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Sunway University, Malaysia

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LIST OF COUNTRIES REPRESENTED

210 colleagues from 26 countries have joined to 2nd ECONEFE in İstanbul and 117 academic papers have been presented.

	Country	Number of Par-ticipants	%
1	Algeria	1	0.85%
2	Azerbaijan	3	2.56%
3	Bangladesh	2	1.71%
4	China	21	17.95%
5	Germany	2	1.71%
6	Greece	3	2.56%
7	India	5	4.27%
8	Indonesia	4	3.42%
9	Kazakhstan	3	2.56%
10	Korea	2	1.71%
11	Lithuania	1	0.85%
12	Malaysia	3	2.56%
13	Mexico	2	1.71%
14	Morocco	1	0.85%
15	Nigeria	3	2.56%
16	Norway	2	1.71%
17	Pakistan	1	0.85%
18	Philippines	1	0.85%
19	Qatar	1	0.85%
20	Russia	2	1.71%
21	Spain	6	5.13%
22	Thailand	1	0.85%
23	Türkiye	44	37.61%
24	UAE	1	0.85%
25	UK	1	0.85%
26	USA	1	0.85%
	TOTAL	117	100.00%

The Effect of Financial Decisions on Dividend Payout Policies: An Application on BIST Dividend Index Firms

Professor Dr. Turhan KORKMAZ

Mersin University, Faculty of Economics and Administrative Sciences, Department of Business Administration

Assist. Prof. Dr. Serdar YAMAN

Şırnak University, Faculty of Economics and Administrative Sciences, Department of Business Administration

Abstract

In this study, it is aimed to reveal the effects of the investment and financing decisions, and the financial performance that emerges as a result of these decisions on the firms' dividend payout policies in Türkiye. Another objective of the study is to test the dividend payout theories in the Turkish stock market. For the purpose of the study, data of the companies traded in the Borsa Istanbul (BIST) Dividend Index were collected. Financial sector companies were excluded from the scope of the study, due to their different financial statement characteristics. The scope of the study consists of companies that are included in the BIST Dividend Index, traded in Borsa Istanbul in the period of 2011-2022, whose data can be accessed regularly and that regularly payout dividends in the period of 2011-2022. As a result of the analyzes, it has been found that the liquidity ratio, financial leverage ratio, internal growth rate and sales growth rates has statistically significant and negative effects on the dividend payout ratio. The working capital ratio, interest coverage and return on assets ratio has been found to have statistically significant and positive effects on the dividend payout ratio. On the other hand, no significant relationship was found between the return on invested capital, asset growth rate and market value, and dividend payout ratio. As a result of the analyzes, important findings were obtained regarding the validity of the signal effect theory and the agency costs theory in the dividend payout policies of the BIST Dividend Index companies.

Keywords: Dividend Payout Policies, Investment Decisions, Financing Decisions, Internal Factors, Panel Data Analysis

1. Introduction

Investors who invest in stocks have two types of earnings expectations: dividends and capital gains. The dividend payout decisions, which imply that firms share some or all the profits they earn during the period with investors in the first few months of the following period, are as important for investors as they are for the managers. Dividend payout decisions, which are one of the fundamental functions of financial management, are among the important decisions that firm managers should make along with investment and financing decisions. The fact that the profits are not distributed to shareholders as dividends, in other words, the profits are kept in the firm through auto-financing, causes dividend payout

decisions to become related to financing and investment decisions. There are many studies examining the relationship between dividend payout decisions and investment and financing decisions and various theories developed as a result of these studies. Lintner's (1956) study is a pioneer in analyzing the internal and external factors affecting dividend payout policies. In the literature of finance, there are important dividend payout theories such as the signal effect theory, the tax effect theory, the agency cost theory, and the customer effect theory, in addition to the irrelevance theory developed by Miller and Modigliani (1961) and the bird-in-the-hand theory developed by Lintner (1962) and Gordon (1963).

The irrelevance theory states that financial leverage does not affect a company's value and dividend policies if it does not have to encounter income tax and distress costs (Miller and Modigliani, 1961). The bird-in-the-hand theory states that investors prefer the certainty of dividend payments of the firms whose stocks they hold to significantly higher capital gains that are possible to be realized in the future (Lintner, 1962; Gordon, 1963). It simply refers to a bird in the hand is worth two in the bush. On the other hand, the signaling effect theory suggest that changes in dividend payout policies provide information to the markets, particularly investors, about the current and future profitability of firms. As a result of their practices regarding investment policy, capital structure and dividend payout decisions, firms can eliminate the asymmetric information problem arising from differences in information levels and create a positive perception in the market and investors (Topaloglu and Korkmaz, 2019: 2). The theory simply suggests that companies with higher dividend payout expected to be more profitable than those with low dividend payout. According to the theory, the amount of dividends paid by companies to their shareholders is a signal to the capital markets regarding the financial condition of the company (Günay, 2015: 584). The tax effect theory evaluates the situation from a different angle. This theory argues that investors prefer capital gains to dividends due to high taxes on dividends (Okka, 2015: 629). The agency cost theory focuses the effects of the conflicts of interest between managers, shareholders, and creditors. Managers acting on their own interest may cause conflicts of interest between stakeholders. Agency costs arise from conflicts of interest between shareholders and management, resulting in costs due to dissatisfaction, disruption and ultimately inefficiencies. The main reason for this conflict of interest is the expenditures that do not meet the expectations of the shareholders and the unnecessary expansion investments. Another theoretical approach to dividend payout policies is customer effect theory. According to the customer effect theory, while some capital market investors want the companies whose shares, they bought to distribute the profits as dividends, some investors prefer the profit to be retained in the company. Companies that pursue a dividend policy in line with the customer effect theory make the decision to payout or retain the profits according to the preferences of the investors. The different preferences of shareholders arise from the fact that dividends and capital gains are subject to different taxation practices (Ceylan and Korkmaz, 2012: 280). Investors determine the companies they will invest in in line with different taxation practices. The theory states the investors who want to benefit from tax advantages related to capital gains do not invest in companies that payout dividends or sell their existing stocks.

