in Table 6.

Table 6. Cointegration Test Results

Panel B: Bounds Test Results (H_0 : No Long-term Relationship)				
<i>Critical Values</i> ^a	<i>1%</i>	<i>2.5%</i>	<i>5%</i>	<i>10%</i>
Lower Bound	4.13	3.55	3.10	2.63
Upper Bound	5.00	4.38	3.87	3.35
$H_0: \alpha_3 = \alpha_4 = \alpha_5 = 0$	F- statistic (F_{PSS})	k	Result	
REKS Foreign - CDS	1.46963	2	No Cointegration	
REKS Domestic - CDS	4.67715	2	Cointegration Exists	
REKS Domestic Individual - CDS	4.69134	2	Cointegration Exists	
REKS Domestic Corporate - CDS	4.01740	2	Cointegration Exists	
REKS Domestic Funds - CDS	5.39184	2	Cointegration Exists	
REKS Qualified - CDS	3.53280	2	Cointegration Exists	

Note: a: The lower and upper bound critical values for the bounds test are obtained from Pesaran, Shin, and Smith (2001).

The presence of long-term cointegration is investigated under the bounds testing approach by comparing the calculated (F_{PSS}) test statistics with the critical values. If the F_{PSS} test statistic is greater than the critical value for the upper bound, the null hypothesis of no cointegrated relationship is rejected. Upon examining the results presented in Table 6, it is observed that there is a cointegrated relationship

between the CDS premium and all other REKS indices (REKS Domestic, REKS Domestic Real, REKS Domestic Institutional, REKS Domestic Funds, and REKS Qualified), except for the REKS Foreign index, when the REKS indices are the dependent variables.

After establishing a long-term cointegrated relationship among the variables, the long-term asymmetric relationship was examined by calculating the long-term coefficients for positive and negative changes in the independent variable. Additionally, the results presented in Table 5 indicate the validity of asymmetry in both the long and short terms. The coefficients demonstrating the long-term asymmetric relationship between the REKS indices and the CDS premium are reported in Table 7. Upon examining the long-term coefficients of the nonlinear ARDL model presented in Table 7, it is observed that the CDS premium is statistically significant for all REKS indices.

Table 7. Long-term Coefficients

Panel C: Long-Term Asymmetric Coefficients		
<i>Dependent Variable: REKS Domestic</i>		
Variable	Coefficient	Probability
CDS ⁺	0.00430	0.002
CDS ⁻	0.00304	0.000
<i>Dependent Variable: REKS Domestic Individual</i>		
Variable	Coefficient	Probability
CDS ⁺	0.00384	0.008
CDS ⁻	0.00850	0.001
<i>Dependent Variable REKS Domestic Corporate</i>		
Variable	Coefficient	Probability
CDS ⁺	0.02617	0.004
CDS ⁻	0.02768	0.015
<i>Dependent Variable: REKS Domestic Funds</i>		
Variable	Coefficient	Probability
CDS ⁺	0.01357	0.046
CDS ⁻	0.01506	0.026
<i>Dependent Variable: REKS Qualified</i>		
Variable	Coefficient	Probability
CDS ⁺	0.02194	0.013
CDS ⁻	0.02130	0.023

According to the long-term coefficients presented in Table 7, for the REKS Domestic index, the long-term coefficient for positive changes in the independent variable CDS premium is 0.00430, while the long-term coefficient for negative changes is 0.00304. This result indicates that a one-unit increase in positive changes in the CDS premium raises the REKS Domestic index by 0.00430 units, whereas a one-unit decrease in negative changes in the CDS premium lowers the REKS Domestic index by 0.00304 units. Positive changes in the CDS premium have a greater impact on the REKS Domestic index compared to negative changes. For the REKS Domestic Real index, the long-term coefficient for positive changes in the CDS premium is 0.00384, while the long-term coefficient for negative changes is 0.00850. For the REKS Domestic Institutional Index, the long-term coefficient for positive changes in the CDS premium is calculated as 0.00430, while the long-term coefficient for negative changes is 0.00304. Examining the results for REKS Domestic Funds in the table, the long-term coefficient for

positive changes in the CDS premium is 0.01357, while the long-term coefficient for negative changes is 0.01506. Finally, for the REKS Qualified index, the long-term coefficient for positive changes in the CDS premium is 0.02194, while the long-term coefficient for negative changes is 0.02130. Overall, the results in the table indicate that positive changes in the CDS premium have a greater impact on the REKS Domestic and REKS Qualified indices compared to negative changes, while negative changes in the CDS premium have a greater impact on the REKS Domestic Real, REKS Domestic Institutional, and REKS Domestic Funds indices compared to positive changes.

4.2.3. Hatemi-J and Roca (2014) Asymmetric Causality Test

The classical causality tests used to determine the direction of causality between variables assume that the causal effects of positive shocks are the same as those of negative shocks when examining the existence of a possible causality relationship between variables (Eryüzlü & Bayat, 2018, p. 188). Granger and Yoon (2002) first suggested that the relationship between positive and negative shocks might differ from the relationship between the variables themselves (Yılandı & Bozoklu, 2014, p. 214). Granger and Yoon (2002) transformed the data into cumulative positive and negative shocks and applied a cointegration approach to these shocks, demonstrating that the relationships between the shocks could vary (Öztürk & Zeren, 2019, pp. 63-64). Hatemi-J (2012) developed an asymmetric causality test that separates shocks in variables into positive and negative, considering the potential impacts of these shocks separately. Essentially, this asymmetric test is a decomposition of the Hacker and Hatemi-J (2006) bootstrap causality test into positive and negative shocks. The asymmetric causality test is an analytical method that determines whether causality varies according to the type of shock (Türk, 2024, p. 102). Hatemi-J and Roca (2014) combined the tests by Granger and Yoon (2002), Hacker and Hatemi-J (2006), and Hatemi-J (2012) to develop a new test (Öztürk, 2020, pp. 144-145). The test examines whether causality is symmetric under the influence of different types of shocks. In the asymmetric causality test, let P_{1t} and P_{2t} be two cointegrated variables (Hatemi-J & Roca, 2014, pp. 8-9):

$$P_{1t} = P_{1t-1} + \varepsilon_{1t} = P_{1,0} + \sum_{i=1}^t \varepsilon_{1i}, \quad (13)$$

$$P_{2t} = P_{2t-1} + \varepsilon_{2t} = P_{2,0} + \sum_{i=1}^t \varepsilon_{2i}, \quad (14)$$

In these equations, while $t = 1, 2, \dots, T$, the constants $P_{1,0}$ and $P_{2,0}$ represent the initial values. The positive and negative changes of each variable are defined as $\varepsilon_{1t}^+ = \max(\varepsilon_{1t}, 0)$, $\varepsilon_{2t}^+ = \max(\varepsilon_{2t}, 0)$, $\varepsilon_{1t}^- = \min(\varepsilon_{1t}, 0)$ ve $\varepsilon_{2t}^- = \min(\varepsilon_{2t}, 0)$. In terms of error terms, they are defined as $\varepsilon_{1t} = \varepsilon_{1t}^+ + \varepsilon_{1t}^-$ ve $\varepsilon_{2t} = \varepsilon_{2t}^+ + \varepsilon_{2t}^-$. Therefore, if Equations (13) and (14) are rearranged:

$$P_{1t} = P_{1t-1} + \varepsilon_{1t} = P_{1,0} + \sum_{i=1}^t \varepsilon_{1i}^+ + \sum_{i=1}^t \varepsilon_{1i}^-, \quad (15)$$

$$P_{2t} = P_{2t-1} + \varepsilon_{2t} = P_{2,0} + \sum_{i=1}^t \varepsilon_{2i}^+ + \sum_{i=1}^t \varepsilon_{2i}^-, \quad (16)$$

Thus, the cumulative sums of the positive and negative shocks for each variable are expressed as follows: $P_{1t}^+ = \sum_{i=1}^t \varepsilon_{1i}^+$, $P_{1t}^- = \sum_{i=1}^t \varepsilon_{1i}^-$, $P_{2t}^+ = \sum_{i=1}^t \varepsilon_{2i}^+$ ve $P_{2t}^- = \sum_{i=1}^t \varepsilon_{2i}^-$. The cumulative components in the equations enable the application of the asymmetric causality test. The causality relationship between the positive cumulative shocks is tested using the vector $P_t^+ = (P_{1t}^+, P_{2t}^+)$. The k-lag Vector Autoregressive (VAR) model, where the lag length is accepted as “k,” is specified as follows:

$$P_t^+ = v + A_1 P_{t-1}^+ + \dots + A_L P_{t-k}^+ + u_t^+, \quad (17)$$

In Equation (17), v denotes the (2x1) vector of constant terms, while u_t^+ represents the (2x1) vector of error terms occurring in positive shocks. The term A_r , for $r=1,2,\dots,k$, represents the (2x2) parameter matrix. The optimal lag length k is determined using the following test statistic developed by Hatemi-J (2003, 2008):

$$HJC = \ln(|\hat{\Omega}_f|) + k2T^{-1}(m^2 \ln T + 2m^2 \ln(\ln T)), \quad k = 0, \dots, k_{max}, \quad (18)$$

In Equation (18), $|\hat{\Omega}_f|$ represents the variance-covariance matrix of the error term in the VAR model based on the optimal lag length k . In the equation, m represents the number of equations in the model, while T denotes the sample size in the model. The null hypothesis of the asymmetric causality test is defined as the j . row and k . column of the A_r matrix is equal to zero, and the Wald test statistic is used to test this hypothesis. If the test statistic is smaller than the critical values, the null hypothesis cannot be rejected. If it is larger, the null hypothesis stating that there is no causality is rejected.

In this study, the asymmetric causality relationship between Turkey’s CDS premium and the REKS indices, which are calculated separately for different types of investors, was tested using the Hatemi-J and Roca (2014) asymmetric causality test. The results are presented in Table 8.

Table 8: Results of Hatemi and Roca (2014) Asymmetric Causality Analysis

Null Hypothesis (H ₀)	MWALD	Critical Values ^{a,b}			Null Hypothesis (H ₀)	MWALD	Critical Values ^{a,b}		
		1%	5%	10%			1%	5%	10%
CDS ⁺ ≠> REKSDomestic ⁺	12.851***	12.61	8.13	6.36	REKSDomestic ⁺ ≠> CDS ⁺	0.483	11.81	7.97	6.27
CDS ⁺ ≠> REKSDomestic ⁻	1.894	12.23	8.13	6.35	REKSDomestic ⁺ ≠> CDS ⁻	6.519	12.41	8.146	6.42
CDS ⁻ ≠> REKSDomestic ⁻	20.226***	12.49	8.03	6.28	REKSDomestic ⁻ ≠> CDS ⁻	5.257	11.98	7.99	6.26
CDS ⁻ ≠> REKSDomestic ⁺	5.580	12.08	8.09	6.35	REKSDomestic ⁻ ≠> CDS ⁺	2.790	11.59	7.77	6.28
CDS ⁺ ≠> REKSIndividual ⁺	15.337***	12.51	8.15	6.46	REKSIndividual ⁺ ≠> CDS ⁺	1.220	11.84	8.07	6.33
CDS ⁺ ≠> REKSIndividual ⁻	0.842	9.73	6.19	4.67	REKSIndividual ⁺ ≠> CDS ⁻	8.69	12.33	7.98	6.39
CDS ⁻ ≠> REKSIndividual ⁻	19.281***	9.76	6.16	4.66	REKSIndividual ⁻ ≠> CDS ⁻	3.941	9.25	5.99	4.67

(Table 8 cont.)

CDS ⁻ \nRightarrow REKSIndividual ⁺	8.797**	10.08	6.16	4.64	REKSIndividual ⁻ \nRightarrow CDS ⁺	6.003	11.48	7.80	6.29
CDS ⁺ \nRightarrow REKSCorporate ⁺	2.600	12.23	8.13	6.38	REKSCorporate ⁺ \nRightarrow CDS ⁺	1.654	12.07	7.97	6.27
CDS ⁺ \nRightarrow REKSCorporate ⁻	1.291	12.49	7.98	6.30	REKSCorporate ⁺ \nRightarrow CDS ⁻	3.088	12.12	8.19	6.42
CDS ⁻ \nRightarrow REKSCorporate ⁻	10.839**	12.53	8.13	6.38	REKSCorporate ⁻ \nRightarrow CDS ⁻	4.471	12.22	7.97	6.28
CDS ⁻ \nRightarrow REKSCorporate ⁺	4.702	12.12	8.03	6.27	REKSCorporate ⁻ \nRightarrow CDS ⁺	1.115	11.96	8.17	6.40
CDS ⁺ \nRightarrow REKSFunds ⁺	2.386	12.17	7.99	6.34	REKSFunds ⁺ \nRightarrow CDS ⁺	1.332	12.19	7.96	6.33
CDS ⁺ \nRightarrow REKSFunds ⁻	7.611***	12.05	8.02	6.49	REKSFunds ⁺ \nRightarrow CDS ⁻	2.456	12.99	8.54	6.62
CDS ⁻ \nRightarrow REKSFunds ⁻	25.957***	13.07	8.67	6.73	REKSFunds ⁻ \nRightarrow CDS ⁻	0.494	11.77	7.96	6.31
CDS ⁻ \nRightarrow REKSFunds ⁺	3.107	12.56	8.09	6.44	REKSFunds ⁻ \nRightarrow CDS ⁺	1.727	12.14	8.14	6.41
CDS ⁺ \nRightarrow REKSQualified ⁺	13.029***	11.79	8.06	6.38	REKSQualified ⁺ \nRightarrow CDS ⁺	4.724	12.05	8.07	6.41
CDS ⁺ \nRightarrow REKSQualified ⁻	2.100	12.45	8.17	6.39	REKSQualified ⁺ \nRightarrow CDS ⁻	4.595	12.22	8.01	6.34
CDS ⁻ \nRightarrow REKSQualified ⁻	5.994	12.21	7.98	6.43	REKSQualified ⁻ \nRightarrow CDS ⁻	9.543	11.84	7.98	6.30
CDS ⁻ \nRightarrow REKSQualified ⁺	3.114	12.08	8.01	6.39	REKSQualified ⁻ \nRightarrow CDS ⁺	1.636	11.47	7.93	6.29

Note: The notation \nRightarrow in the table indicates the null hypothesis of no causality in the direction shown between the variables. a: The HJC information criterion was used to select the optimal lag length. b: Bootstrap critical values were obtained with 10,000 iterations. *, **, *** indicate the presence of a causality relationship from the first variable to the second at the 10%, 5%, and 1% levels of statistical significance, respectively.

In the Hatemi-J and Roca (2014) asymmetric causality test, if the MWALD test statistic, which indicates the direction of the causality relationship between the relevant variables, is greater than the critical values, the null hypothesis of no causality between the variables is rejected. According to the Hatemi-J and Roca (2014) asymmetric causality test results, a causality relationship at the 1% significance level was found from positive shocks in the CDS premium to positive shocks in the REKS Domestic, REKS Real, and REKS Qualified indices. This indicates that a positive shock in the CDS premium will lead to a positive response in the REKS Domestic, REKS Real, and REKS Qualified indices, as determined through both asymptotic and bootstrap methods.

Additionally, according to the asymmetric causality test results in the table, there is a causality relationship at the 1% significance level from negative shocks in the CDS premium to negative shocks in the REKS Domestic, REKS Real, REKS Institutional, and REKS Funds indices. Furthermore, the asymmetric causality test results in the table show that there is no causality relationship at the 5% statistical significance level from positive and negative shocks in the REKS indices, calculated separately for each type of investor, to positive and negative shocks in the CDS premium.

5. CONCLUSION

The relationship between Investor Risk Appetite Indices (REKS) and Credit Default Swap (CDS) premiums in Turkey is evaluated as an indicator of market sentiment and perceived credit risk. The indicator defined as "investor risk appetite" increases with positive market expectations and decreases with negative ones, reflecting the decision of savers or investors to make purchases. In Turkey, the Risk Appetite Indices (REKS) are calculated by the Central Securities Depository as a measure of the risk appetite of investors in different groups. The Credit Default Swap (CDS) market, which insures the principal or interest payments of securities issued by the government, public, or private sector, has rapidly grown over the past two decades and become one of the most closely monitored indicators in the financial literature.