The aim of the study is to reveal the effects of the investment and financing decisions, and the financial performance that emerges as a result of these decisions on the companies' dividend payout policies in Türkiye. Another objective of the study is to test the dividend payout theories in the Turkish stock market. In this context, the study consists of four sections. Following the introductory section where the theoretical framework is presented, the second section of the study describes the data set and the methodology followed in the analysis. In the third section, the findings of the panel regression analysis are presented and interpreted. The fourth and final section of the study includes the conclusion section where the findings are evaluated and discussed.

2. Data and Methodology

The objective of this study is to show the impact of companies' investment decisions, financing decisions and financial performances on dividend payout policy. Another objective of the study is to provide empirical evidence on which of the dividend payout theories is valid for the Turkish stock

market. In this regard, it is expected that the results of the study will contribute to the literature. The data of the companies traded in the Borsa Istanbul Dividend Index were used for the study. The start date of BIST Dividend Index was considered in determining the study period. The scope of the study consists of companies included in BIST Dividend Index, traded on Borsa Istanbul during the period 2011-2022, whose data can be accessed regularly, and which pay dividends regularly during the period 2011-2022.

At the time of the study, 86 companies are traded in the BIST Dividend Index. In determining the scope of the study, financial sector companies with different accounting characteristics were excluded from the scope. In this regard, brokerage houses, banks, exchange-traded funds, leasing and factoring companies, real estate companies, real estate funds, real estate investment funds, venture capital investment trusts, venture capital investment funds, holding companies, investment companies, securities investment trusts and insurance companies were excluded. A total of 18 companies in the groups were excluded from the study. Another limitation that was taken into consideration while creating the scope of the study is that the companies to be included in the study are traded on Borsa Istanbul during the period 2011-2022 and their data can be accessed regularly. It was found that 46 of the companies included in the BIST Dividend Index, excluding the financial sector, were traded on Borsa Istanbul during the period 2011-2022 and their data can be accessed regularly. The final limitation of the study is that the companies included in the index payout dividends regularly. Upon reviewing the financial statements, it was found that 18 of the companies included in the BIST Dividend Index during the study period and whose data could be accessed regularly throughout the study period paid out dividends on a regular basis.

In this context, the dataset of the study was created using the annual financial statements data for the period 2011-2022 of 18 companies of the BIST Dividend Index, whose stock market codes, and company names are listed in Table 1. The created dataset is a panel dataset with a cross-sectional dimension of 18 units and a time dimension of 12 years.

Table 1. Companies Included in the Research

No	Code	Company Name
1	AKCNS	Akçansa Çimento Sanayi ve Ticaret A.Ş.
2	AKSA	Aksa Akrilik Kimya Sanayii A.Ş.
3	ALKIM	Alkim Alkali Kimya A.Ş.
4	ASELS	Aselsan Elektronik Sanayi ve Ticaret A.Ş.
5	CCOLA	Coca-Cola İçecek A.Ş.
6	ECILC	Eis Eczacıbaşı İlaç Sınai ve Finansal Yatırımlar Sanayi ve Ticaret A.Ş.
7	EGEEN	Ege Endüstri ve Ticaret A.Ş.
8	ERBOS	Erbosan Erciyas Boru Sanayii ve Ticaret A.Ş.
9	FMIZP	Federal-Mogul İzmit Piston ve Pim Üretim Tesisleri A.Ş.
10	FROTO	Ford Otomotiv Sanayi A.Ş.
11	INDES	İndeks Bilgisayar Sistemleri Mühendislik Sanayi ve Ticaret A.Ş.
12	NUHCM	Nuh Çimento Sanayi A.Ş.
13	PETUN	Pınar Entegre Et ve Un Sanayii A.Ş.
14	PNSUT	Pınar Süt Mamulleri Sanayii A.Ş.
15	SARKY	Sarkuysan Elektrolitik Bakır Sanayi ve Ticaret A.Ş.
16	SELEC	Selçuk Ecza Deposu Ticaret ve Sanayi A.Ş.
17	SISE	Türkiye Şişe ve Cam Fabrikaları A.Ş.
18	TOASO	Tofaş Türk Otomobil Fabrikası A.Ş.

The variables used in the study are determined by considering the theoretical framework and the related literature on dividend payout policies. In this context, cash dividend payout ratio of firms is used as the dependent variable in the econometric model constructed within the scope of the study. In the model, working capital financing and investment policies of firms are represented by liquidity ratio and working capital investment ratio, while capital structure decisions are represented by leverage ratio. Interest coverage ratio is used to represent the efficiency of the firms' financing policies. Return on assets and return on invested capital ratios are used to represent firms' profitability, while the growth in assets ratios and growth in net sales ratios, and internal growth rates are used to represent firms' growth policies. Finally, the market capitalization of firms is included in the model as an independent variable. The variables used in the study are given in Table 2 together with the formulas used in their calculation and notations used in the econometric model.

Table 2. Variables Used in the Study

Dependent Variable	**Notation**	**Calculation**
Cash Dividend Payout Ratio	CDPR	Cash Dividend Payout / Net Profit
Independent Variable	**Notation**	**Calculation**
Liquidity Ratio	LR	(Current Assets - Inventories) / Short-Term Liabilities
Working Capital Investment Ratio	WCIR	Current Assets / Total Assets
Financial Leverage Ratio	FLR	Total Liabilities / Total Assets
Interest Covering Power	ICP	Profit Before Interest and Taxes / Interest Expenses
Return on Assets	ROA	Net Profit / Total Assets
Return on Invested Capital	ROIC	((1 – Tax Rate) * Operational Profit) / ((Total Financial Debt + Equity + Cash and Cash Equivalents) + (Total Financial Debt + Equity + Cash and Cash Equivalents) / 2)
Growth in Assets	GIA	Percentage change of Total Assets between periods t and t-1
Growth in Sales	GIS	Percentage change of Net Sales between periods t and t-1
Internal Growth Rate	IGR	$IGR = \frac{ROAxb}{1-ROAxb}$ ROA = Net Profit / Total Assets b = Retained Earnings Ratio
Market Value	MV	Stock Price in the Current Period * Number of Stocks in Circulation

In order to reveal the percentage change created by a 1% change in an independent variable on the dependent variable as a result of the analyses, the variables were assigned to percentage transformation was applied with the help of the formula $\frac{(t_1-t_0)}{t_0}$. The variables that constitute the data set of the study are calculated based on the financial statement data of the firms. Financial statement data of the firms were obtained from the Financial Information News Network (FINNET) Stock Expert financial database. The data set created within the scope of the study is a panel data set that includes both a 12-year time dimension (T) covering annual data for the period 2011-2022 and a horizontal cross-sectional dimension (N) of 18 firms, consisting of firms other than financial sector firms and holdings, which are continuously included in the BIST Dividend Index for the period 2011-2022. Due to the nature of the data set, the relationships between financial decisions and dividend payout policies are analyzed using panel regression analysis.