In this study, the relationship between the Risk Appetite Indices, calculated separately for each investor type, and Turkey's CDS premium was examined using the nonlinear ARDL (NARDL) method with weekly data from 09.04.2010 to 31.12.2023. The stationarity levels of the series were determined using the Lee and Strazicich (2003) LM unit root test, which allows for two endogenous breaks to account for possible structural breaks in the series. To test for a cointegrated relationship between the REKS indices and the CDS premium, it is first necessary to identify at least one long-term or short-term asymmetric effect between the series. In this context, an analysis of long-term and short-term asymmetry was initially conducted between the series. The results indicated asymmetric effects between the CDS premium and the REKS Foreign Investors, REKS Domestic Investors, REKS Domestic Institutional Investors, REKS Domestic Funds, and REKS Qualified Investors indices. Following the identification of at least one long-term or short-term asymmetric effect, the cointegration relationship between the CDS premium and the REKS indices—REKS Foreign, REKS Domestic, REKS Domestic Real, REKS Domestic Institutional, REKS Domestic Funds, and REKS Qualified Investors—was tested using the asymmetric ARDL method developed by Shin, Yu, and Greenwood-Nimmo (2014). The results of the applied asymmetric ARDL (NARDL) method indicated the existence of a cointegrated relationship between the CDS premium and the REKS Domestic, REKS Domestic Real, REKS Domestic Institutional, REKS Domestic Funds, and REKS Qualified Investors indices. After establishing the existence of a cointegrated relationship, long-term coefficients for positive and negative changes in the independent variable were calculated to show the long-term asymmetric relationship. According to the long-term coefficients, positive changes in the CDS premium have a greater impact on the REKS Domestic and REKS Qualified indices compared to negative changes, while negative changes in the CDS premium have a greater impact on the REKS Domestic Real, REKS Domestic Institutional, and REKS Domestic Funds indices compared to positive changes. In the final stage of the analyses, the asymmetric causality relationship between the REKS indices and Turkey's CDS premium was examined using the asymmetric causality test developed by Hatemi-J and Roca (2014), which separates shocks in variables into positive and negative and considers their potential impacts separately. According to the

results of the Hatemi-J and Roca (2014) asymmetric causality test, there is a statistically significant causality relationship from positive shocks in the CDS premium to positive shocks in the REKS Domestic, REKS Real, and REKS Qualified indices, and from negative shocks in the CDS premium to negative shocks in the REKS Domestic, REKS Real, REKS Institutional, and REKS Funds indices. On the other hand, no statistically significant causality relationship was found between positive and negative shocks in the REKS indices to positive and negative shocks in the CDS premium.

The findings of this study provide insights into market efficiency and the psychological dimensions of investor behavior. The stronger impact of positive changes in CDS premiums on the REKS Domestic and REKS Qualified indices suggests that investors are more responsive to improving credit risk conditions. Conversely, the greater influence of negative changes on the REKS Domestic Real, Institutional, and Funds indices reflects heightened sensitivity to deteriorating risk conditions, consistent with the concept of loss aversion.

The Hatemi-J and Roca (2014) asymmetric causality test reveals a unidirectional causality from shocks in CDS premiums to REKS indices, with no significant causality observed in the opposite direction. While this finding aligns with the Efficient Market Hypothesis, the asymmetric effects underscore the influence of psychological factors on investor behavior, highlighting potential limitations in market efficiency.

In Turkey's liberal, export-oriented, free-market economy, adopted after the 1980s, a significant transition occurred from a fixed exchange rate policy to a flexible exchange rate policy. As a result of these policies, market risks stemming from fluctuations in interest rates and exchange rates have become a significant source of stress for investors and portfolio managers over time. While various factors influence investment decisions—including market liquidity, monetary and fiscal policies of central banks and governments, economic and political structures, and other macroeconomic variables—CDS premiums and risk appetite indicators have emerged as critical determinants of foreign portfolio investors' decisions regarding Turkey. In this context, risk appetite can be defined as a function of investors' sensitivity to risk and macroeconomic variables.

Financial market participants can prepare themselves for potential future uncertainties with effective risk policies and financial information. CDS premiums, which can change daily based on a country's economic and political risk levels, reflect current market dynamics. In this context, CDS premiums are among the instruments closely monitored by investors as risk indicators. Investors' risk perception and their attitudes towards risk are reflected in their investment decisions and risk appetites.

Success in financial markets can be achieved through the level of information market participants possess about their transactions, their ability to understand and mitigate potential risks, and the selection and implementation of appropriate financial instruments and risk management policies. Accordingly, many macroeconomic variables, such as investor risk appetite and country risk (CDS

premiums), are closely monitored by market participants as key indicators. Both indicators we are studying fluctuate daily based on countries' economic and political risk levels, making them primary sources of information for financial decision-makers.

Consequently, the findings from empirical analyses can assist financial institutions, portfolio managers, and investors in protecting their savings or making the right investment decisions during periods of market stress. The results of this study can contribute to the goal of return maximization for savers, collective investment institutions engaged in portfolio management, financial intermediaries, and individual investors by enabling them to make informed decisions, select appropriate risk management tools, and adjust their positions as needed. Stakeholders can use these insights to make informed decisions and allocate resources in line with their strategic objectives. This, in turn, can lead to stable growth, support efficiency in resource allocation, achieve competitive advantage, and protect investors and savings, resulting in sustainable financial outcomes.

Overall, our results indicate that investor risk appetite and CDS premiums are significant factors in investment decisions. The findings offer potential implications for financial institution managers and policymakers in forming financial policies to reduce market uncertainty and strengthen economic and financial stability. From an investor's perspective, the results show that risk appetite indices have a strong relationship with CDS premiums. The results show that risk appetite and CDS premium are considered important indicators in predicting risk and return expectations and determining investor behavior in financial markets.

The CDS premium is an important indicator frequently used by foreign investors for portfolio diversification and assessing country risks. Therefore, the investment decisions of international investors are significantly influenced by CDS premiums. As a result, for economic and financial policies to be effectively implemented in real markets, decisions and strategies concerning Turkey's capital markets should be developed by considering the factors that influence investors' risk appetite, alongside market risks and uncertainties. In this context, the regular monitoring of market risks and uncertainties, which significantly impact investors' risk appetite, may play a pivotal role in supporting sound and rational investment decisions.

In this study, only the positive and negative effects of the CDS premium on risk appetite indices are analyzed. In future studies, it is suggested to include fear indices representing market uncertainty in addition to the CDS premium. Moreover, future research could examine in detail the relationship between different economic conditions (e.g. crisis periods), various macroeconomic indicators or different types of volatility and investors' risk appetite. Finally, econometrics literature is always evolving and can, therefore, be further extended through the implementation of new econometric methodologies in future studies.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that they all equally contributed to all processes of the research.

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The Impact of the Internet on Relational Goods: Empirical Evidence from European Countries

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Abstract

Along with behavioral approaches in economics, a new social concept has emerged which is built on human relationships. Being called relational goods, this concept represents the advantages that people derive from their relationships with each other, such as social approval, friendship, companionship, etc. Relational goods that make people feel satisfied and content are generally produced/consumed in positive family and friendship connections. Nowadays it might be expensive to maintain this kind of relations. Spending time on the internet or social media has become more and more appealing for many people. Especially in European countries, where the percentage of people who prefer to be isolated is rising rapidly day by day, the rate of internet use is quite high. This study aims to investigate the impact of the internet on relational goods in Europe based on the data from the 10th Round of the European Social Survey. In this direction, firstly, categorical principal component analysis was employed in order to construct proxy indicators coded as “social relations” and “family relations” instead of relational goods. Afterwards, the relationship between these indicators and internet use was analyzed with the help of figures. The figures suggest that as average daily internet use increases, both social and family relationships weaken. The findings reveal that in countries where people spend less time online, social ties with family, friends, neighbors or close friends are relatively robust; on the contrary, in countries where people use the internet intensively, communication within the family and in social life is generally poor. The results of the regression indicate that in addition to the internet, socio-economic and socio-demographic factors are also determinants of interpersonal relationships. This study, contrary to the literature, finds that in European countries, the use of the internet weakens the ties between people and reduces the production/consumption of relational goods.



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<https://doi.org/10.30798/makuiibf.1513530>

Keywords: *Relational Goods, Internet, European Countries.*

Article Type	Application Date	Admission Date
Research Article	July 9, 2024	December 18, 2024

1. INTRODUCTION

Standard economic theory assumes that only the rational choices of individuals matter, and that their relationships with each other must be treated as a hypothesis in the models. The standard models, in order to analyze economic behavior, regard human beings as abstract rational agents who act only out of self-interest. Emotional reactions as a result of interactions such as sorrow, rage, joy, etc., and therefore subjective experiences of life are not included in the models. Yet, non-economic behaviors might cause economic outcomes. Hence, it is vital to consider not only one part of human life but also different aspects of it, including personal relationships such as friendship and companionship (Becchetti et al., 2019, pp. 377-378).

The recent integration of psychology into economics has led to a more robust analysis of economic behavior. Attempts to interpret economic behavior with the understanding of the discipline of psychology have brought acceptance that human beings can act not only out of self-interest, but also out of an intrinsic motive that does not expect anything in return. Experimental studies, particularly those based on human decisions, have found that an individual may have an innate urge to share his or her feelings. Thanks to this, social concepts built on human relationships have been included in the models.

Relational goods represent one of these social concepts that were previously regarded as extrinsic. These goods appear in relationships that are formed between two or more people. These values, which are shared in common between people, fulfill social-level needs, which are considered as one of the basic human needs in the discipline of psychology, just like eating, drinking and shelter. Meeting these needs, including a sense of love and belonging, ensures that the individual is content and achieves self-actualization (Donati, 2014, p. 31).

Relational goods entail the interaction of at least two people at the same time. This simultaneous reciprocal communication induces interdependence in the preferences of the people to be interacted with each other. The person who initiates communication may not know in advance how the other party will behave. The other party may rather prefer individual leisure activities or working instead of interacting with him or her. Therefore, there may not exist a sufficient level of production/consumption of relational goods. Today, relational goods appear to be scarce as there are many more alternatives to maintaining relationships compared to the past century. Due to the spread of technological developments to the fields of communication, the cost of maintaining interpersonal relationships face-to-face has increased and individuals prefer to spend time on the internet. Given that the opportunity cost of time allocated for socializing has increased with the massive use of the internet, the risk of people getting caught in the “relational poverty trap” has also increased (Gui, 2013, p. 297; Pugno, 2022, p. 75).

There is no denying the fact that the internet facilitates people's communication and saves time, but it is also well known that it further reduces the time spent socializing, especially in countries where individualism is an issue. For example, in Europe, where individualistic cultural values are at the

forefront, the intensive use of the internet by individuals contributes to the reduction of the number of people with whom they can share their sorrows and joys. Europe is known to lack traditional family characteristics that prevent loneliness and preserve the bonds between people. Children often live far away from their parents and family ties are not very strong. In this respect, it is clear that the harmful effects of the internet on family relations will be more pronounced in Europe. Furthermore, in Europe, where materialistic values are highly appreciated, the internet may lead to an increase in the number of people with a tendency towards materialistic values, as they are more likely to be exposed to messages encouraging materialism.

Considering the foregoing, one would expect the internet to reduce the quality and, more importantly, the level of production/consumption of relational goods in European countries. From this perspective, this study empirically investigates the impact of internet usage on relational goods in Europe. Research on internet use and relational goods is quite limited in the literature and the majority of existing studies are not empirical. There is almost no study that specifically investigates the question “What is the role of time spent on the internet on the decline of relational goods?” in the scope of European countries. Therefore, this study aims to reveal empirically whether the internet may lead to a weakening of social ties in Europe and thus accelerate the decline in relational goods.

In the second section of the study, the definition of the concept of relational goods from different perspectives is explained and the differences between public goods, private goods and social capital are mentioned so that the concept may be understood more clearly. In the third section, the relationship between internet use and relational goods is explained. In the fourth section, a literature review has been conducted. In the first part of the fifth section, information about the data set, variables and methodology used in the analysis is provided. In the second part, firstly, the indicators to be used as proxies instead of relational goods are constructed and then the findings are interpreted. In the last section, general evaluations are carried out based on the results, suggestions are made and the restrictions of the study are addressed.

2. RELATIONAL GOODS

A new theoretical tool for analyzing interpersonal relationships appears in economic studies: the concept of relational goods. Benedetto Gui (1987) and Carole Uhlaner (1989) are the first economists to introduce this concept. In subsequent years, economists have enriched the concept by considering different aspects of it. Therefore, since there is no single generally accepted definition and measurement of the concept of relational goods, the definitions of the pioneers will be presented for a clearer understanding of the concept.

Carole Uhlaner (1989) defined them as goods that “can only be ‘possessed’ by mutual agreement that they exist after appropriate joint actions have been taken by a person and non-arbitrary others.” As Uhlaner argues, the benefits of a private good or a public good such as a road or a dam hinge on the

individual's own consumption, whereas the benefits of a relational good depend on both the individual's own consumption and the consumption of others with whom he or she interacts. As an example, watching a sunset by oneself in nature is considered a public good that may be consumed individually, but the extra pleasure of enjoying a sunset with one's significant others is characterized as a relational good. Since relational goods arise as a result of joint actions at the moment of interaction, they therefore may not be conceived independently of the preferences and status of the other party. The other party must either be a particular person or a member of a particular group. Uhlaner cited social approval, solidarity, friendship, the desire to be recognized or accepted by others, the desire to be respected by others, the desire to maintain an identity and the feeling of being appreciated when fulfillment of a duty or moral norm of the examples of relational goods (Uhlaner, 1989, pp. 253-255).

Benedetto Gui (1996, p. 270) defined relational goods as “intangible capital assets that inhere in enduring interpersonal relationships and provide both intrinsic and instrumental benefits.” Gui (2005) defines forms of communication as a specific production process, which he calls “economic encounters.” Gui cites the interactions between an employer and an employee, two customers in the same store, a tenant and a landlord, two coworkers at work, a patient and a doctor as examples of economic encounters. In these encounters, relational goods are produced in addition to economic outputs such as the transfer of property rights, the performance of a task or the provision of a service. For example, when an elderly person goes to a neighborhood market, it may be seen as if he or she just buys fruits and vegetables or gets information about new products, but he or she also gets other economic outputs. He or she also gets an additional output (relational goods) that makes him or her satisfied by chatting with the sellers and other shoppers in the market (Gui, 2005, pp. 32-37).

Gui (2013) argues that the benefits arising from relationships fulfill the necessary criteria to be characterized as “goods.” Today, relationships may be sustainable by sacrificing alternative goods or activities. For example, an individual may prefer to spend his/her free time on the internet or social media rather than with family or friends. Maintaining friendship and family relationships will require time. In this respect, relational goods involve an opportunity cost. At the same time, relational goods, as mentioned before, satisfy the need for socialization. Yet, even if the individual is willing to pay for the effort and time devoted to a relationship, especially the human resources of the other party, there may not be sufficient supply. This is because the basic composition of a relationship is mutual positive emotions and it is not possible to purchase these emotions with money.

Influenced by Gui's studies, economist Robert Sugden (2005) defined relational goods as “the affective and communicative components of interpersonal relations.” Sugden explained the production process of a relational good based on the concept of Adam Smith's fellow-feeling. Fellow-feeling refers to the capability to share someone else's emotion, whether it is pleasurable or painful, and to put oneself in his/her shoes in terms of emotion or thought. Considering this, Sugden suggested that an individual may benefit from relational goods by realizing that positive emotions during interaction tend to be

reciprocal. To illustrate, if a paid caregiver who provides personal care services to a patient approaches the patient in a friendly manner and the patient recognizes and responds to this positive feeling, fellow-feeling emerges (Sugden, 2005, pp. 66-69).

Many studies with a rich theoretical background (see Becchetti & Santoro, 2007; Becchetti et al., 2011; Becchetti & Pelloni 2013; Becchetti et al., 2019; Becchetti et al., 2022) have highlighted a distinctive aspect of relational goods. These goods are labeled as a type of good, the use of which may neither be excluded nor competition arises between interacting parties. This implies that since relational goods are produced/consumed in reciprocal relationships by their very nature, there will be no need for the parties to compete with each other in accessing such goods. Since the existence of these goods depends entirely on the joint actions of the interactants, it will not be possible to deprive the parties of this good at the time of communication. The studies underlined that relational goods may be classified as a subcategory of local public goods since their existence is restricted to those who are in communication.

Relational goods may be confused with the concept of social capital as they hold a similar meaning. However, although they have similar characteristics in terms of abstractness, there are some differences between them. Social capital, despite the existence of different definitions, refers to a set of relationships between people based on trust, co-operation and respect. Relational goods on the other hand represent benefits that are shared through these relationships and fulfil socio-emotional needs such as belonging, social approval, attention and affection. From this perspective, the production/consumption of relational goods heavily hinges on the existence of social capital (Robinson et al., 2020, p. 1290). In addition, as Antoci et al (2007) argue, when social capital refers to permanent and strong ties established through social participation, relational goods may accompany the accumulation of social capital as a by-product. For example, strong ties between individuals are established through repeated communication that is fueled by a certain emotion such as caring, fellowship, admiration, etc.

Defining separate indicators for these interconnected and intertwined concepts may be quite challenging. Following Putnam (2000), social capital indicators may be categorized under four main headings: membership in organizations, trust proxies, level of interaction with networks in the immediate environment and participation in group activities. Relational goods and social capital have a bidirectional relationship that feeds each other, hence, networks in the close environment such as family, relatives, friends and participation in activities and events serve as indicators of relational goods (Sabatini, 2009; Sarracino, 2012). These indicators, as seen in Table 1, represent a measure of the networks dimension of social capital, which is called relational capital.