Within the scope of panel data analysis, basic assumptions such as multi-collinearity, cross-sectional dependence, homogeneity, stationarity, auto-correlation and heteroskedasticity are tested. The panel regression model developed in line with the results of the assumption tests is estimated and findings on

the relationship between dividend payout policies and internal financial decisions are presented. There are three types of panel data models: fixed effects model, random effects model and pooling model. If it is assumed that there is no difference between the countries or firms in the panel data set, the pool model should be used; if the countries or firms in the data set are randomly selected from a large population, the random effects model should be used; and if the data set focuses on a specific set of countries or firms and the results are limited to the behavior of this group of countries or firms, the fixed effects model should be used (Baltagi, 2014: 14-20). In line with this approach, it is accepted that the fixed effects model will be valid since the cross-sectional units that constitute the panel data set in this study are not randomly selected from a large sample, but rather, they are determined by focusing on firms operating in Türkiye, included in the BIST Dividend Index, and excluding financial sector firms and holdings.

Within the scope of panel regression analysis, the multi-collinearity, cross-sectional dependence, homogeneity, and stationarity of the series should be examined (Ün, 2015: 71). Within the scope of the study, whether the series will cause multi-collinearity problem is examined by Spearman correlation analysis and Variance Inflation Factor (VIF) analysis. Whether the series contain cross-sectional dependence is tested with the *CD* (Cross-section Dependence) test developed by Pesaran (2004), which gives consistent results when the cross-sectional dimension is greater than the time dimension in panel data. The homogeneity/heterogeneity properties of the series are tested with the Delta ($\tilde{\Delta}$) and Delta adjusted ($\tilde{\Delta}_{adj}$) tests developed by Pesaran and Yagamata (2008). The stationarity of the series is tested using first generation and second-generation unit root tests according to the results of cross-sectional dependence test and homogeneity tests. For the series that do not contain cross-sectional dependency the stationarity test is performed using the first-generation unit root test Levin, Lin and Chu (2002), while for the series, which contain cross-sectional dependency, the second-generation unit root test Pesaran (2007) *CIPS* test is used. Before model estimation, the models should be tested for the presence of heteroskedasticity and auto-correlation problems. In the models constructed within the scope of the study, the assumption of autocorrelation (serial correlation) is tested using LMp and Born and Breitung (2016) $LMp*$ tests, and the assumption of heteroskedasticity is tested using Breusch and Pagan (1979) LM_h test. The Period SUR (PCSE) robust estimator, which is based on the Period Corrected Standard Error (PCSE) methodology developed by Beck and Katz (1995), is used to estimate models with time or cross-sectional heteroskedasticity and auto-correlation problems. Pre-tests and analyses were conducted using EViews 12 and Gauss 22 econometric analysis software packages. The panel data model developed, and the main hypothesis tested through the model is as follows.

$$CDPR_{it} = \beta_0 + \beta_1 LR_{it} + \beta_2 WCIR_{it} + \beta_3 FLR_{it} + \beta_4 ICR_{it} + \beta_5 ROA_{it} + \beta_6 ROIC_{it} + \beta_7 GIA_{it} + \beta_8 GIS_{it} + \beta_9 IGR_{it} + \beta_{10} MV_{it} + u_{it} \quad (1)$$

H_0: Financial decisions have no effect on dividend payout policies.

In Equation 1 β_0 represent the constant term of the model, β_n denotes the slope coefficients for variables, subscripts *t* and *i* denote that the variables contain values for each firm and each period.

3. Findings

Within the scope of the study, firstly, descriptive statistics of the series and scatter diagrams are analyzed to observe the linear relationships between the dependent and independent variables. Then, multi-collinearity, cross-sectional dependence, homogeneity, and stationarity of the series are examined and auto-correlation and heteroskedasticity assumptions for the models are tested. Before model estimation, in order to obtain consistent and robust results, the presence of time and cross-sectional fixed effects and random effects in the models are investigated with F test, Breusch and Pagan (1980) *LM* test and Honda (1985) test in order to decide on the most appropriate estimator. Panel data model developed in line with the results of estimator specification tests is estimated with robust estimators and the results are evaluated and interpreted.

Descriptive statistics and Jarque-Bera normality test results for the variables are presented in Table 3.

Table 3. Descriptive Statistics and Normality Test Results

	CPDR	LR	WCIR	FLR	ICP	ROA
Mean	-0.067977	0.010125	0.011015	0.042268	0.706072	0.142717
Median	-0.043728	-0.003305	0.014405	0.015778	-0.064735	0.099955
Maximum	2.888098	1.044100	0.485268	1.430277	41.798460	3.533197
Minimum	-8.147767	-0.569111	-0.358538	-0.511519	-3.615473	-7.768113
Std. Dev.	0.794348	0.252300	0.108721	0.223168	3.747117	0.815612
Skewness	-5.196649	0.842261	0.029310	2.262603	7.601913	-3.717965
Kurtosis	55.114120	4.866215	5.654348	13.739770	74.530640	44.641760
Jarque-Bera	25415.12	56.88	63.44	1222.38	48130.10	16103.96
Probability	0.000000***	0.000000***	0.000000***	0.000000***	0.000000***	0.000000***
	ROIC	**GIA**	**GIS**	**IGR**	**MV**	
Mean	0.224629	0.259611	0.285099	0.437816	0.413041	
Median	0.086552	0.188908	0.167024	0.142932	0.200357	
Maximum	13.479300	1.301450	2.104039	15.570750	3.144781	
Minimum	-0.677561	-0.375731	-0.547113	-5.761854	-0.488189	
Std. Dev.	1.039506	0.283651	0.383978	1.720916	0.654887	
Skewness	9.945589	1.565283	2.263405	4.080992	1.532248	
Kurtosis	124.618700	5.886498	9.344276	34.268440	5.571226	
Jarque-Bera	136680.90	163.19	546.68	9399.00	144.02	
Probability	0.000000***	0.000000***	0.000000***	0.000000***	0.000000***	

Note: The sign *** indicates 1% significance level.

According to the statistics in Table 3, the ICP variable stands out as the variable with the highest mean and standard deviation values. Skewness values show that CPDR and ROA variables are negatively skewed while the other variables are positively skewed. When Kurtosis values are analyzed, it is seen that all variables are leptokurtic. According to the Jarque-Bera normal distribution test results, the variables included in the model do not exhibit a normal distribution.

The linear relationships between the financial decisions included in the model as independent variables and the cash dividend payout ratio variable included as dependent variables are analyzed through scatter diagrams and regression lines. Scatter diagrams between variables are presented in Figure 1.

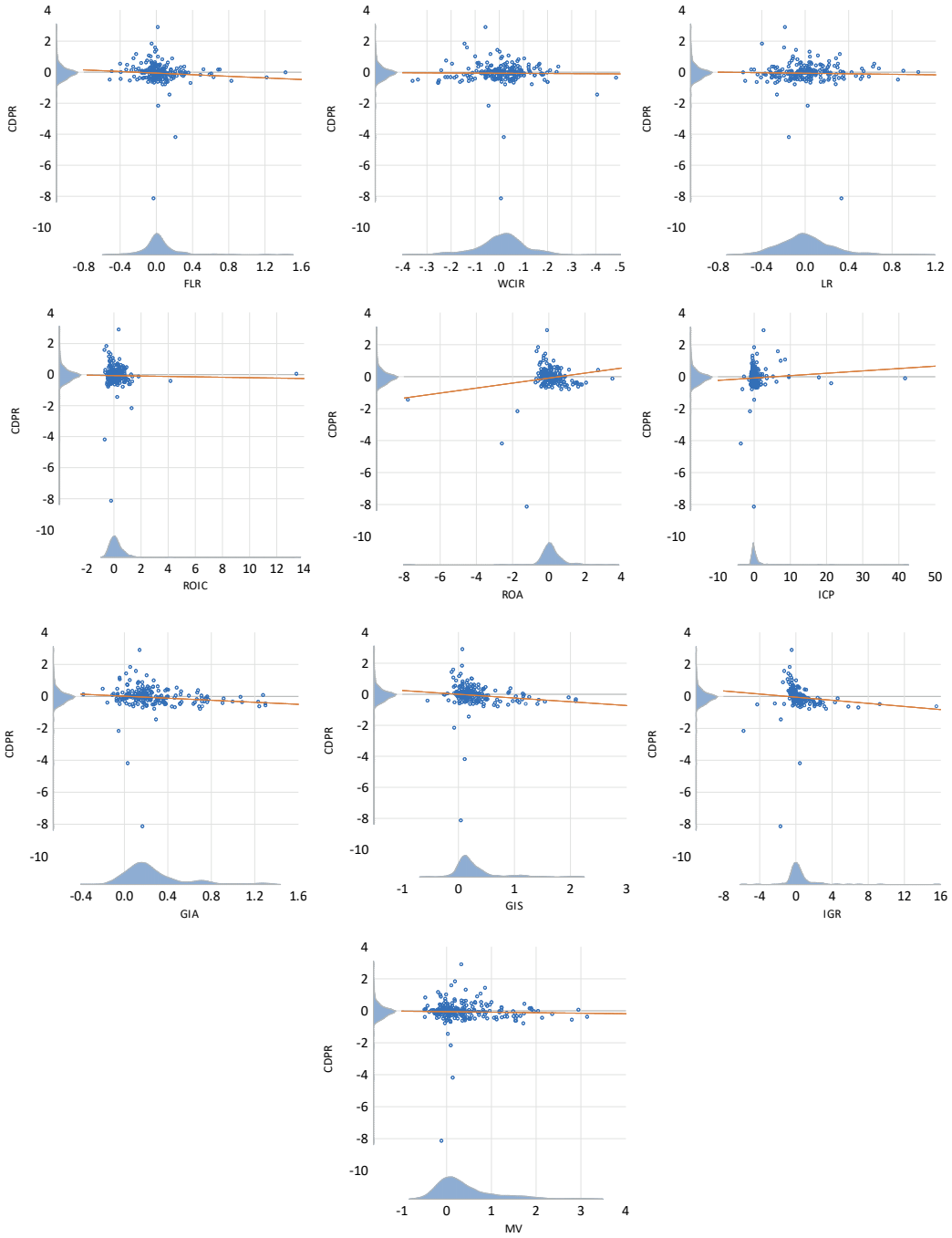

Figure 1. Scatter Diagrams between Dependent and Independent Variables

Figure 1 shows that the regression line showing the relationship between LR and WCIR, which represent working capital financing and investment policies, and CPDR has a horizontal and negative slope. While the slope of the regression line between FLR and CPDR is negative, the slope of the regression line between ICR and CPDR is positive. As expected, the slope of the regression line between ROA and CPDR is positive. However, contrary to expectations, the slope of the regression line between ROIC and CPDR is negative. Figure 1 shows that the slope of the regression line between all three growth rates and CPDR is negative, as expected. Similarly, the slope of the regression line between MV and CPDR is also negative.

In panel data analyses, the presence of a high level of correlation between the independent variables included in the model is called multi-collinearity and may cause deviations in estimations (Gujarati,

2004: 341-386). Within the scope of the study, whether the independent variables will cause multi-collinearity problem in the model is analyzed by Spearman correlation analysis and VIF analysis. As a result of Spearman correlation analysis, it was accepted that variables with a correlation higher than 0.75 or lower than -0.75 would cause multi-collinearity problem. If the VIF values of the independent variables are higher than 4, it is accepted that the relevant variable will cause multi-collinearity problem. Spearman correlation matrix and VIF analysis results for independent variables are presented in Table 4.