Table 1. Indicators of Relational Goods: Relational Capital

Macro	Micro		
Ethno-linguistic fractionalization	Political participation	Relational Capital	Structural
Contract enforcement	Individual social support		
Quality of government/bureaucracy	Kinship connections		
Corruption and rule of law	Friendship connections		
Political Stability and liberty	Associational activity		
Cooperative culture	Volunteering and Reciprocity		
Cross country measures of trust	Quality of social/family relations		Cognitive
Social norms	Trust in community/neighbors		
Beliefs			

Source: (Bruni et al., 2019, p. 3329).

3. RELATIONAL GOODS AND THE INTERNET

Today, people widely use the internet for various purposes such as working, chatting, researching, watching films, shopping, playing games, making appointments. The penetration of the internet into all areas of life has caused people to modify the way they learn, work and communicate. Most people now communicate with each other via instant messaging, e-mail or social networks instead of face-to-face communication. This increasingly prevalent form of communication has occupied an important place in our daily lives. This is mainly owing to the fact that the internet is remarkably cheap and accessible at any time of the day (Stanca, 2016, pp. 467-469).

Virtual communication, like relational goods, is a type of communication that is carried out reciprocally with one or more persons. The person himself or herself often determines with whom he or she interacts. However, one can use the internet to communicate with family, friends, neighbors and relatives, as well as with an unknown person. In an online interaction with a stranger, it is not always easy to perceive the feelings and sensitivity of the other party, so online conversations are more prone to disagreements and misunderstandings. Facial interactions, on the other hand, allow a person to better express his/her ideas, opinions and feelings. It allows one to better understand the gestures and facial expressions of the person with whom he or she is interacting (Sabatini & Sarracino, 2019, p. 249). From this point of view, the communication established in the virtual environment has a content that is not sincere, natural and genuine. Due to its remote structure, it lacks a deep level of sharing as it is based on artificial participation and the level of satisfaction of the parties involved is low. Thus, virtual communication, which is easily and quickly carried out, may be characterized as “pseudo-relational goods” that undermine the value and quality of relational goods (Bruni, 2012, p. 123).

The internet has partly favored the production/consumption of relational goods, which are quite costly to access in terms of time and effort, while increasing the opportunity cost of time devoted to real relationships. The internet allows people to communicate with each other without committing to time

and location; however, it has also brought with it a number of limitations. Intensive use of the internet has a close link with the decline in active participation in social life. All kinds of transactions such as purchasing, banking and education may be carried out online via the internet. This saving of time has led to a decline in people's face-to-face interactions and social relations. To put it differently, the time allocated for face-to-face meetings with family, friends and colleagues diminishes as the number of online activities and the time allocated for these activities increases (Stanca, 2016, p. 475; Bauernschuster et al., 2014, pp. 74-75). Notably, the internet eases people's access to contacts located in the distant environment, while reducing the quality of those relationships located in the close environment. The internet, in this sense, shifts the proportion of strong and weak ties in society through the emergence of virtual relationships and may result in a decline in the emotional support provided by strong ties. This in turn may lead to low levels of relational goods.

The internet has deeply affected the relationships such as friends, relatives, neighbors and especially family relationships, which represent strong ties. The dimensions in which the internet affects family communication the most appear to be the time spent with the family, the relationships between spouses and the parent-child relationship. Intensive use of the internet causes family members to spend lesser amounts of time together and reduces the frequency and intimacy of their communication. Family members now mostly spend time on social networking sites. This may encourage spouses to communicate with other people virtually. As a consequence, there may be trust problems between the spouses, disputes may occur in the family and most importantly, divorces may also be experienced. The internet is used by young people mostly for chatting or gaming purposes. Parents' expectations would probably contradict with such usage. This is because parents expect their children to connect to the internet at home for educational purposes. This leads to increased conflicts between parents and children (Mesch, 2006, pp. 121-122).

The most prominent reason why the internet causes communication breakdowns in family and social life may be seen as the fact that it creates various addictions, as these addictions eventually result in people becoming isolated from society. Due to the widespread use of the internet as well as the conveniences it provides, the time spent on online applications increases and many people become addicted to screens without even being aware of it. In the internet environment where there is a huge amount of entertainment and game content, the individual may turn to a very different use than he or she planned and becomes unable to control his/her online behaviours. When he or she fails to connect to the internet, he or she feels extremely irritable, tense and restless. He or she experiences family and social unrest and his/her relationships gradually diminish. As a result, they become distant from their immediate social environment and become trapped in a virtual world as time passes. Such addiction may result in various disorders such as long-term distraction, inability to remember past events, complex thinking, insecurity, anxiety and depression. Thus, this leads to loneliness and a socially isolated life (Pugno, 2022, pp. 74-75).

4. LITERATURE REVIEW

Recently, the number of empirical studies on relational goods has been increasing significantly in the literature. The majority of these studies investigate the impact of relational goods on happiness. Only a few studies have empirically examined how factors commonly observed in developed countries such as the internet, television, high income, and the desire to possess materialistic goods affect the relational goods. These studies can be summarized as follows.

Bruni & Stanca (2008) studied how time spent watching television influences the consumption of relational goods using data from the World Values Survey (WVS) covering the period between 1990 and 2004. Using the instrumental variable method (2SLS), they have concluded that there is a negative and strong correlation between time spent watching television and the consumption of relational goods. Accordingly, individuals who spend more than 2 hours a day watching television consume less relational goods. The time spent watching television had a crowding-out effect on the relational goods. Stanca (2009) also analyzed the relationship between high income and relational goods using the first five waves of the World Values Survey (WVS) (1981-2009). An index measuring the quality of social life was created as an indicator for the relational goods. OLS estimation revealed that there is a strong and positive correlation between high income and quality of social life. Therefore, individuals having a high standard of living also have a high quality of social life and consume more relational goods.

Using the first 3 rounds of the European Social Survey (ESS) dataset for 21 European countries (2002, 2004, 2006), Bünger (2010) examined the relational goods through the question of “How often socially meet with friends, relatives or colleagues?”. With both OLS and the ordered logistic regression method, it was concluded that household income and social status positively affect leisure time spent for socializing, while leisure time spent for watching television negatively affects the leisure time spent for socializing. In the study, it was observed that individuals in European countries spend more time for socializing when their social status and income level increase. Becchetti et al. (2011) also explored whether high-income individuals consume relational goods with the fourth wave of the World Values Survey (WVS). They created an index representing the relational goods by using the question “How often do you spend time with the people around you?”. With the ordered logit model, it was concluded that higher income level has a negative effect on the time spent on social relations, that is, the consumption of relational goods decreases as the income level increases.

Colombo & Stanca (2014) attempted to determine the price of relational goods within the hedonic approach using the Aspects of Daily Life Survey dataset covering the period 2001-2010. OLS estimation revealed that a one-unit increase in the frequency of meeting with friends is worth an extra €1150 per year in terms of foregone income and higher housing costs. In other words, a certain financial burden has to be incurred in order to live in cities like Italy where more time is spent with friends. Colombo et al. (2018) examined the relationship between the relational goods and macroeconomic conditions with the 2015 data of the Italian Household Survey conducted on 50,000 individuals. Using

the OLS regression method, the researchers concluded that the deteriorating macroeconomic conditions have a negative impact on socializing with friends, participating in social events and volunteering. Accordingly, the consumption/production of the relational goods decreases during the recession period.

Rasciute et al. (2017) also studied the effect of watching television on participation in social activities among young and elderly adults using the first wave (2005) of the Taking Part Survey dataset on 28,117 individuals in the UK. Using the ordered probit model, the researchers found that elderly adults prefer watching television rather than participating in social activities. This indicates that watching television can be a substitute for the relational goods. Schmiedeberg & Schröder (2017) explored the impact of watching television and using the internet on other leisure activities with the waves 1, 3, and 5 of the German Family Panel. As a result of the fixed effects regression estimation, it was concluded that using the internet and watching television for more than 3 hours a day negatively affects life satisfaction. This negative effect is due to the crowding-out of other leisure activities (meeting with friends, doing sports, and going on vacation) through the excessive use of television and internet.

Barbosa Neves et al. (2018), who analyzed the relationship between the use of the Internet and relational capital and how this relationship differs by age, used the survey data of 417 adults aged 18 and over living in Lisbon, Portugal. They analyzed the data using the Latent Class Modeling and logistic regressions. The findings suggested that elderly adults were less likely to have high levels of social capital; however, in this age group, frequent Internet users were reported to have higher levels of social capital than infrequent users or non-users. Kwilinski et al. (2020) investigated the impact of the level of digitalization on the risks of poverty and social exclusion in the member states of the European Union using The Digital Economy and Society Index and the indicator “People at risk of poverty or social exclusion” calculated by the European Commission in 2019. Using the Monte Carlo method and correlation analysis, it was concluded that EU countries with higher levels of digitalization have a lower percentage of population at risk of poverty and social exclusion. Sarracino & Piekalkiewicz (2021) also explored the changes in the level of the relational capital during the economic downturns in European countries. For this purpose, they analyzed the European Social Survey dataset for the period 2006-2012 with a Blinder-Oaxaca decomposition and regression analysis with interaction effects. The results of the analysis revealed that the relational capital tends to drop during economic downturns when financial concerns are at the forefront.

Carlsen et al. (2021) researched the role of using social media in offering social support during the COVID-19 pandemic with the survey data they performed on individuals between the ages of 16-99 in Denmark in 2020. The study revealed that the use of social media during the pandemic strengthened social networks and was effective in meeting the changing needs of vulnerable citizens. Kharisma (2022) analyzed the fifth wave of the Indonesian Family Life Survey (IFLS) with the instrumental variable (IV) method to determine the impact of internet access on the relational capital in Indonesia. Findings showed

that the use of the Internet strengthens the relational capital, particularly for men with strong internal cohesion and neighborhood relationships built on mutual trust. Albuquerque & Fontainha (2023) analyzed the differences in social exclusion between wage earners aged 49-58 and pensioners aged 65-74 in European countries using the European Social Survey data from 2002 and 2018. In the study, it was concluded that individuals switching from being wage-earners to retirees are more affected by social exclusion, and therefore, participation in the labor market has a role in protecting individuals against social exclusion.

Becchetti et al. (2024) addressed the difference between the relational goods and high income in determining life satisfaction in European countries with the data from the European Social Survey (ESS) for 2012 and 2016 and the European Statistics on Income and Living Conditions Survey (EU-SILC) for 2018. The questions “How often do you meet socially with friends, family or colleagues?” in the ESS and “How long in the last 4 weeks have you felt alone?” in the EU-SILC were used as indicators for the relational goods. Using OLS and 2SLS regression methods, they concluded that a change from the lowest to the highest level of relational life has an impact three times larger than the change from the lowest to the highest income decile. Chung et al. (2024) examined the impact of internet use on relational capital using data from the World Values Survey, which includes more than 120 countries, for the period 1990-2020. By applying a two-way fixed-effect panel analysis and logit regression method, they reported that there is a statistically significant and positive relationship between the internet and relational capital, and this relationship is particularly significant for social trust. This suggests that the Internet strengthens the relational capital between individuals.

5. EMPIRICAL ANALYSIS

The analysis has been performed in two steps in order to investigate how spending time online affects shared values in relationships. In the first step, indicators have been created as proxy variables for relational goods. In the second step, the relationship between internet usage time and relational goods has been discussed.

5.1. Data Set and Variables

The analyses have been performed in 29 European countries using Round 10-2020 data compiled within the framework of the European Social Survey (ESS). Conducted in Europe since 2001, the ESS aims to comparatively investigate the behavioral patterns, beliefs and values of different populations. The survey is implemented every 2 years in more than 30 European countries through a common questionnaire. The ESS, which is conducted online or face-to-face interviews with individuals aged 15 and over, consists of ten rounds and the last round has been completed between 2020-2022 with approximately 59000 participants.

Round 10 countries can be listed as follows: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania,

Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Table 2. Descriptions of Variables

Variable Group	Variables	Descriptions
Relational Goods	How many people with whom you can discuss intimate and personal matters	Likert Scale, 6 categories: 1. One, 2. Two, 3. Three, 4. Four-Six, 5. Seven-Nine, 6. Ten or more
	Take part in social activities compared to others of same age	Likert Scale, 5 categories: 1. Much less than most, 2. Less than most, 3. About the same, 4. More than most, 5. Much more than most
	How often socially meet with friends, relatives or colleagues	Likert Scale, 7 categories: 1. Never, 2. Less than once a month, 3. Once a month, 4. Several times a month, 5. Once a week, 6. Several times a week, 7. Everyday
	Parent lives in same household	Binary, 2 categories, 1. Yes, 2. No
	How close to parent	Likert Scale, 5 categories: 1. Extremely close, 2. Very close, 3. Quite close, 4. Not very close, 5. Not at all close
	Speak with parent in person, how often	Likert Scale, 6 categories: 1. Several times a day, 2. Once a day, 3. Several times a week, 4. Several times a month, 5. Once a month, 6. Less often, 7. Never
Internet	Internet use, how much time on a typical day, in minutes	Numerical variable
Socio-economic and Socio-demographic Variables	Age	Numerical variable
	Gender	Dummy variable: Female, Male
	Main activity, last 7 days.	Dummy variable: Employed, Retired, Housewife, other
	Education	Dummy variable: Primary, Secondary, High, University
	Years of education	Numerical variable
	Income	10 Steps Cantril Ladder
Covid-19	Respondent had Covid-19	Dummy variable: Yes, No

The desire to maintain an identity, a sense of fellowship, the desire to be recognized or accepted by others, which Uhlaner (1989) exemplifies as relational goods, fulfill emotional needs. In order to fulfill these needs, one must be in a mutual relationship. As the frequency of meeting with the social environment, the frequency of participation in social activities and the number of people with whom personal issues can be talked about increases, individuals' interactions increase and they can benefit from relational goods more. Smith's concept of fellow-feeling suggests that the more time spent with the family, the greater the value of shared emotions since family members have a high sense of fellow-feeling as they know each other well. Those who are close to their family, live in the same house as their family and talk to them frequently have intense shared emotions and the quality of relational goods is

relatively high. In this context, the first six variables in Table 2 may be utilized as proxy variables instead of relational goods.

5.2. Method

The variables selected as proxies for relational goods are response variables possessing ordered categories. Categorical principal component analysis (CATPCA) has been employed to quantify and transform the selected categorical variables into a smaller number of new variables.

The purpose of principal component analysis (PCA) is to obtain the linear components of m variables and then to narrow them down to a smaller number of uncorrelated summary variables (principal components) that represent the information in these variables as accurately as possible. In PCA, it is often asserted that the relationships between variables are linear and all variables are assumed to be on a numerical scale so that the final output may be properly interpreted. These assumptions are generally invalid in social sciences and PCA may not always represent the most appropriate analysis method in this case. To circumvent these limitations, the CATPCA method, which has the same purpose as PCA and referred to as nonlinear PCA, has been developed (Linting et al., 2007, p. 336).

CATPCA is a convenient method for analyzing data sets containing variables of different scales (nominal, ordinal or numeric) that may be related to each other in a non-linear way. In this method, the categories of variables are assigned numerical values through a process called optimal scaling (optimal quantification/optimal scoring). During the optimal scaling process, the categories of the original variables are replaced with numerical values in such a way as to minimize the loss of information in the variables. This transformation is performed employing an algorithm that converges to a stationary point where the optimal quantifications of the categories do not change anymore (Meulman et al., 2004, p. 50; Linting et al., 2007, p. 337). To put it differently, optimal scaling, which is the basis of nonlinear PCA, refers to the process of repeating iterations until the loss function including category scores and the unknown object is minimized. Due to the minimum loss, the relationships between categories and variables in the real space are represented in a lower dimensional space. Therefore, CATPCA offers several advantages over PCA in analyzing categorical variables, including fewer limitations and a higher ratio of explained variance (Demir et al., 2021, pp. 444-449).

5.3. Results

5.3.1. The Relational Goods Indicator

The six variables considered to be indicators of relational goods have been subjected to categorical principal components analysis and narrowed down to two dimensions.

Table 3. Model Summary of CATPCA

Dimension	Cronbach's Alpha	Variance Accounted For (VAF)	
		Total Eigenvalue	Variance Percentage
1	0.741	2.613	43.550
2	0.572	1.911	31.850
Total	0.935	4.524	75.400

The variance accounted for and Cronbach's Alpha value of each dimension are reported in Table 3. The VAF, which is considered as the main criterion for variable selection, is represented by eigenvalues in principal component analysis, and the VAF of a component is calculated by dividing its eigenvalue by the number of analysis variables. Eigenvalues may be used as an indicator of how many dimensions are required. In the model, the eigenvalue of the first dimension is 2.613 and the eigenvalue of the second dimension is 1.911. The VAF of the eigenvalues are 43.550% and 31.850% respectively. It is seen that the total variance with the two dimensions is 75.400%. This rate points to a reasonable fit. In the literature, an explanation rate of 67% is generally considered to be adequate. However, this is not a widely accepted rule. The total Cronbach's Alpha coefficient, which is a measure of reliability, has been calculated as 0.935 in the model. This value indicates that the fit of the model is high. A threshold value of 0.7 is generally considered to be an adequate lower limit (Lopes & Calapez, 2012, p. 94).

Figure 1. Relational Goods Indicators in Two-dimensional Space

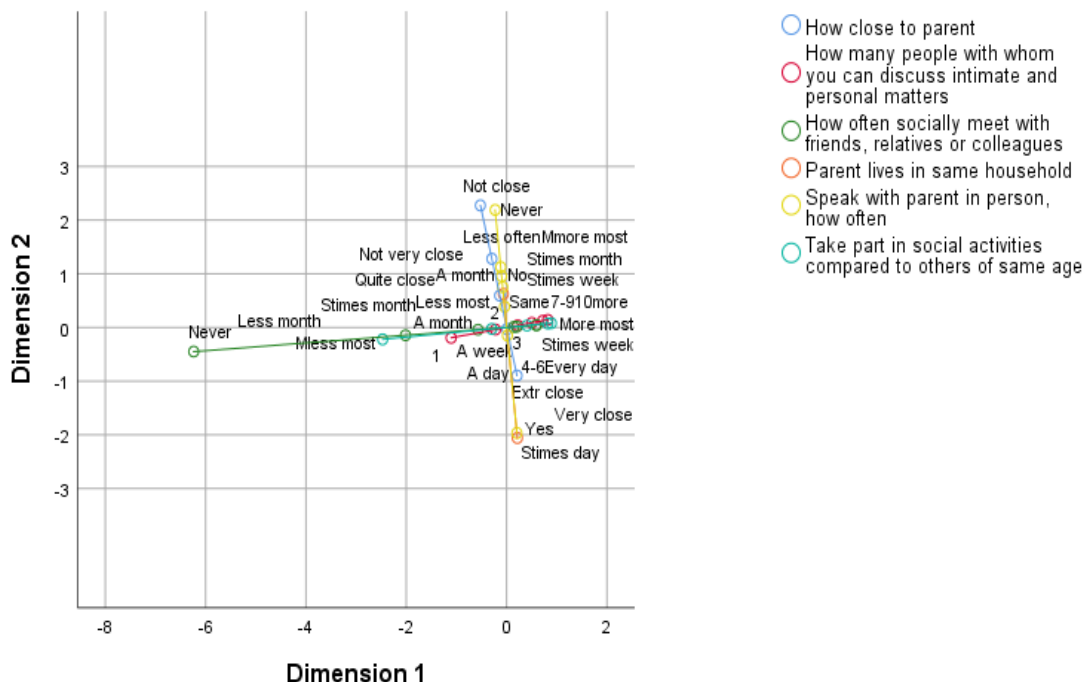


Figure 1 reveals a strong relationship between the frequency of family contact and the variables of being close to the family and living in the same month house with the family in both dimensions. There is a positive relationship between the “several times a day” category of the frequency of talking to the family variable and the “yes” category of the living in the same house with the family variable, and between

the “not at all close” category of the being close to the family variable and the “never” category of the frequency of talking to the family variable. This suggests that people who live in the same house with their families have a high frequency of talking to them; however, people who do not have close relationships with their families tend not to communicate with them. It is evident that the variables of frequency of meeting with social circle, frequency of participation in social activities and the number of people with whom one has close relationships are also correlated with each other. The “never” category of the frequency of meeting with the social circle is negatively related to the “10 or more” category of the number of people with whom one has close relationships; and the “much less than most” category of the frequency of participation in social activities is negatively related to the “everyday” category of the frequency of meeting with the social circle. This relationship indicates that those who have no contact with family, relatives, neighbors, friends and other people around them have fewer people with whom they have close relationships, whereas those who meet socially with others everyday are more likely to participate in social activities compared to their peers.

According to the first dimension in Figure 1, the categories “never” and “less than once a month” of the variable of frequency of meeting with the social environment, the categories “much less than most” and “less than most” of the variable of frequency of participation in social activities and the category “1” of the variable of number of people with whom one has close relationships are positively related. Similarly, the “no” category of the variable of living in the same house with the family, the “not at all close”, “not very close” and “quite close” categories of the variable of being close to the family, and the “never”, “less often” and “once a month” categories of the variable of frequency of talking to the family are positively related to the first dimension. It is known that categories that are distant from the origin have a high impact on the formation of the dimension. It has been observed that the categories that contribute the most to the first dimension are the “never” category of the frequency of meeting with the social environment and the “much less than most” category of the frequency of participation in social activities.

According to the second dimension, a positive relationship was found between the “several times a day” and “once a day” categories of the frequency of talking to the family, the “extremely close” and “very close” categories of being close to the family, and the “yes” category of living in the same house with the family. There is also a positive relationship between the “10 or more”, “7-9” and “4-6” categories of the variable of the number of people with whom the respondent has close relationships and the “every day” and “once a week” categories of the variable of the frequency of meeting with the social environment. The categories with the highest effect for the second dimension are the “yes” category of living in the same house with the family and the “several times a day” category of the frequency of talking to the family.

Table 4. Correlations Between Variables According to Dimensions of Relational Goods (Component Loadings)

	Dimension	
	1	2
How many people with whom you can discuss intimate and personal matters	0.572	0.100
Take part in social activities compared to others of same age	0.976	0.087
How often socially meet with friends, relatives or colleagues	1.140	0.082
Parent lives in same household	-0.089	0.855
How close to parent	-0.129	0.559
Speak with parent in person, how often	-0.096	0.918

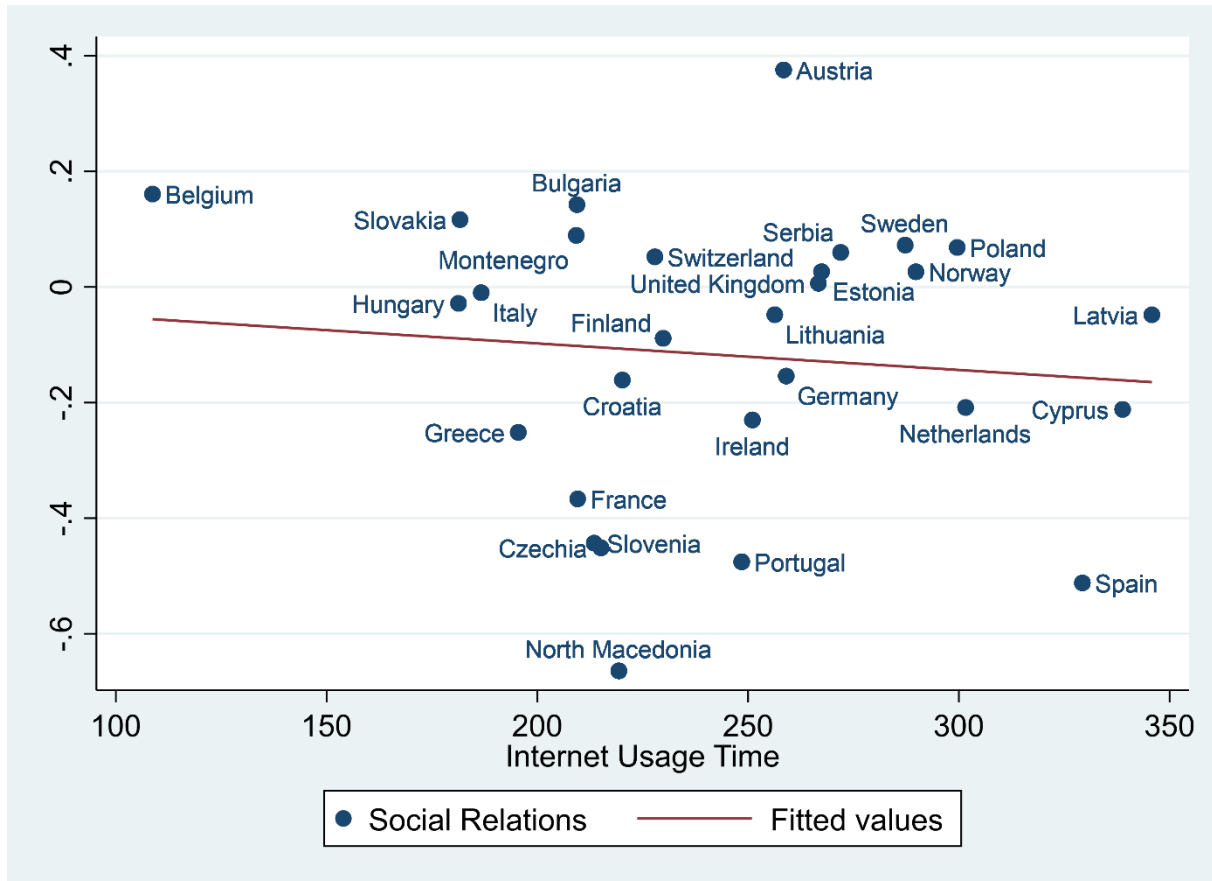
Table 4 presents the classification of the six variables according to the components of relational goods. Component loadings represent the correlations between the quantified variables and the principal components. The signs of the component loadings denote the close and positive or close and negative relationship of the variables with each component. (Saukani & Ismail, 2019, p. 642). Based on this, it appears that the variable with the highest load value in the first dimension is the frequency of meeting with the social environment with a load value of 1.140. This variable is followed by the frequency of participation in social activities with a load value of 0.976 and the number of people in close relationships with 0.572. These three variables constitute the dominant variables that have a high impact on determining the first dimension. Other variables contribute very little to the dimension. Therefore, the first dimension may be called “social relations.”

In the second dimension, the variable of frequency of talking to the family has the highest load value with 0.918. The variable of living in the same house with the family has the second highest load value with 0.855 and the variable of being close to the family has the third highest load value with 0.559. The loadings of the other variables seem to be quite low. Therefore, the variables that have the highest contribution in shaping the second dimension are the three variables related to family with the highest loadings. Therefore, the second dimension may be named as “family relations.”

5.3.2. Relational Goods and the Internet: European Countries

The relationship between relational goods and time spent on the internet by recording the score values of the dimensions obtained with CATPCA has been analyzed in the context of European countries with the help of the figure.

Figure 2. The Relationship between Social Relations and Internet Usage Time in European Countries

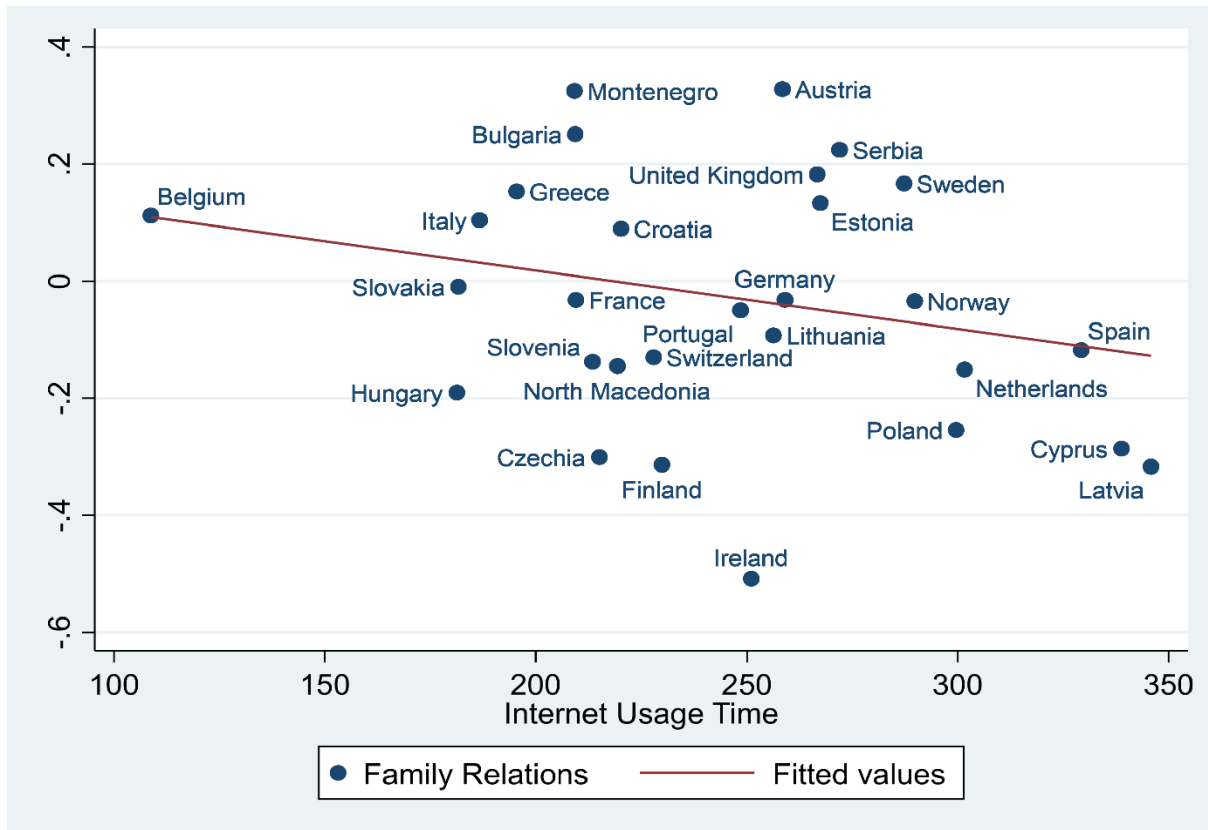


Note: OLS: Social Relations= 0.059[-1.22] – 0.00046[-23.86] Internet Usage Time. Observation = 57474, R-square= 0.0089 ve Prob >F =0.0000. Internet usage time is significant at the 0.01 level.

Figure 2 illustrates a negative correlation between time spent online and social relations in European countries. In general, social relations seem to be weaker in countries where internet usage time is high, and on the contrary, sharing, solidarity and interpersonal ties are stronger in countries where internet usage time is low. In Belgium, where the average daily internet usage time is considerably lower than in other countries in Europe, the frequency with which people meet socially appears to be higher and the network of social relations is wider. On the other hand, in Spain, where the average daily internet usage time is more than 300 minutes, the time spent in the social environment is low and communication is weak. Excess of 5 hours of internet usage time indicates that in Spain, more time is spent in front of online applications than planned. A striking result in the figure is that social relations are quite weak in North Macedonia. This result could mean that in North Macedonia, where people connect to the internet more frequently than in Greece, Italy, Hungary, Slovakia, Montenegro, people have a high opportunity cost for time spent socializing and value spending time individually more. Figure 2 illustrates that individuals in France, Czechia, Slovenia and Portugal do not spend enough time together socially, such as attending events, going on vacation, playing sports, chatting, etc. Compared to other European countries, the average duration of internet use in these countries stands at 3.5-4 hours. However, this duration is above the world average (2 hours 23 minutes). Based on these figures, one may say that the

internet has a negative impact on social relations in these countries. Another remarkable result is that despite the high average daily time spent on the internet in Austria, relationships between friends, family, neighbors and relatives are strong. The widespread use of the internet in Austria has not led to a decline in social relations. Overall, it may be concluded that the production/consumption level of relational goods decreases as the time spent in front of screens increases with the use of the internet in European countries.

Figure 3. The Relationship Between Family Relations and Internet Usage Time in European Countries



Note: OLS: Family Relations=0.218[69.07] – 0.001[-79.45] Internet Usage Time. Observation = 57474, R-square = 0.0564 ve Prob >F =0.0000. Internet usage time is significant at the 0.01 level.

Figure 3 demonstrates that family relations weaken as internet usage time increases in European countries. In Latvia, which has the highest daily internet usage time of approximately 350 minutes, communication within the family is very limited and the level of closeness, satisfaction and participation in relationships between family members is low. It may be stated that people in Latvia, who spend an average of 6 hours on the internet daily, spend a large part of their time on the internet outside of sleep and work. This situation, which is also characterized as addiction, may diminish the areas of common sharing between the family and reduce or completely destroy the quality of relationships. Similar to the relationship in Figure 2, ties between family members are strong in Belgium, where the daily time spent online is the lowest (1.5 hours on average). It is understood that individuals in this country prefer to spend time in the family environment rather than in the virtual world, do not have a life intertwined with

social media and have close family ties. In Montenegro and Bulgaria, where internet usage is average, most people have close relationships with their families and see and talk to family members frequently. Good family relations have also been observed in Austria, Serbia, Sweden, the United Kingdom and Estonia, where the internet is used more intensively than in these countries. It is observed that the average daily internet usage time of 4.5-5 hours in these countries does not negatively affect the time spent with the family and thus communication within the family. Among the countries where family ties are quite weak, Ireland stands out. In Ireland, people spend an average of 4 hours on the internet per day. The figure shows that this figure is higher than the European average. It may be said that in this country, the internet leads to a serious communication gap between family members, which in turn leads to family unrest. People in the Netherlands, Poland, Cyprus and Spain, where internet use is more intensive than in other European countries, do not maintain healthy family relations. In these countries, spending too much time in virtual environments decreases the communication between the individual and his/her family and distances him/her from his/her family. Broadly speaking, as shown in Figure 3, the increase in internet usage time in European countries leads to a decrease in time spent with the family and a weakening of family relations. Therefore, the production/consumption of relational goods in Europe is decreasing day by day.