Table 4. Correlation Matrix and VIF Analysis Results

Spearman Correlation Analysis										
	LR	**WCIR**	**FLR**	**ICP**	**ROA**	**ROIC**	**GIA**	**GIS**	**IGR**	**MV**
LR	1.0000									

WCIR	0.1122	1.0000								
	(0.1001)	-----								
FLR	-0.4894	0.1794	1.0000							
	(0.0000)***	(0.0082)***	-----							
ICP	-0.0382	-0.0569	-0.0359	1.0000						
	(0.5762)	(0.4055)	(0.5996)	-----						
ROA	0.1441	-0.1079	-0.1183	0.1131	1.0000					
	(0.0343)**	(0.1138)	(0.0827)*	(0.0973)*	-----					
ROIC	0.0683	0.0994	-0.0475	0.0686	0.1973	1.0000				
	(0.3178)	(0.1452)	(0.4878)	(0.3155)	(0.0036)***	-----				
GIA	-0.0973	0.0912	0.2660	-0.0024	0.2647	0.1931	1.0000			
	(0.1540)	(0.1818)	(0.0001)***	(0.9717)	(0.0001)***	(0.0044)***	-----			
GIS	0.0080	0.1594	0.0195	-0.0962	0.2483	0.1217	0.7378	1.0000		
	(0.9067)	(0.0191)**	(0.7753)	(0.1588)	(0.0002)***	(0.0742)*	(0.0000)***	-----		
IGR	0.0151	0.0154	-0.0304	0.0187	0.4345	0.0926	0.2724	0.3289	1.0000	
	(0.8253)	(0.8218)	(0.6567)	(0.7844)	(0.0000)***	(0.1753)	(0.0000)***	(0.0000)***	-----	
MV	-0.0451	0.0096	0.1612	0.1012	0.2316	0.1162	0.5184	0.4729	0.2055	1.0000
	(0.5094)	(0.8884)	(0.0177)**	(0.1383)	(0.0006)***	(0.0885)*	(0.0000)***	(0.0000)***	(0.0024)***	-----

Variance Inflation Factor (VIF) Analysis		
	R^2	**VIF**
LR	0.303356	1.435453
WCIR	0.161945	1.193239
FLR	0.412881	1.703232
ICP	0.06639	1.071111
ROA	0.290034	1.408518
ROIC	0.089144	1.097868
GIA	0.653011	2.881936
GIS	0.634699	2.737469
IGR	0.243857	1.322501
MV	0.319778	1.470108

Note 1: Values in parentheses represent probability values.
Note 2: The sign *** indicates %1, the sign ** indicates %5 and the sign * indicates %10 significance level.
Note 3: The VIF values for the independent variables were calculated using the formula $\frac{1}{(1-R^2)}$ over the R^2 values obtained from the least squares regression models in which each independent variable is the dependent variable, and the others are independent variables, respectively.

According to the results of the Spearman correlation analysis in Table 4, the highest correlation observed between pairs of independent variables is between GIA and GIS variables with 0.73. The fact that the correlation degrees between the independent variable pairs are neither greater than 0.75 nor less than -0.75 indicates that these variables can be included in the regression model together and that they will not cause multi-collinearity problems. The findings of the VIF analysis also support the results of the spearman correlation analysis. According to the results of VIF analysis, all independent variables have VIF values considerably smaller than the critical value of 4. These results indicate that the independent variables will not cause deviations in the model due to multi-collinearity.

To test for cross-sectional dependence among the units in the data set, the *CD* test developed by Pesaran (2004), which provides consistent results when the cross-sectional dimension is greater than the time dimension, is used. The homogeneity of the slope coefficients in the series is analyzed using Pesaran and Yagamata (2008) $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests. The results of the cross-section dependence test and homogeneity tests are presented in Table 5.

Table 5. Cross-Sectional Dependence and Homogeneity Tests Results

Variables	Pesaran (2004) *CD* Test			Pesaran and Yagamata (2008) Delta Tests				
				$\tilde{\Delta}$		$\tilde{\Delta}_{adj}$		Decision
	Statistics	Prob.	Decision	Statistics	Prob.	Statistics	Prob.	
CDPR	3.839707	0.0001***	Dependent	-1.565	0.941	-1.807	0.965	Homogen
LR	0.268725	0.7881	Independent	0.785	0.216	0.906	0.182	Homogen
WCIR	0.718195	0.4726	Independent	-1.155	0.876	-1.334	0.909	Homogen
FLR	1.632203	0.1026	Independent	0.791	0.214	0.913	0.180	Homogen
ICP	9.644479	0.0000***	Dependent	-0.415	0.661	-0.479	0.684	Homogen
ROA	4.246734	0.0000***	Dependent	1.472	0.071*	1.699	0.045**	Heterogen
ROIC	2.699969	0.0069***	Dependent	-0.242	0.596	-0.280	0.610	Homogen
GIA	22.87395	0.0000***	Dependent	1.954	0.025**	2.257	0.012**	Heterogen
GIS	29.55208	0.0000***	Dependent	2.258	0.012**	2.608	0.005***	Heterogen
IGR	4.619467	0.0000***	Dependent	-0.238	0.594	-0.274	0.608	Homogen
MV	23.37945	0.0000***	Dependent	-1.254	0.895	-1.447	0.926	Homogen
Null Hypothesis for Cross-sectional Dependency Test **H_0:** No cross-sectional dependency				**Null Hypothesis for Homogeneity Tests** **H_0**: No heterogeneity				
Note: The sign *** indicates 1% and the sign ** indicates 5% significance level.								

According to Pesaran (2004) *CD* test results, LR, WCIR and FLR variables do not have cross-sectional dependence, while the opposite result is true for other variables. According to the results of Pesaran and Yagamata (2008) $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests, the slope coefficients of ROA, GIA and GIS variables are heterogeneous while the slope coefficients of other variables are homogeneous. In line with the *CD* test results, the stationarity test for LR, WCIR and FLR variables is performed with the Levin, Lin and Chu (2002) test, which is one of the first-generation unit root tests and gives homogeneous results, while the stationarity test for the other variables is performed with the Pesaran (2007) *CIPS* test, which is one of the second-generation unit root tests. The results of Levin, Lin and Chu (2002) unit root test are presented in Table 6 and Pesaran (2007) *CIPS* test results are presented in Table 7.