The impact of internet use as well as socio-economic and socio-demographic variables on relational goods was also investigated. The scores of the dimensions obtained by applying the CATPCA method were transformed into categorical variables grouped into 5 ordinal options for this purpose. Both OLS and ordered logistic regression were used as estimation methods and the results are reported in Table 5.

Table 5. Regression Estimation Results

Variables	Social Relations Dimension		Family Relations Dimension	
	Logit	OLS	Logit	OLS
Age	-0.002*** (0.001)	-0.002*** (0.001)	-0.000 (0.001)	-0.000 (0.001)
Female	-0.017 (0.021)	-0.013 (0.016)	-0.062*** (0.021)	-0.049*** (0.017)
Employed	0.065** (0.032)	0.051** (0.025)	-0.028 (0.032)	-0.023 (0.026)
Retired	0.172*** (0.047)	0.137*** (0.037)	-0.026 (0.047)	-0.021 (0.038)
Housewife	0.127** (0.052)	0.101** (0.041)	-0.057 (0.053)	-0.046 (0.042)
Years of education	-0.004 (0.003)	-0.003 (0.002)	-0.007** (0.003)	-0.006** (0.003)

(Table 5 cont.)

Secondary school	0.354*** (0.073)	0.272*** (0.058)	0.063 (0.071)	0.053 (0.056)
High school	0.368*** (0.068)	0.284** (0.054)	0.100 (0.066)	0.083 (0.052)
University	0.388*** (0.073)	0.300*** (0.058)	0.153** (0.071)	0.125** (0.056)
Internet usage time	-0.000** (0.000)	-0.000** (0.000)	-0.000* (0.000)	-0.000** (0.000)
Income	0.009** (0.004)	0.007** (0.003)	0.004 (0.004)	0.003 (0.003)
Covid-19	0.029 (0.023)	0.023 (0.019)	-0.027 (0.023)	-0.022 (0.019)
cut1	-1.101*** (0.085)		-1.410*** (0.083)	
cut2	-0.110 (0.085)		-0.465*** (0.083)	
cut3	0.712*** (0.085)		0.358*** (0.083)	
cut4	1.724*** (0.085)		1.339*** (0.083)	
Constant		2.768*** (0.067)		3.035*** (0.065)
Observation	31,045	31,045	31,045	31,045
R-squared		0.002		0.001
Pseudo R-squared	0.000612		0.000245	
Prob > chi2	1.38e-08		0.0176	
Prob > F		3.29e-08		0.0161

Note: Level of significance: *** p<0.01, ** p<0.05, * p<0.1. Figures in brackets refer to standard errors.

In Table 5, we observe a negative relationship between age and social relations. This relationship indicates that when an individual gets older by one year, his/her relationships with social contacts deteriorate. The coefficient of the female variable for social ties is not significant. There is no significant difference between men and women in terms of establishing social ties. Regarding employment status, it is observed that employed, retired and housewives have good social ties. In comparison to the unemployed, these individuals have a higher frequency of social contacts with acquaintances. Those who have completed secondary school, high school and university education have stronger communication with their environment and therefore have better relationships than those who have graduated from primary school. Therefore, we can state that the higher the level of education, the better social relations the individual has with the people around him/her. According to the total net income of

the household, it is seen that those who are ranked one level higher have better social relations. It is understood that increasing income contributes to social relations. It is expected that the social networks of those who have undergone Covid-19 in the immediate or distant environment will weaken, but there are no significant differences with those who have not undergone Covid-19. As expected, internet usage time negatively affects social relations.

The findings on family relations suggest that men have better relationships with their family members than women. Regarding the results for the age variable, it may be observed that the effect of one-year older age on family relations is not statistically significant. Similarly, no significant relationship has been found between income and family relations. It is also observed that there are no significant differences between the unemployed and the employed, retired and housewives in terms of family relations. In comparison to those who have graduated from primary school, only those who have completed university level education have better relations with their parents, spouse or children. Completion of secondary and high school education is not found to be statistically significant for strong family ties. The impact of Covid-19 on family relations is not observed to be statistically significantly different between those who have had the disease and those who have not. As in social relations, internet use has a negative impact on family relations.

6. CONCLUSION

Recently, a growing number of researchers have been studying the social concept called relational goods as a result of behavioral approaches in economics. Relational goods, which may also be defined as the benefits that people derive from their relationships with each other, are created by positive relationships established over time. However, the time and effort devoted to relationships nowadays has decreased considerably. Most people now spend most of their time on the internet. Especially in European countries, the internet is used regularly every day. According to Eurostat data, 86% of people between the ages of 16 and 74 use the internet every day in 2023. It is known that in Europe, where the internet is used intensively, there is a proliferation of people who isolate themselves from their social environment. This study empirically investigates this negative situation with the data of the 10th Round of the European Social Survey covering the period 2020-2022.

In this study, firstly, proxy variables were created instead of relational goods using categorical principal components analysis (CATPCA). The first variable transformed as a result of the quantification of the selected categorical variables has been coded as “social relations” and the second variable as “family relations.” Studies in the literature have either directly used the variables selected as indicators of relational goods in the analyses or reduced them to fewer components by subjecting them to principal component analysis. There are very few studies using CATPCA method (see Lopes & Calapez, 2011; Lopes & Calapez, 2012; Saukani & Ismail, 2019). In this study, new indicators for relational goods have been created by applying CATPCA method with an up-to-date data set.

In the study, the relationship between the internet use in Europe and the indicators of relational goods is analyzed with the help of figures. It is concluded that in the European countries where the average daily internet use time is quite low, people meet with each other more frequently and, consequently, have stronger social bonds. On the other hand, in countries where daily internet use exceeds 5 hours, the time spent with family, friends, relatives or close acquaintances is less and communication is limited. According to Bartolini (2019), nowadays, individuals prefer activities that they can do alone, such as using social media and watching television, instead of building social relationships with others. Such preferences of individuals depend on the quality of their relationships with each other. Particularly in the developed world, the increasing pursuit of individual success and interpersonal competition, along with materialism, wear down the shared values and social norms, leading individuals to spend time on the internet and thus to loneliness. Pugno (2009) emphasized that the materialistic tendencies which increase internet use cause individuals to have difficulty in establishing close relationships with their families, relatives, friends and other people around them, or the close relationships they establish are problematic and short-lived. According to Becchetti & Santoro (2007), individuals tend to purchase products with higher materialistic value in order to protect themselves from this process of isolation and increase the time they dedicate to work in order to meet their increased desire for consumption. Therefore, even though the income level is higher in the developed countries, the time devoted to the production/consumption of the relational goods decreases.

The findings obtained with the help of the figure show that in the European countries where living standards are higher, the Internet has a negative impact on both family relations and social relations as it causes communication gaps between individuals. It might be said that the internet has increased the number of people who are estranged from their families and social circles in Europe. In fact, during the Covid-19 period, the internet was expected to facilitate the communication of people who could not meet face to face and strengthen the bond between them. On the contrary, the results suggest that the increase in internet use during this period weakened the bonds between people. The study demonstrated that the production/consumption level of relational goods decreased as the time spent on the internet increased. According to Bruni (2016), since it is easy and quick to access, the internet replaces face-to-face communication in the real world and creates a virtual environment, virtual communication and virtual relationships. The researcher argued that the internet, which he also referred to as pseudo-relational goods, prevents individuals from communicating with others in real life and participating in social activities in societies with advanced communication technology. Pugno (2013) also demonstrated that the replacements of relational goods, which Scitovsky (1976) defined as comfort goods, have become increasingly widespread in rich countries due to technological developments and that people tend to consume such goods because they are offered at low costs. On the other hand, Stanca (2016) argued that such goods, which cut down the production/consumption of the relational goods and

are costly to access in terms of time and effort, create a kind of addiction over time, distancing people from social life and alienating them from real-life relationships.

The study also examines the impact of socio-economic and socio-demographic variables on relational goods. The regression analysis has revealed that the higher the income and education level of the individual, the better his/her relations with his/her social environment; however, the older he/she gets by one year, the worse his/her social relations become. No significant difference between men and women in terms of social relations has been found, whereas it has been observed that men have better intra-family relationships compared to women. It has been observed that compared to the unemployed, employed, retired and housewives have better social relations; however, there are no significant differences between them in terms of domestic relations. Given that Covid-19 is expected to shrink social networks, findings reveal that its effect on both family and social relations is not statistically significant.

In general, this study suggests that as the duration of internet use increases in European countries, both intra-family relations and communication in social life are weakened, thus accelerating the downward trend of the relational goods. In the literature, there are also studies reporting that factors such as television viewing, internet use, materialistic tendencies, and being in a high income group, which lead to the weakening of interpersonal social ties, reduce the level of production/consumption of the relational goods (see, for example, Bruni & Stanca, 2008; Bünger, 2010; Becchetti et al, 2011; Colombo & Stanca, 2014; Rasciute et al. 2017; Schmiedeberg & Schröder, 2017; Sarracino & Piekalkiewicz, 2021; Becchetti et al. 2024 in the literature review section). In these studies, only “social relations” were used as an indicator for the relational goods. Contrary to the literature, in this study, a new proxy indicator called “family relations” was created instead of the relational goods by applying the CATPCA method with an up-to-date data set. In this way, the effect of extensive internet use on the relationship between family members was empirically explored.

On the basis of the research findings, recommendations may be made to policy makers to prevent the negative effects of the internet on relationships within the family and in social life. In this regard, resources may be provided to institutions and organizations such as non-governmental organizations, universities, and parent-teacher associations to inform the society about the harmful aspects of the internet. Trainings may be organized for families on internet risks in order to keep the communication between family members strong. Specialists on this subject might be employed in schools to protect children from internet addiction from an early age. Moreover, efforts may be made to develop psychosocial support programs to help internet addicts overcome psychological problems. Family counseling programs may also be introduced to increase awareness of the factors that trigger internet addiction in families.

The study offers substantial findings that time spent online is a determinant of interpersonal relationships in Europe and that intensive internet use triggers loneliness. It also sheds light on the indicators of relational goods in Europe and the determinants of these indicators as well as the internet. Therefore, this study may serve as a guide for researchers working on relational goods. However, long-term effects and the direction of causality are not clear since cross-sectional data are used. No inference may be drawn from the findings that people with weak social ties will spend more time online. The use of panel data may provide a more reliable measure of causality. Furthermore, the European Social Survey dataset does not contain information on the purpose for which respondents use the internet. For this reason, the study has been unable to find out how the use of the internet for communication, learning or entertainment affects the bonding between people. These limitations may be helpful in identifying research topics for future studies.

This research does not need the approval of Ethics Committee.

The study has been crafted in adherence to the principles of research and publication ethics.

The author declares that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article.

The entire work was carried out by its only, stated author.

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Investigating the Perception of Internal Audit in Women's Cooperatives: The Case of Isparta Province *

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* This study was produced from Ayşe Gül GÖK's doctoral's thesis titled "Examining the Current Situation of Women's Cooperatives in the Perspective of Internal Audit: Research in Isparta Province".

<https://doi.org/10.30798/makuiibf.1517637>

Abstract

Today, women's cooperatives, whose numbers are increasing, are among the organizations whose establishments are supported in Turkey. The main subject of our study is to investigate the internal audit perceptions of the partners of women's cooperatives, which have encountered various problems in their operation after their establishment. The study covers women's cooperatives in Isparta center and its surroundings. In this regard, a qualitative research was conducted with women's cooperatives that agreed to participate in the study. Qualitative data obtained with the semi-structured interview form were analyzed with the MAXQDA 2020 program and code schemes were created and interpreted. As a result of the study, it was concluded that the concept and mechanisms of internal audit are not fully known and are not carried out effectively. In addition, it has been concluded that the members do not have full information about the main organs of the cooperative, that cooperatives are generally reluctant to recruit partners, that organ activities generally remain on paper, that risk management is weak, and that there may be erroneous or fraudulent behavior in some cooperatives.

Keywords: *Women's cooperative, internal audit, Isparta, cooperatives.*

Article Type	Application Date	Admission Date
Research Article	July 17, 2024	December 20, 2024

1. INTRODUCTION

Cooperatives are organizations established for a common goal based on cooperation and solidarity. These organizations are established by people coming together to meet the common needs of individuals or businesses and for economic, social or cultural purposes. Cooperativeism; It stands out as an important business model that aims to support social and economic development around the world, reduce income inequalities and strengthen local communities. The first place of modern cooperatives in their current sense is the European continent. It first emerged in England and Germany with the industrial revolution and spread all over the world (Bijman et al., 2014; Prinz, 2002). It is accepted that Rochdale started the first cooperative movement in the world by establishing the “Consumer Cooperative” on 24 October 1844 (Fairbairn, 1994). Cooperatives are also quite common in Germany, a European country (Prinz, 2002). In Germany, one in every four individuals has a cooperative membership (Guinnane, 2001) and there are approximately 19.4 million cooperative members (Ministry of Commerce, 2015, p. 9). Cooperatives are seen as an important business model widely used worldwide and operates in various sectors. Especially in developing countries such as Turkey, cooperatives are seen as an important tool to promote local economic empowerment, improve income distribution and increase social solidarity.

Cooperatives in Turkey can be examined in two ways: before the Republic and during the Republic. Mithat Pasha during the Ottoman Empire and Mustafa Kemal ATATÜRK during the Republic period took important steps regarding cooperative structures (İnan, 2008). It is seen that the Ahi structures in the pre-Republic period are similar to cooperatives. The Ahi organization, founded by Ahi Evran, includes the rules of today's modern cooperatives such as solidarity, education, cooperation, equal work and fair price policy (Serinikli, 2017). In addition, the “Memleket Funds”, founded by Mithat Pasha in 1863 regarding pre-Republican cooperatives, is the first cooperative movement (Erçin, 2002) and its field of activity is agricultural credit (Serinikli, 2017).

Today, cooperatives operate within the Ministry of Commerce, Ministry of Agriculture and Forestry, Ministry of Environment, Urbanization and Climate Change. Cooperatives in our country are generally divided according to their field of activity. While in the early days, cooperatives in the fields of production, housing, consumption, development and supply distribution constituted the majority, today it is observed that the establishment of sector-oriented cooperatives is increasing. In this sense, new types of cooperatives are encountered in the fields of women, agricultural sales, press, education, health and transportation. Current cooperative data in Turkey obtained through CİMER and in the World Cooperative Monitor (WCM) report published by the International Cooperatives Alliance (ICA) in 2023 are given in Table 1.

Table 1. Cooperative Data in the World and Turkey

	World*	Türkiye**
Starting year	1844	1863
Number of Cooperatives	3 Million	52,034
Number of Partners	1 Billion	2,302,387
Number of Employees	280 Million	100,000

Source: *ICA, 2023, **Data prepared by the KOOP-BIS system dated 06.03.2024 is presented through CİMER.

According to International Cooperative Alliance (2023) data; Approximately 20 years after the start of the cooperative movement in England, the first studies in the field of cooperatives began in Turkey. Additionally, there are around 3 million cooperatives in the world. These cooperatives have approximately 1 billion members. In this regard, it can be thought that one in every seven people in the world is a cooperative partner. In addition, around 280 million people obtain all or part of their income from cooperatives. Currently, 10% of the world's working population is employed in cooperatives. There are 52034 cooperatives in Turkey, which corresponds to 1.73% of the cooperatives worldwide. Additionally, there are around 2 million cooperative partners in Turkey. Therefore, one in every 40 people in Turkey is a cooperative partner. In addition, 100 thousand people work in cooperatives and cooperative subsidiaries in Turkey. However, the share of this employment in the total working population in Turkey is below 1%. In other words, the employment level created by cooperatives in Turkey is quite low compared to the employment level created by cooperatives around the world.

Women's cooperatives play an important role in empowering women in economic and social life, ensuring gender equality and supporting sustainable development in Turkey. Women are seen as a disadvantaged group that may struggle to meet their social and economic needs and create their own business areas (Kara, 2020). Today, there are reasons that have a negative impact on the sustainability of women's cooperatives in almost every province. The problems experienced in women's cooperatives and affecting these cooperatives negatively are the same as the basic problems related to cooperatives (Duguid et al., 2015). In addition to these problems, the International Labour Organization (2022) report contains findings that overlap with the literature on the main problem areas of women's cooperatives. These; weakness of solidarity and partnership structures, weak capital base and difficulties in accessing finance, insufficient preparation processes and sudden establishment, insufficient capacity regarding business and organization management, weight of non-tax financial liabilities related to organization management, problems related to the cooperative type, informalization and fake the danger of regression to cooperative status is the limits on women's representation and activities in mixed cooperatives (p. 48).

In addition to supporting the internal control systems of women's cooperatives, internal auditing contributes to the effective execution of risk management and governance processes. The concept of internal auditing, which holds significant importance in this context, is defined as "an independent and objective assurance and consulting activity designed to evaluate, improve and add value to an organization's operations" (Korkmaz, 2007). On the other hand, risk management is described as the

process of identifying, assessing, and managing risks directly related to an organization's mission and objectives, which may impact the achievement of these goals. Within this scope, internal auditing assists organizations in managing potential risks by conducting preliminary evaluations of the risks associated with the activities under review (Acar, 2024). The results of an internal audit and the benefits it provides to management vary depending on the purpose of the internal audit and the support and expectations of managers in this regard (Lazarus et al., 2021, p. 104). Internal audit must be properly integrated into the strategic management system to use internal audit as an effective management tool (Alic and Rusjan, 2011). Thus, internal audit; it helps organizations achieve financial, operational and strategic goals with a systematic and disciplined approach and contributes to sustainable success and growth by adding value to their core functional areas (Lazarus et al., 2021, p. 104).

Today, women's cooperatives, whose numbers are increasing and are faced with many problems, are in danger of closing for some reasons (Gök and Öztürk, 2024, p. 58). Reasons such as the weakness of cooperative economic management, the inability to balance income and expenses, and weak internal audit effectiveness are major obstacles to women's cooperatives' progress. In our study, the perception of internal control of women's cooperatives in Isparta province was investigated using qualitative research methods.

2. MATERIAL AND METHOD

2.1. Method and Approach of the Research

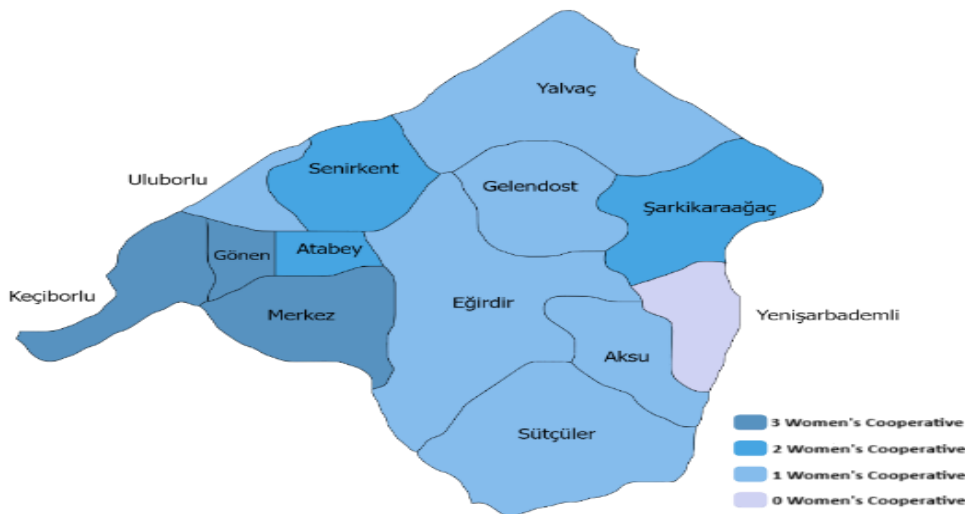
Qualitative research explains complex events and perceptions by using experiences. It is explained as an interpretive and explanatory research method that aims to examine the formation stages of events, which helps to discover decision-making processes and what affects these processes (Creswell, 2013). The phenomenological approach, one of the qualitative research methods, was preferred in the research. The phenomenological approach is an approach that includes text analysis focusing on meanings and context, discourse analysis and understanding how the process occurs (Chigbu, 2019, p. 1). The phenomenological approach is theoretically based on qualitative research. Qualitative research, on the other hand, adopts a holistic perspective and examines the research questions with an interpretive approach (Karataş, 2015, p. 63). In this regard, this research was carried out within the framework of the phenomenological approach, one of the qualitative research methods, as it provides an in-depth understanding of the situation as a method suitable for its subject and purpose. In the phenomenological approach, the researcher tries to understand “what is”, “what it means”, “how it is” and “with what common meanings it is represented by experiences” the social phenomenon or process he is researching (Çelik et al., 2020, p. 383). In this regard, the main data source of the study is obtained through interviews (Günbayı and Sorm, 2018, p. 65). The research was carried out within the framework of semi-structured interview technique.

2.2 Population and Sample

Most researchers who prefer the hermeneutic phenomenological approach are able to select people who closely experience a certain situation or event that is the focus of the research question using the purposeful sampling method (Tindall, 2009). In this regard, “criterion-based sampling” was chosen among the purposeful sampling types when determining the participants in the study, as people who could guide the study and help shed light on the subject under investigation were preferred. In criterion-based sampling, people who have experience with the phenomenon under investigation are represented, and this type of sampling is seen as a very useful method in phenomenological research (Tashakkori and Teddlie, 2010).

Some researchers in the literature argue that the number of participants should be in different ranges in phenomenological research. Tindall (2009) state that the number of participants should be between 4-10, and Creswell (2013) states that the number of participants can be between 5-25. Charmaz (2011) and Wilson (2015) suggest that this number should be at least 10. However, in qualitative research, in order to determine the ideal sample size rather than the number of samples (Wilson, 2014), it should be taken into consideration whether the information has reached the saturation point or whether it has become repetitive (Baltacı, 2018, p. 262) and the number of samples should be terminated accordingly (Wilson, 2014). In this regard, after it was determined that the data obtained from the participants in the study became repetitive and the saturation point was reached, the study was stopped and the sample size was determined. Figure 1, the universe of the study, including the field research, is presented graphically.

Figure 1. Provincial Center and District Locations Where Field Research Was Conducted



Women’s cooperatives, which contribute to the social and economic development of women and are seen as a key role in local development, were determined as the study group of the research. Only cooperatives founded and run by women were considered in the study. In this regard, the research focused on women's cooperatives established in Isparta Province as the study group. Isparta Province

was chosen because of the increase in the number of women's cooperatives over the years and the lack of a comprehensive study on women's cooperatives specifically in Isparta Province. According to the data received from official institutions as of January 2024, the population of the study consists of 20 women's cooperatives established in Isparta Province. 8 women's cooperatives out of 20 women's cooperatives refused to participate in the study for various reasons. For this reason, the study was continued with 12 women's cooperatives and the sample size was terminated with 16 participants from 5 cooperatives being included in the study due to the repetition of participant responses and reaching the saturation point.

2.3. Data Collection Tool and Analysis

The interview was conducted by preparing the questionnaire in a semi-structured manner using the in-depth interview method, one of the qualitative research methods, and addressing it to the participants face to face. An in-depth interview is a data collection technique that allows collecting information through one-on-one, face-to-face interviews in which all dimensions of the subject under investigation are addressed, mostly open-ended questions are asked, and detailed answers are obtained (Tekin, 2006, p. 101). In the semi-structured interview type, an interview form includes a set of predetermined questions. Therefore, before the data collection process, domestic and foreign literature was researched in detail and the questions asked to the participants in qualitative studies conducted in women and women-dominated cooperatives were examined. As a result of the review, questionnaires were created to include the COSO Model (COSO, 2024) fraud triangle and red flags theories. In this context, in the study, the "Semi-Structured Interview Survey Form Applied to Women's Cooperatives Partners" prepared by the researcher to women's cooperatives partners, cooperative presidents, vice presidents, cooperative board members, cooperative audit board members was directed to the participants along with probing (detailing) questions. The participants' answers to the questions were recorded with a voice recorder by the consent of the participants. Additionally, in addition to the answers given by the participants, observations were made and notes were taken during the field research. The researcher concluded the research by asking the participants if there was anything else they would like to add at the end of the interview. The research was applied to 16 participants starting on January 11, 2024 and ending on February 10, 2024. Accordingly, in this study, field research was conducted with participants who were determined through criterion-based sampling and played a key role in the study. The research questions were tried to be answered.

In the analysis given, firstly, the voice recordings obtained as a result of in-depth interviews of 16 participants were deciphered and transcribed. The approximately 80-page text obtained as a result of interviews ranging from approximately 30 minutes to 1.5 hours was read several times in line with the objectives of the research, formal errors and spelling errors were corrected, and all introductory information in the interview texts was anonymized before starting the coding process. Afterward, based on descriptive analysis, coding and data analysis were carried out with the help of the MAXQDA 2020

program, which included adhering to the original formats of the data in the interview transcripts and presenting the data to the other party with a descriptive approach by directly quoting the expressions used by the participants (Kümbetoğlu, 2017, p. 152). In this direction, the data were examined within the framework prepared according to the literature with a deductive thematic analysis approach (Saldana, 2019: 75) and the research results were mapped with code schemes. The codes in the emerging themes are presented with code matrices.

2.4. Information on Women's Cooperatives and Participant Profile

Anonymous information of the 16 participants in the study is given in Table 2.

Table 2. Anonymous Participant Profile

Code	Age	Educational Status			
P ₁	55	Associate Degree			
P ₂	51	High School			
P ₃	62	High School			
P ₄	57	Associate Degree			
P ₅	58	Associate Degree			
P ₆	52	High School			
P ₇	67	Primary School			
P ₈	65	High School			
P ₉	53	Primary school			
P ₁₀	54	High School			
P ₁₁	62	High School			
P ₁₂	29	Associate Degree			
P ₁₃	37	High School			
P ₁₄	46	Primary School			
P ₁₅	50	Primary School			
P ₁₆	38	Bachelor Degree			
$\bar{X}=52,25$ year age		Primary School	High School	Associate Degree	Bachelor Degree
		4 Person	7 Person	4 Person	1 Person

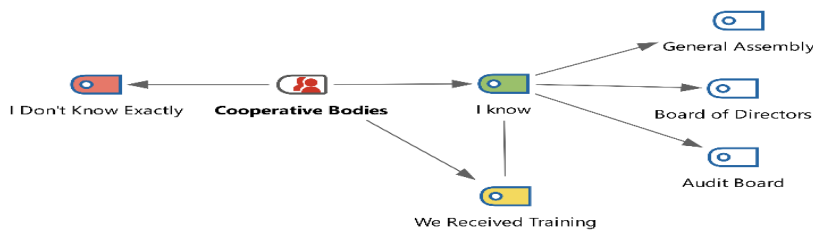
When Table 2 is examined, it is observed that the average age of the participants is 52.25 years and 4 of the participants are primary school graduates, 7 are high school graduates, 4 are associate degree graduates and 1 is a bachelor's degree graduate.

3. RESULTS

3.1. Cooperative Bodies Information Status

The 16 cooperative partners interviewed in the field research asked, “Do you have any information about cooperative bodies?” (Detailing question: Have you heard of the general assembly, board of directors, audit board?), the code scheme in Figure 2 was created by examining their answers to the question.

Figure 2. Cooperative Bodies Information Status

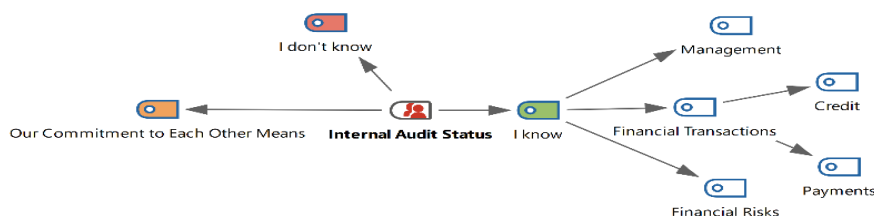


When Figure 2 is examined, some of the participants stated that they knew the names of the cooperative bodies but did not have full knowledge of their functioning. Some of the participants stated that they received informational training on cooperative bodies during the establishment stages of the cooperative. In this regard, participants organize cooperative bodies; They expressed it as the board of directors, audit board and general assembly. It was observed that the participants agreed on the common idea that the board of directors consists of three people who are authorized to manage, and that it is the board where those at the forefront of cooperative management gather. Participants' thoughts about the general assembly; They stated that board must meet once a year and all members must participate. Some participants also stated that it is a board in which a person from the provincial directorate to which the cooperative is affiliated and accountants participate. While some participants see the board of auditors as supervising all cooperative activities, others see it as supervising the expenditures and monetary transactions. In addition, participants think that these boards are mandatory in terms of legislation. During the field studies, it was observed that some members participated in these boards with the direction of the management.

3.2. Internal Audit Concept Information Status

The question “What do you know about the concept of internal audit in cooperatives?” was asked by 16 cooperative partners interviewed in the field research. The code scheme in Figure 3 was created by examining their answers to the question.

Figure 3. Internal Audit Concept Information Status



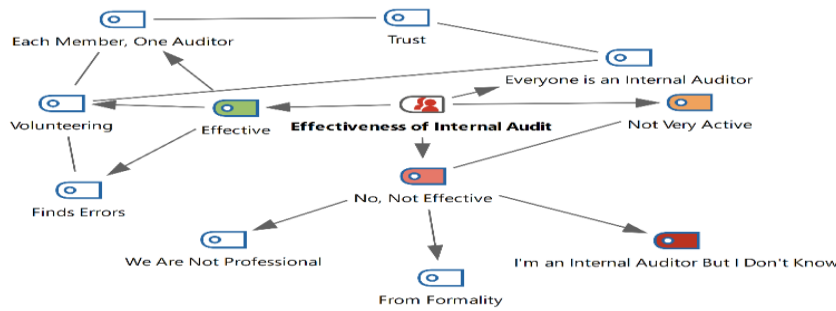
When Figure 3 is examined, it is seen that the participants responded to the concept of internal audit as “I do not know” or “I know”. Participants who answered “I don't know” mostly expressed it literally as inspecting the inside of the cooperative. Participants who said they knew stated that internal auditing is the auditing of financial risks, auditing financial transactions and auditing the affairs of management. Participants who stated that financial transactions are audited explained that what they

mean by financial transactions is auditing payments and loan withdrawal situations. In addition, a participant explains the concept of internal audit as “it means our commitment to each other”.

3.3. Effectiveness of Internal Audit

The question “Do you think the internal audit carried out in the cooperative is effective?” was asked by 16 cooperative partners interviewed in the field research. The code scheme in Figure 4 was created by examining their answers to the question.

Figure 4. Effectiveness of Internal Audit

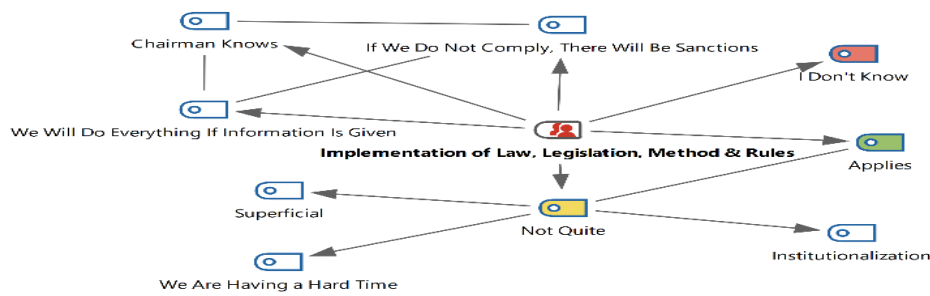


When Figure 4 is examined, participants evaluate internal auditing in cooperatives as “effective”, “no, not effective” and “not very active”. Some of the participants who thought it was effective stated that internal auditing was beneficial in finding errors, while others stated that it was effective because it was done voluntarily. In addition, some participants do not see auditing as the sole activity of the audit board. In this regard, they believe that each member carries out the audit activity voluntarily, with the awareness of an auditor. In addition, the participants think that selecting the internal audit board from reliable partners makes the audit activity effective, as one of the reasons why it is effective. Those who stated that internal auditing was not effective stated that the reason for this was that they were not professional in auditing. Some of the participants working in the internal audit body think that the reason for its ineffectiveness is that they do not have enough information about internal auditing. Some participants think that they are not very active. During the field interviews, it was observed that some participants did not have sufficient knowledge about the effectiveness of internal auditing. It has been observed that the process mostly remains on paper, it does not operate very actively, and in some cooperatives, the internal auditor does not have knowledge about internal auditing.

3.4. Implementation of Law, Legislation, Method and Rules in the Cooperative

16 cooperative partners interviewed in the field research were asked the question “Do you think that the law, legislation, methods and rules are applied in your cooperative?”. The code scheme in Figure 5 was created by examining their answers to the question.