Table 6. First Generation Unit Root Test Results

Levin, Lin and Chu (2002) Test					
Model	**Intercept**		**Intercept and Trend**		**Decision**
Variables	**Statistic**	**Prob.**	**Statistic**	**Prob.**	
LR	-18.0166	0.0000***	-15.1851	0.0000***	I(0)
WCIR	-12.8596	0.0000***	-12.0713	0.0000***	I(0)
FLR	-19.2509	0.0000***	-18.8169	0.0000***	I(0)
Null Hypothesis for Levin, Lin and Chu (2002) Test **H_0:** Series are not stationary					
Note 1: The lag lengths in the tests were determined according to the Schwarz Info Criterion. **Note 2:** The sign *** indicates 1% significance level.					

According to the results of Levin, Lin and Chu (2002) unit root test in Table 6 and Pesaran (2007) *CIPS* test in Table 7, all variables included in the model are stationary at level.

Table 7. Second Generation Unit Root Test Results

Pesaran (2007) *CIPS* Test						
Model		**Constant**		**Constant and Trend**		**Decision**
Variables	**Statistic**	***CIPS***	***Truncated CIPS***	***CIPS***	***Truncated CIPS***	
CDPR	t-Statistic	-3.44970	-3.25600	-4.13460	-3.58374	I(0)
	P-value	<0.01***	<0.01***	<0.01***	<0.01***	
ICP	t-Statistic	-5.15585	-4.15446	-4.71036	-4.07695	I(0)
	P-value	<0.01***	<0.01***	<0.01***	<0.01***	
ROA	t-Statistic	-3.48603	-3.48603	-4.19494	-3.63785	I(0)
	P-value	<0.01***	<0.01***	<0.01***	<0.01***	
ROIC	t-Statistic	-2.57709	-2.50334	-2.90940	-2.96606	I(0)
	P-value	<0.05**	<0.05**	<0.05**	<0.05**	
GIA	t-Statistic	-2.97599	-3.46979	-3.62250	-3.34274	I(0)
	P-value	<0.01***	<0.01***	<0.01***	<0.01***	
GIS	t-Statistic	-2.28490	-2.19071	-2.92110	-2.95204	I(0)
	P-value	<0.10**	<0.10**	<0.05**	<0.05**	
IGR	t-Statistic	-3.59944	-3.42074	-3.37991	-3.34515	I(0)
	P-value	<0.01***	<0.01***	<0.05**	<0.01***	
MV	t-Statistic	-2.84587	-2.81857	-3.22706	-3.12811	I(0)
	P-value	<0.01***	<0.01***	<0.05**	<0.05**	
Critical Values	**Significance level**	**Constant**		**Constant and Trend**		
	%1	-2.65	-2.58	-3.42	-3.20	
	%5	-2.34	-2.30	-3.00	-2.84	
	%10	-2.18	-2.16	-2.81	-2.73	
Null Hypothesis for Pesaran (2007) *CIPS* Test **H_0:** Series are not stationary						
Note 1: The lag lengths in the tests were determined according to the Schwarz Info Criterion. **Note 2:** The sign *** indicates 1% and the sign ** indicates 5% significance level.						

In order to test the assumption of autocorrelation in the model, Baltagi and Li (1991) LM_p test and Born and Breitung (2016) LM_p^* test is used, while the Breusch and Pagan (1979) LM_h test is used to test the assumption of heteroscedasticity. Baltagi and Li (1991) LM_p test, Born and Breitung (2016) LM_p^* test and Breusch and Pagan (1979) LM_h test results are given in Table 8.

Table 8. Diagnostic Test Results

Test	**Baltagi and Li (1991) LM_p**	**Born and Breitung (2016) LM_p^***	**Breusch and Pagan (1979) LM_h**
Statistics	0.722171	4.640774	534.8916
Prob.	0.395433	0.031221**	0.000000***
	Null Hypothesis		**Null Hypothesis**
	H_0: No autocorrelation		**H_0:** No heteroskedasticity
Note: the sign *** denotes 1% and the sign ** denotes 5% significance level.			

According to the results of Baltagi and Li (1991) LM_p test in Table 8, there is no auto-correlation problem in the model, while according to the results of Born and Breitung (2016) LM_p^* test, which

is an improved version of Baltagi and Li (1991) LM_p test, the model contains auto-correlation at 5% significance level. According to the results of Breusch and Pagan (1979) LM_h test, there is heteroskedasticity in the model at 1% significance level.

The presence of autocorrelation and heteroskedasticity problems in panel regression models may cause inconsistencies and high deviations in the analysis results. This necessitates the use of estimators that are robust to autocorrelation and heteroscedasticity. In order to avoid the negative effects of autocorrelation and heteroskedasticity problems detected in the model developed in this study, model estimations were performed using the Period SUR (PCSE) robust estimator developed by Beck and Katz (1995). The F test is used to examine whether the variations in the fixed parameter in the models occur only across units, only across periods and both across periods and units, in other words, whether there are fixed effects in the time dimension, cross-sectional dimension and two-way dimension. The study also examined the presence of random effects in the models with the Breusch and Pagan (1980) *LM* test and Honda (1985) test. The results of F test, Breusch and Pagan (1980) *LM* test and Honda (1985) test are presented in Table 9.

Table 9. Results of Estimator Specification Tests

Test	Statistic	Prob. Value
F-Group Fixed Effects	1.430901	0.126592
F-Time Fixed Effects	1.275633	0.241769
F-Two Way Fixed Effects	1.382467	0.108073
LM-Group Random Effects	1.054426	0.30449
LM-Time Random Effects	0.100657	0.751043
LM-Two Way Random Effects	1.155083	0.561277
Honda- Group Random Effects	1.026852	0.152245
Honda- Time Random Effects	0.317265	0.375521
Honda- Two Way Random Effects	0.950435	0.170946
Null Hypothesis for the Tests		
Group Effects	**H_0:** While there is a cross-section effect, there is no time effect	
Time Effects	**H_0:** While there is a time effect, there is no cross-section effect	
Two Way Effects	**H_0:** No cross section and time effect	

According to the F test results in Table 9, the F test probability values for group fixed effects, time fixed effects and two-way fixed effects are statistically insignificant. Similar results are obtained from Breusch and Pagan (1980) *LM* and Honda (1985) tests. The results of the panel data regression model developed to determine the relationship between financial decisions and dividend payout policies of BIST Dividend Index firms are presented in Table 10.