Figure 5. Implementation of Law, Legislation, Method and Rules in the Cooperative

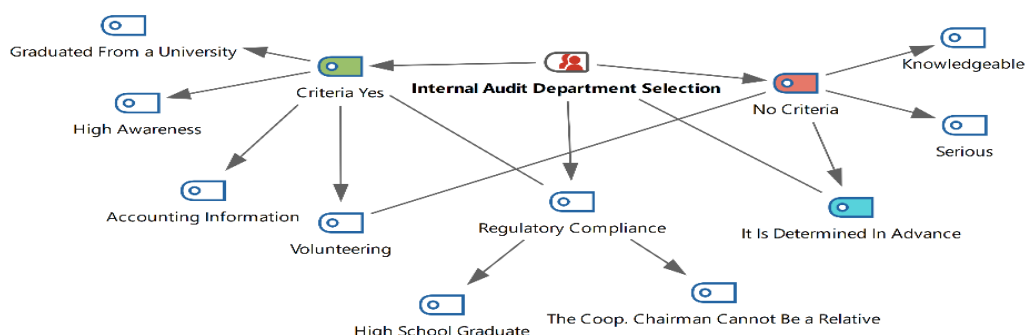


When Figure 5 is examined, some participants stated that the law, legislation, methods and rules are applied in the cooperative, some participants stated that they did not have information about whether they were implemented or not, and some participants stated that they were not fully implemented. Participants who thought that it was not fully implemented stated that the reason for this was that they were not yet institutionalized, that they could not implement it superficially and effectively, and that they had difficulty. In addition, some participants state that there is a sanction for not implementing the law, legislation, methods and rules, so they implement it. Some participants stated that the cooperative president would know the answer to this question better. Some participants stated that if they were informed about this issue, they would be more knowledgeable about such issues and be careful about their implementation. During the field interviews, it was observed that there was a lack of information on this issue and that such issues were left to the initiative of the president.

3.5. Internal Audit Department Selection

The 16 cooperative partners interviewed in the field research asked, “What do you think about the selection of the cooperative internal audit body?” The code scheme in Figure 6 was created by examining their answers to the question “(Detailing question: from outside or from the members? Are you looking for certain criteria? Are those chosen from the heart?)”

Figure 6. Internal Audit Department Selection



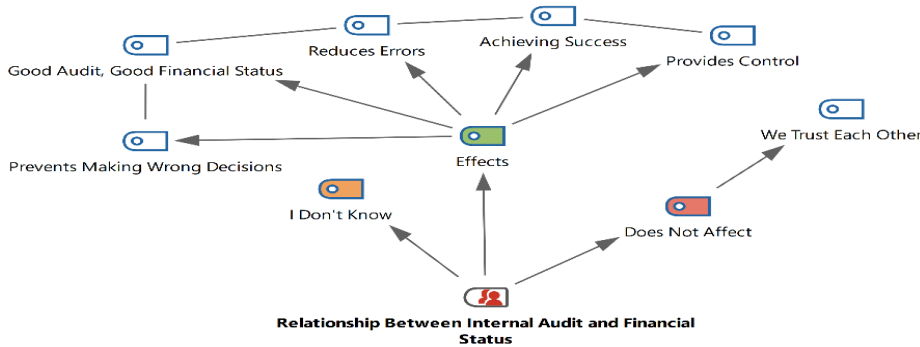
When Figure 6 is examined, some participants stated that it is mandatory to act in accordance with the legislation in the selection of the internal audit body. Therefore, they require candidates to have at least a high school diploma. They also emphasized ensuring that the internal auditor is not someone close to the board of directors. Other participants mentioned that they do not look for specific criteria in

the selection but prefer individuals who they believe are knowledgeable and will take the role seriously. Some participants also stated that volunteers for the internal audit body are determined beforehand, and the selection is made from among these volunteers.

3.6. Internal Audit and Financial Status

The question “Do you think that the internal audit system affects the financial situation of the cooperative?” was asked by 16 cooperative partners interviewed in the field research. The code scheme in Figure 7 was created by examining their answers to the question.

Figure 7. Internal Audit and Financial Status

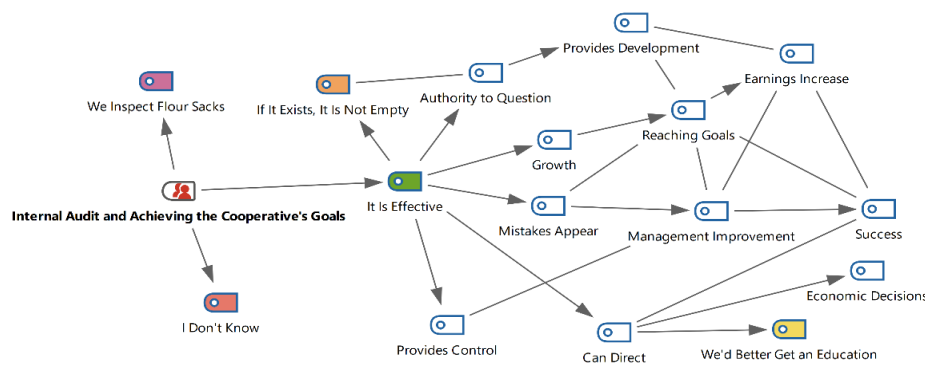


When Figure 7 is examined, some participants think that the internal audit system “affects” the financial situation of the cooperative, “does not affect” and “they have no information” about it. Participants who think that the internal audit system affects the financial situation of the cooperative have different opinions; they think that internal audit reduces errors, prevents making wrong decisions, provides control of the cooperative, and is a tool for the cooperative to achieve success. In addition, some participants state that the effect of internal audit on the financial situation of the cooperative is through a good audit activity, in other words, a good financial situation can be achieved with a good audit. Participants who think that the internal audit system does not affect the financial situation of the cooperative stated that they trust each other as cooperative partners. The reasons for this, based on field observations are; It can be stated that the participants do not have knowledge about internal audit, they do not consider internal audit as an activity, they think that cooperative internal audit is provided based on trust, and they think that there is no connection between the financial situation and internal audit. It is thought that the participants who stated “I do not know” whether the internal audit system affects the financial situation of the cooperative do not have knowledge about internal audit based on field observations.

3.7. Internal Audit and Achieving the Cooperative’s Goals

The question “Is internal audit effective in achieving the goals of the cooperative?” was asked by 16 cooperative partners interviewed in the field research. The code scheme in Figure 8 was created by examining their answers to the question.

Figure 8. Internal Audit and Achieving the Cooperative's Goals

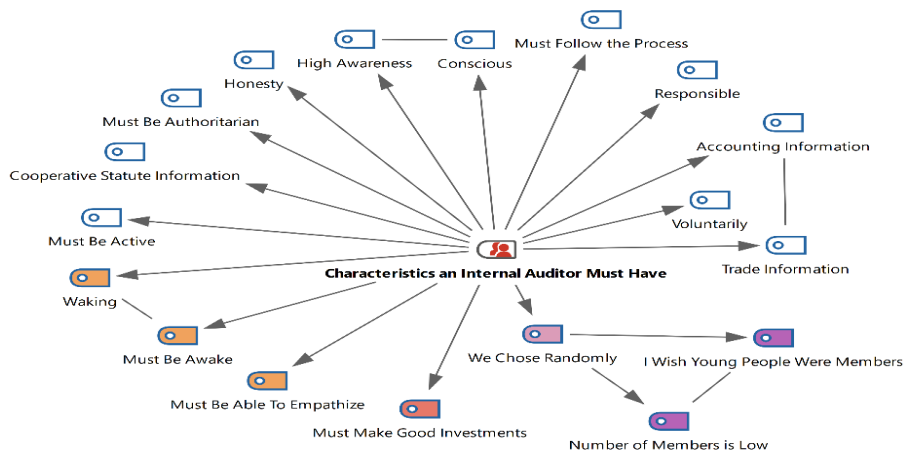


When Figure 8 is examined, participants responded with main themes such as “internal audit is effective” in achieving the goals of the cooperative, “I do not know” and “If it exists, it is not in vain”. Some of the participants who think that internal audit is effective in achieving the goals of cooperatives stated that internal audit provides control, thus improves management, and achieves success by increasing profits. In addition, some participants stated that internal audit has a guiding effect, thus enabling correct economic decisions. In addition, some participants who think that it is effective think that the cooperative can grow due to this effect and thus achieve its goals. Some of the participants stated that this effect would positively contribute to the development of the cooperative as it provides the auditing board with the authority to question, thus making it easier to achieve the goals. Some participants stated that they had no idea whether internal auditing would impact the cooperative's achievement of its goals. Some of the participants stated that they only inspected flour sacks as an auditing activity and that they did not know any other auditing activities, so they could not answer whether internal auditing was effective in achieving the goals of the cooperative. It is thought that this answer is due to the lack of information in the field interviews and an incompatibility between the concept of internal audit and the perceived concept of internal audit.

3.8. Characteristics an Internal Auditor Must Have

The 16 cooperative partners interviewed in the field research asked, “What kind of characteristics should the internal auditor have in order to carry out internal audit activities effectively?” Do you think this is taken into consideration in your cooperative? The code scheme in Figure 9 was created by examining their answers to the question.

Figure 9. Characteristics an Internal Auditor Must Have

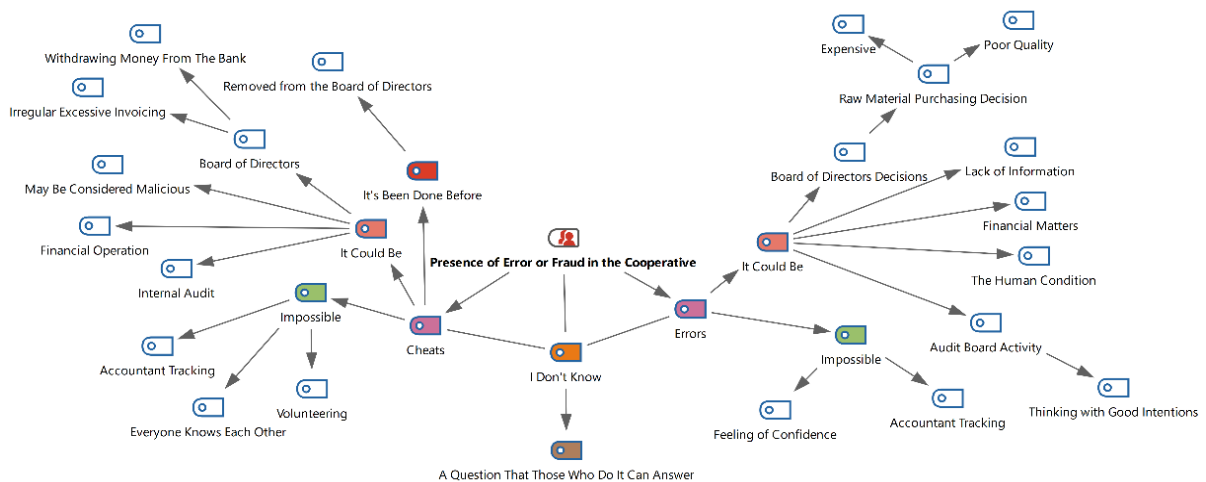


When Figure 9 is examined, the participants list the characteristics that an internal auditor should have. They stated that they should be active, have knowledge of the cooperative statute, be authoritarian, be honest, have high awareness and consciousness, follow the cooperative process, be responsible, have accounting and trade knowledge, and be a volunteer. In addition, 3 participants, who are members of the same cooperative, stated that they chose internal auditors randomly, and the reason for this was the small number of members. However, the same cooperative does not welcome new members. Some participants emphasized that the cooperative should have young members as internal auditors. Some participants stated that, in addition to these characteristics, the internal auditor should be open-minded and alert. In addition, one of the participants stated that the internal auditor should show empathy and another participant stated that the internal auditor should make good investments. When the answers given and field interviews are evaluated, it is important for the participants that the internal auditor should be knowledgeable as well as the characteristic features he should have.

3.9. Presence of Error or Fraud in the Cooperative

The 16 cooperative partners interviewed in the field research asked, “Do you think there is or could be a mistake or fraud in the cooperative?” “What kind of errors and frauds have occurred or are they occurring in which organs or cooperatives?” The code scheme in Figure 10 was created by examining their answers to the question.

Figure 10. Presence of Error or Fraud in the Cooperative

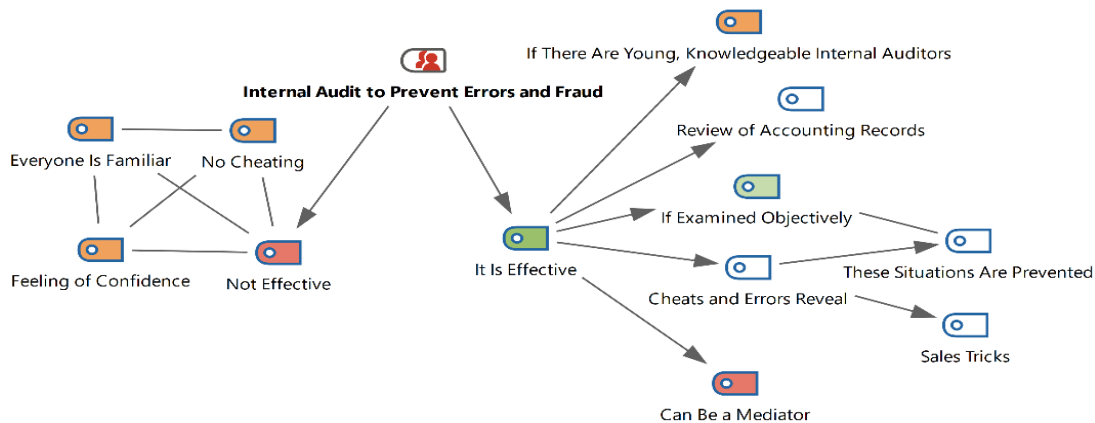


When Figure 10 is examined, the answers given regarding the existence of error or fraud in the cooperative are “it could be an error”, “it cannot be an error” and “I don't know”. Participants who thought there might be a mistake stated that this mistake could be in the board of directors, audit board and financial matters. There is also the idea that the decision to purchase raw materials may be wrong in the board of directors. In this regard, the participants also stated that the decision to purchase expensive or poor-quality raw materials could be made by the wrong decision by the board of directors. Some participants stated that wrong decisions could be made by not questioning the issues that should be questioned in the activities of the audit board, thinking that they were made in good faith. Participants who thought that there would be no mistakes in the cooperative explained the reason for this as the sense of trust between them and the fact that the accountant follows all transactions.. P₁₀, one of the participants who answered “I do not know if there is any mistake or cheating in the cooperative”, stated that those who make mistakes or cheats could answer this question. Regarding the existence of fraud in the cooperative; In addition to the participants who say that there is no cheating, there are also participants who say that cheating can happen and that cheating has been done. Three participants in the same cooperative, who stated that fraud was committed, stated that as a solution, the partner who exhibited fraudulent behavior was removed from the board of directors, but his partnership continued. It was a field observation that when asked about the fraud, they did not want to give information about this issue. Participants who think that fraud may occur in the cooperative stated that this fraudulent behavior may occur due to bad intentions. They stated that fraudulent behavior can occur in the board of directors, financial activities and internal audit activities. Fraudulent behavior on the board of directors was explained as irregular over-invoicing and irregular withdrawal of money from the bank. In addition, the participants who thought that there was no or would not be cheating stated that the reason for this was that everyone in the cooperative knew each other and that they would not dare such behavior, that they were in the cooperative voluntarily and that their accountants would not allow such a situation.

3.10. The Effect of Internal Audit in Preventing Errors and Frauds

The question “Is internal audit effective in preventing or detecting errors and frauds?” was asked by 16 cooperative partners interviewed in the field research. How can it be effective?” The code scheme in Figure 11 was created by examining their answers to the question.

Figure 11. Internal Audit to Prevent Errors and Fraud

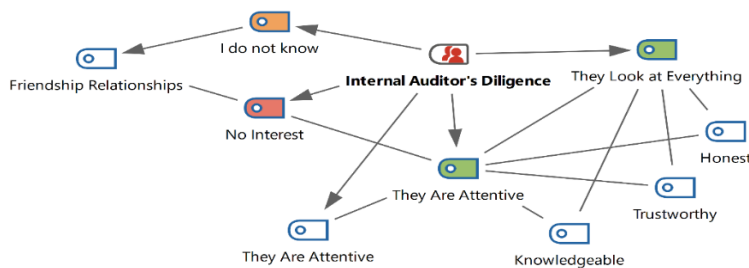


When Figure 11 is examined, it is observed that participants hold differing views on whether internal auditing is “effective” or “ineffective” in preventing errors and fraud. Participants who believe it is effective stated that internal auditors are more likely to detect or prevent errors and fraud by reviewing the information and documents obtained from accounting records. These participants emphasized that conducting detailed examinations during the internal audit process helps identify errors and potential fraudulent transactions in cooperative activities at an early stage. Additionally, some participants highlighted the presence of young and knowledgeable internal auditors as playing a significant role in preventing errors and fraud. Furthermore, they pointed out that conducting the internal audit process impartially and objectively is a critical factor in preventing errors and fraud. Thus, they argued that objectively conducted internal audit activities could effectively prevent errors and fraud. On the other hand, participants who believed that internal auditing is ineffective in preventing errors and fraud emphasized the strong social bonds and trust among cooperative members as factors that naturally deter such behaviors. These participants noted that cooperative members usually know each other for a long time and have a trust-based relationship, which they believe prevents individuals from engaging in fraudulent behavior. Therefore, they argued that internal auditing does not have a direct impact on preventing errors and fraud, as the trust relationships among cooperative members primarily ensure this. In conclusion, while participants held differing views on the effectiveness of internal auditing in preventing errors and fraud, those who believed it to be effective emphasized the importance of detailed examinations and impartiality in audit processes. Conversely, those who deemed it ineffective focused on the social bonds and trust relationships among cooperative members as the key factors in preventing errors and fraud.