Table 10. Panel Data Analysis Results

Dependent Variable: CDPR Method: Panel EGLS (Period SUR) Period SUR (PCSE) standard errors & covariance			Periods included: 12 Cross-section included: 18 Sample (Adjusted): 2011-2021 Total panel (balanced) observation: 216	
Variable	**Coefficient**	**Std. Error**	**t-Statistics**	**Prob.**
C	0.048508	0.019668	2.466372	0.0145**
LR	-0.30742	0.077912	-3.94573	0.0001***
WCIR	0.668088	0.180677	3.697686	0.0003***
FLR	-0.43822	0.086831	-5.04687	0.000***
ICP	0.022141	0.008328	2.658611	0.0085***
ROA	0.278117	0.020546	13.53659	0.0000***
ROIC	-0.00321	0.019036	-0.1685	0.8664
GIA	-0.09521	0.097499	-0.97655	0.3299
GIS	-0.25346	0.067286	-3.76695	0.0002***
IGR	-0.0883	0.008908	-9.91218	0.0000***
MV	0.034609	0.034969	0.989697	0.3235
R^2	0.618837	**Root MSE**		0.97304
Adjusted R^2	0.600244	**Mean dependent var**		-0.13870
S.E. of regression	0.998804	**S.D. dependent var**		1.574214
F-Statistic	33.28275	**Sum squared resid**		204.5101
P-Value (F-Statistic)	0.000000***	**Durbin-Watson Statistic**		1.983882

Note: The sign *** indicates 1% and the sign ** indicates 5% significance level.

When the results of the panel regression analysis in Table 10 are analyzed, it is seen that the F-probability value for the model is significant at the 1% significance level. This result requires the rejection of the null hypothesis tested in the model and indicates that the financial decisions taken by the firm management are statistically significant in explaining the changes in dividend payout policies. The R^2 value of the model is 61.88%. According to the results of the analysis, the independent variables can be explained approximately 61.88% of the changes in the cash dividend payout ratio. When the results of the analysis are analyzed on a variable basis, it is found that liquidity ratio, leverage ratio, growth in sales ratio, and internal growth rate have statistically significant and negative effects on dividend payout policies at 1% significance level. On the other hand, working capital investment ratio, interest coverage ratio and return on assets ratio have statistically significant and positive effects on dividend payout policies at 1% significance level. As a result of the analysis, it was found that the ratio of return on invested capital and the growth in asset ratio, and market value do not have a statistically significant effect on dividend payout policies. As a result of the analyses, it is determined that a 1-unit increase in the liquidity ratio, leverage ratio, growth in sales ratio and internal growth rate of the firms leads to a 0.30-unit, 0.43-unit, 0.25-unit and 0.08-unit decrease in the cash dividend payout ratio, respectively. On the other hand, the results of the analysis show that a 1-unit increase in the working capital investment ratio, interest coverage ratio, and return on assets ratio leads to a 0.66-unit, 0.02-unit and 0.27-unit increase in the cash dividend payout ratio, respectively. The fact that the Durbin-Watson statistic for the model is close to 2 indicates that the auto-correlation problem in the model is eliminated thanks to the robust estimators.

4. Conclusion

This study aims to reveal the effects of firms' investment decisions, financing decisions and financial performance on dividend payout policies and to provide empirical evidence on which dividend theories are valid in the Turkish stock market by using the data of firms traded in the BIST Dividend Index for the period 2011-2022. The data set of the study is a panel data set constructed using the annual financial statement data of BIST Dividend Index firms for the period 2011-2022.

In the econometric model constructed within the scope of the study, working capital financing and investment policies, capital structure decisions, interest coverage, profitability ratios, growth rates and market capitalization are included as independent variables, while cash dividend payout ratio is included as the dependent variable. Within the scope of the study, a panel regression model was developed to determine the relationship between financial decisions and dividend payout policies. Before estimating the panel regression model, multi-collinearity, cross-sectional dependence, homogeneity, stationarity, auto-correlation and heteroskedasticity assumptions are tested with various econometric tests.

Panel regression analysis provides significant evidence that financial decisions are influential factors on dividend payout policies. As a result of the analysis, the null hypothesis stating that financial decisions have no effect on dividend payout policies is rejected. As a result of the analysis, it is determined that increases in the liquidity ratio, which is an indicator of working capital financing policy, lead to a decrease in the dividend payout ratio. This finding suggests that the disadvantageous situations arising from high opportunity cost in firms with low levels of short-term debts have a negative impact on dividend distribution decisions. On the other hand, this finding suggests that firms with high liquidity achieve this high liquidity by keeping the level of dividend payout low. It is found that firms that increase their working capital investments also increase their dividend payout levels in the following periods. A negative relationship is found between firms' indebtedness level and dividend payout decisions. This finding indicates that financial distress and bankruptcy costs caused by high debt levels make dividend payout more difficult. Another finding of the study indicates that increases in firms' interest coverage and return on assets have a positive impact on dividend payout decisions. The findings of the study indicate that the decisions made by firm managers towards internal growth and the growth in sales reduce the level of dividend payout and that firm managers aim to grow by leaving a significant portion of the profits generated in the firm through auto-financing. The relationships between liquidity ratio and cash dividend payout ratio suggest that the tax effect theory is valid in the dividend payout policies of BIST Dividend Index firms. However, the relationships between return on assets, financial leverage, working capital investments, net sales, internal growth rate and interest coverage rate and cash dividend payout ratio suggest that the signal effect theory and agency costs theory are valid in the dividend payout policies of BIST Dividend Index firms.

The empirical findings of the study are important in terms of guiding firms' dividend payout policies. The findings are also thought to be useful for many other groups such as portfolio managers, shareholders, and researchers.