3.11. Internal Auditor's Diligence

The 16 cooperative partners interviewed in the field research were asked, “Do you think that the internal audit staff takes the necessary care to detect fraudulent or erroneous transactions?” The code scheme in Figure 12 was created by examining their answers to the question.

Figure 12. Internal Auditor's Diligence

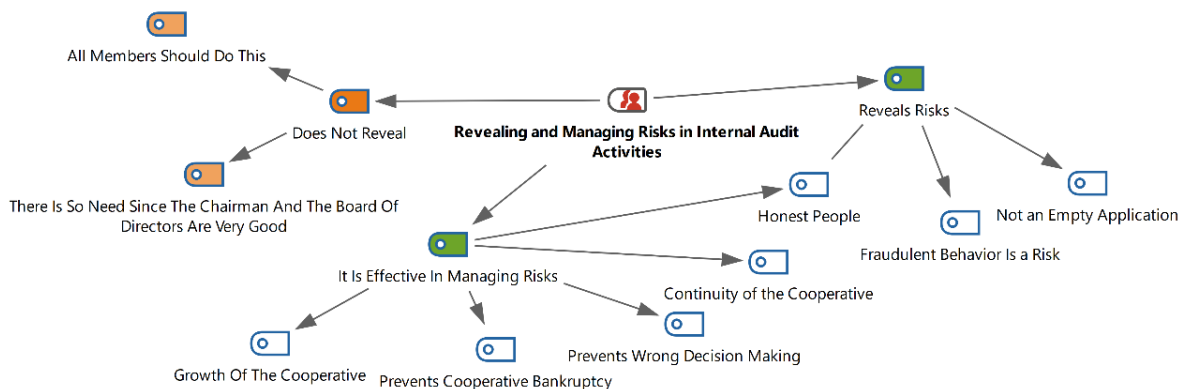


When Figure 12 is examined, some participants think that the internal auditor takes the necessary care while performing the audit activity, as well as participants who answer this question with “I don't know.” Participants who stated that the internal auditor showed care explained this as follows: a meticulous internal audit can be achieved if internal auditors show the required reaction during the audit, perform their activities honestly and reliably, and reveal their knowledge about auditing. Some participants attributed the internal auditor's diligence to his lack of interest and not including friendships in the auditing activity. Participants who answered, “I don't know whether the internal auditor showed the necessary care” said; They stated that everyone in the cooperative knows each other, even relatives, and that they do not know how to ignore these issues and carry out the audit activity objectively.

3.12. Internal Audit and Risk Emergence and Management

The question “Do you think that internal audit activities have an impact on revealing and managing risks?” was asked by 16 cooperative partners interviewed in the field research. The code scheme in Figure 13 was created by examining their answers to the question.

Figure 13. Internal Audit and Risk Emergence and Management



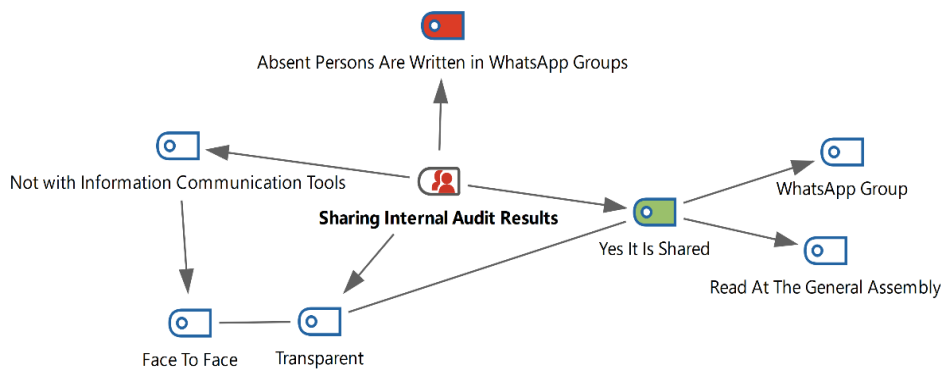
When Figure 13 is examined, some participants give the main answers that internal audit activities “reveal risks”, “are effective in managing risks” and “do not reveal” in revealing and managing

risks. The participants who responded that it would not reveal the activity stated that it would only be possible if every partner participated, as not all members actively participated in the activity. Another participant stated that the chairman and the board of directors carry out the audit, so there is no need for the internal audit activity to reveal the risks. Participants who think that internal audit activities reveal risks think they can reveal risks because they are a mandatory practice. In addition, some participants think that risks can be revealed by performing auditing activities by honest people. Some participants consider fraudulent behavior as a risk and state that these fraudulent behaviors can be detected through internal audit activities. Some participants think that internal audit activities are effective in managing risks. It is thought that by managing risks, wrong decisions in the cooperative will be prevented, its continuity will be ensured, the cooperative will grow and its closure will be prevented. When field observations and participants' statements were examined, it was observed that the prevailing opinion was that the all members of the cooperative should carry out the internal audit activity and should not be left only to the names on paper. In this regard, it has been observed that cooperative partners are willing to participate in activities that are not within their scope of duty.

3.13. Sharing the Results of Internal Audit

The 16 cooperative partners interviewed in the field research asked, “Are internal audit problems or results shared with you through information and communication tools in your cooperative?” The code scheme in Figure 14 was created by examining their answers to the question.

Figure 14. Sharing Internal Audit Results



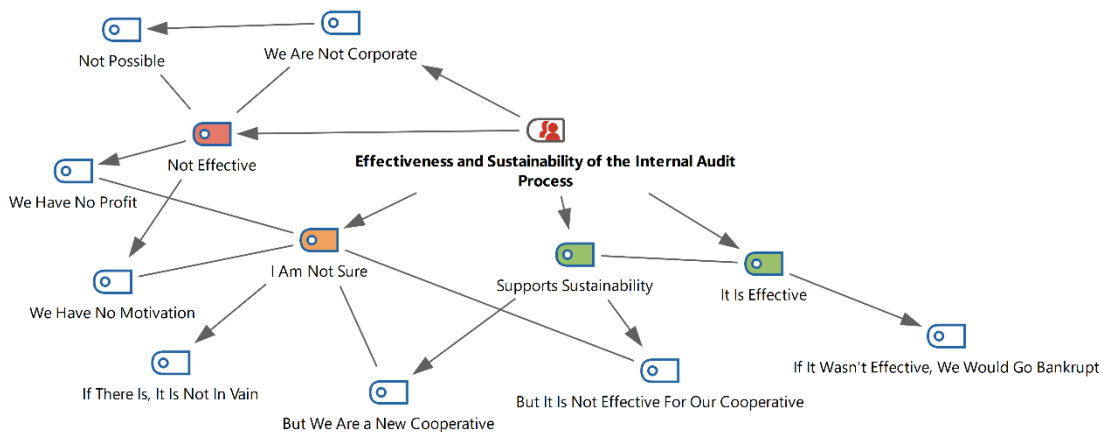
When Figure 14 is examined, it is observed that the results they perceive as internal audit results are shared in all cooperatives. However, this type of sharing may differ in cooperatives. In this regard, some participants stated that the internal audit results were read at the general assembly to be explained to all members. Some participants stated that current internal audit results were shared in WhatsApp groups. In addition, some participants state that internal audit results are shared face-to-face in weekly meetings. Some of the participants stated that the internal audit results are disclosed annually in written form to all partners at the general assembly. Based on the answers to the question and field observations, it has been observed that internal audit activities are not carried out within a standardized framework, in

some cooperatives, audit activities are discussed weekly, and in some cooperatives, these activities are presented to the general assembly only once a year in the form of a report. Within the framework of the answers given and field observations, it is evaluated that the results of internal audit cannot be distinguished from the results of other activities. Therefore, there is a lack of information about internal audit and its results.

3.14. Effectiveness and Sustainability of the Internal Audit Process

The question “Do you think the internal audit process in your cooperative is effective and sustainable?” was asked by 16 cooperative partners interviewed in the field research. The code scheme in Figure 15 was created by examining their answers to the question.

Figure 15. Effectiveness and Sustainability of the Internal Audit Process

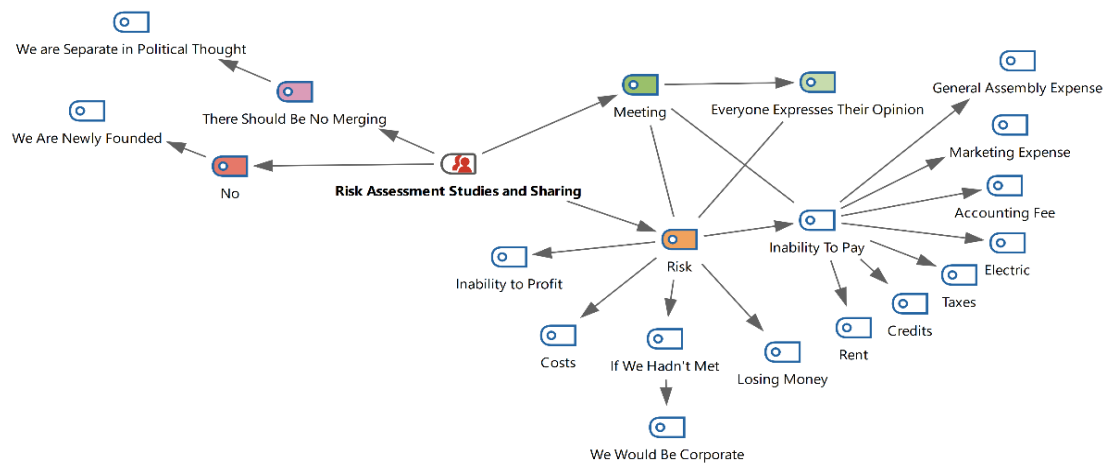


When Figure 15 is examined, the answers given regarding the effectiveness and sustainability of the internal audit process are “it is effective”, “it ensures sustainability”, “I am not sure”, “it is not effective”. Participants who thought it was effective explained the reason for this by saying that the audit supports sustainability and if it were not effective, it would lead to the closure of the cooperative. Participants who answered “I’m not sure” stated that the establishment of an internal audit body within the framework of the law was a necessity and interpreted it as “if it exists, it is not in vain.” Some participants stated that they were not sure because they were a very new cooperative. Participants who answered “not effective” stated that their Earnings were not high and that effective control would not be possible because they were not a corporate business. In addition, they stated that being a small and low-earning cooperative reduced their motivation therefore they did not have an effective internal audit process.

3.15. Risk Assessment and Sharing

The 16 cooperative partners interviewed in the field research asked, “Are there any studies on risk assessment in your cooperative?” Is it shared with you? The code scheme in Figure 16 was created by examining their answers to the question.

Figure 16. Risk Assessment Studies and Sharing



When Figure 16 is examined, some participants stated that risk assessment studies and sharing were carried out, as well as participants who stated that this was not done because they were newly established. Participants stated that risk assessment studies and sharing were carried out. It has been observed that they perceive situations such as not being able to make a profit, costs, being far from corporate, and losing money as risks. They also stated that failure to pay expenses such as rent, loans, accounting fees, marketing expenses, taxes, general assembly expenses, and electricity costs is a risk. They also stated that they discussed the statements they defined as risks in the meetings with all partners' participation within the information sharing framework. When the code scheme and field observations were evaluated, it was observed that the cooperative partners were cautious about risks and exchanged ideas with each other. In cooperatives where risk assessment studies or information exchange are carried out, meetings are held on this issue and everyone expresses their opinion regarding risky transactions. After analyzing a large number of studies, Byrnes et al. (1999) concluded that female respondents were more risk-averse than their male counterparts. In his study, Niessen-Ruenzi (2015), using data on professional investment fund managers in the USA, stated that female managers adopted more risk aversion strategies than their male counterparts. In this regard, when the participants' statements and field observations were evaluated, it was observed that the participants cared about risk assessments, avoided risks and mostly mentioned financial risks in risk assessment.

4. CONCLUSION

When the findings obtained as a result of the study were evaluated in general, similar results were found with the literature. According to Schultz (2019); educating women increases productivity. It ensures that women's social environment opens up to the outside world, eliminates intergenerational differences by providing children with access to good education and health opportunities, and offers equal opportunities between low and high incomes. Bubolz (2001) comments that educating a woman is equivalent to educating a family and a society. Although it is known that women's education

contributes positively to the development of society, it is not taken into account that more importance should be given to women's education, especially in developing countries (Yumuşak, 2004).

Cooperatives have been established in various branches of activity in Turkey and the world. The size of the number of cooperatives and partners reveals the importance of the cooperative sector in Turkey. However, Turkish cooperatives are inadequate in calculating the contributions of cooperatives to the country's economy. The reason for this is that quantitative data on cooperatives is limited; that is, economic indicators are almost non-existent (Everest, 2018, p. 1008). Altman (2015) argues that the standard of rules and regulations aimed at providing benefits (high income) to members attract many members and determines the success of cooperatives. This ultimately helps promote economic growth. The state has a significant impact on cooperatives. The dominant systems and ideologies of the countries where cooperative activities are implemented directly or indirectly affect cooperatives. The idea dominating the economic, political, cultural and social structures also affects how the cooperative activity is implemented (Ültanır, 2019, p. 28). In his study, Masabo (2015) argues that cooperatives are good mechanisms that offer the advantages of economies of scale to bring together women's resources and raise their living standards. Cooperative membership improves women's capacity to make strategic choices in their lives and increases their self-esteem and decision-making ability. In addition, the study reveals how complex and conditional the process of women's empowerment through cooperatives is. Although cooperatives have been found as a tool to initiate this process, they are not universally seen as an effective method (Masabo, 2015). Beyond providing employment or an income-generating activity, the fact that cooperatives influence women's skills, knowledge and self-confidence enables them to shift voluntarily, as it allows them to use their resources and networks in times of scarcity. The study by Paudel and Acharya (2022) also reveals that policymakers' attention is needed to ensure that the current capital mobilization in the cooperative sector makes a positive contribution. In this regard, it has been concluded that the priority areas and working scopes of cooperatives need to be re-examined and developed. Aju and Adeosun (2021) emphasize that women's cooperatives should take measures to encourage increased participation of female members and develop their capacity with their own economic resources.

Jamaluddin et al (2023) stated that it would be interesting to investigate the effectiveness of internal auditors appointed from among members, especially in cases limited to certain segments of the society, such as farmers' or fishermen's cooperatives. Internal audit, a tool of internal governance and control, is perceived as a detection mechanism to detect internal control weaknesses in microfinance institutions' processes, procedures and policies. Some studies in the literature suggest that internal audit activities can strengthen board policies and procedures through systematic monitoring and reducing the likelihood of various risks arising (Ayayi, 2012; Omidiji et al. 2023). Internal audit provides independent assurance on enterprise risk management and internal control framework (Institute of Internal Auditors, 2013). Therefore, the collaborative efforts of both female managers and the internal auditor can be an

effective governance mechanism to reduce agency and asymmetric information problems in organizations (Adams, 1994; Goodwin-Stewart and Kent, 2006; Isern et al., 2007; Mbeba, 2008; Adams and Ferreira, 2009; Okello et al., 2021; Omidiji et al., 2023). The interesting situation stated by Jamaluddin et al. (2023). In their study was actually observed in our field study. Jamaluddin et al. (2023) stated in their study that the majority of board members are appointed from among the members, and in the cooperative environment, little importance is given to the effectiveness of committees affiliated with the board of directors, such as nomination and remuneration, as well as audit and sustainability committees. In the fieldwork observations made in this direction, it was observed that the low number of members due to the closeness to the outside world limited the elections of the cooperative body to a narrow area and most officials were determined in advance.

When field interviews were analyzed, it was seen that women's cooperatives were in a vicious circle. The results obtained in the study on the internal audit axis of the cooperatives interviewed showed that there were issues on which the partners and management lacked knowledge and that this affected the cooperative activities. Many women's cooperatives cannot rise economically or stagnate. The examined internal audit phenomenon is seen as a legal obligation in cooperatives and remains on paper. The problems observed in field studies are the inability to provide economic benefit and sustainability. The focus of this study on a specific region significantly contributes to understanding the local dynamics of women's cooperatives; however, it is recommended that similar studies be conducted in different regions to achieve universal generalizations. Regular training programs should be implemented, focusing on internal auditing, risk management, and financial analysis to enhance the internal audit processes of women's cooperatives. An independent and impartial internal audit mechanism should be established to ensure auditors operate within professional ethical standards. Integrating technological tools and software into auditing processes will enhance their efficiency, and internal audit standards should be defined at national or local levels. Audit results should be shared with members, and feedback mechanisms should be established by adopting a transparency principle. Regular external audits should complement these efforts, while technical support and guidance from governmental and non-governmental organizations remain critical. These recommendations aim to improve the internal audit capacities of cooperatives, fostering a more sustainable and effective operational structure.

Ethics committee approval for the study was obtained from the Süleyman Demirel University Ethics Committee on January 10, 2024, with document number 144-34.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that they all equally contributed to all processes of the research.

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