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State and prospects of application of Artificial Intelligence in the banking sector of the Republic of Kazakhstan

A.M. Baimukhamedova[1] *, R.A. Pritula[2], S.G. Eslyamov[3], G.S. Baimukhamedova[4], H.H. Isaeva[5]

[1]* Gazi University, Ankara, Türkiye, [2]Kostanay Engineering and Economic University named after M. Dulatov, [3]Eurasian National University, [4,5]Kostanay Social-Technical University, Kostanay, Kazakhstan

Abstract

The state of application of artificial intelligence (AI) in the banking sector is considered. A description of the main directions of the application of AI is given. The main purpose of artificial intelligence in the banking sphere is to get an idea of clients' preferences, and their level of satisfaction with banking services, to help determine clients' future expectations with respect to new financial products and technologies. It is noted that the customer-oriented goal of implementing artificial intelligence in the banking sector is to provide personalized and high-quality conditions to form customer satisfaction in parallel with efficient and time-saving services. The dynamics of the application of AI technologies in the banking sector of the Republic of Kazakhstan for 2018-2022 are considered. When artificial intelligence technologies are introduced into banking practice, they help to effectively explore the database and make it easier for banks to form recommendations, and forecasts and perform specialized financial consultations for clients. With these apps, you can quickly get information about financial strategies, credit rates, and future market progress. The customer-oriented goal of the introduction of artificial intelligence in the banking sector is to provide personalized and high-quality conditions for the formation of customer satisfaction in parallel with efficient and time-saving services. In the future, many banks of the republic may become fully digitalized and close their branches in different regions of the country.

Keywords: artificial intelligence, banking sector, customers, banking services, machine learning, digital technology, machine learning.

1. Introduction

We are at the threshold of an era in which artificial intelligence and machine learning technologies are becoming widespread and widely used.

Moreover, the use of machine learning helps us at every stage of client interaction, from attracting new clients to providing trading services and retention techniques, and most importantly, is part of the democratization of trading and investment services that underpins Saxo Bank's business. Previously only large clients received personalized support from a financial advisor and broker, but today we strive to offer this high level of personalized service to everyone.

If technological tools have made the global financial market accessible to everyone, then artificial intelligence will help to provide all clients with individually prepared and relevant information materials and services. This circumstance will change the situation in the area of creating a level playing field for financial services.

Artificial Intelligence is one of today's most advanced technologies that can be used in almost any field. Because of its ability to promote consumer innovation, these technologies allow users to make faster, more informed and more effective decisions.

The main purpose of artificial intelligence in the banking sector is to get an idea of the preferences of customers, their level of satisfaction with banking services, to assist in determining the future expectations of customers regarding new financial products and technologies.

In the banking sector, artificial intelligence has a wide range of applications. Here are some of them:

1. Customer satisfaction.

Artificial intelligence helps to increase revenue, make decisions faster and build relationships with

customers. The presence of artificial intelligence not only guarantees customer satisfaction, but also helps banks to maintain the effective functioning of the back office.

2. Process automation.

AI can be used to automate routine banking operations, such as transaction processing, authentication and authorization of transactions, and management of back-office processes. This allows banks to reduce costs and improve operational efficiency.

3. Personalized service and recommendations.

AI can analyze data about customers, their preferences, purchases, and behaviors to offer personalized recommendations and services. Banks can use AI to provide customers with customized financial plans, budget management, and other advice based on their unique needs.

4. Virtual assistants, chatbots and customer service.

AI can be used to create virtual assistants and chatbots that can answer customer questions, provide information about banking services, account balances, transaction history, and help with basic banking transactions, as well as help with payments and other operations.

With the help of chatbots, banks can understand each customer's needs, form the right commercial offers, and implement loyalty programs.

AI helps clients find out transaction details, the composition of additional services offered. This increases the availability and convenience of customer service.

5. Detecting and combating fraud.

Fraud in banking is one of the most serious industry problems. When cyberattacks aimed at financial fraud occur, it is very difficult for the affected person and the bank to cope with them without the AI detecting the fact of penetration into the system. The sooner the AI receives a response about the threat, the sooner it will be eliminated - this helps the bank to retain its regular customers. Artificial intelligence has a unique ability to detect and minimize the risk of bank fraud. One of the ways to detect bank fraud is to scan extensive transactional data and track any unorthodox actions or irregular behaviors [1]. AI can analyze large amounts of data and detect anomalies and unusual patterns indicating possible fraud. This helps banks use AI to detect suspicious activity based on transaction data. It also allows them to more effectively detect and prevent fraudulent banking transactions, identify suspicious transactions more accurately and quickly, and prevent financial losses, protecting customers and reducing risk to themselves.

6. Risk analysis and credit scoring

AI can be used to analyze customer data and determine creditworthiness. Machine learning and AI algorithms can take many factors into account and predict the likelihood of default or default. This helps banks make more informed lending and risk management decisions.

7. Analytics and forecasting

AI can analyze large amounts of data and identify hidden patterns and trends. Banks can use this information to predict market conditions, determine customer behavior, and provide personalized offers and services.

8. Beta testing and recommendations

AI can help banks identify the most promising investment portfolios, optimize their risk profile and offer recommendations to clients based on their financial situation, preferences and goals.

9. Digitization.

Digitization uses technology support to convert data into digital format [2,3]. There are many advantages of using digitization in the banking industry, which allow us to achieve the following goals:

1) improving the quality of customer service;

2) optimization of time costs for both the client and the bank;

3) reducing the likelihood of human error risk;

4) formation of customer loyalty;

5) ensuring cash flow;

6) organization of non-cash payments.

These are just a few examples of AI applications in the banking sector. In general, the use of AI allows banks to increase efficiency, improve customer service, and make more informed and data-driven decisions.

A review of banking practices allowed us to identify key areas implementation of AI. First of all, we should mention customer-centricity based on artificial intelligence (AI), which means providing banking services with customer preferences.

Next is the creation of a technology platform that supports all banking and customer processes.

Another is to optimize costs. For example, in 2020, the introduction of AI brought Sberbank a financial effect of 100bn rubles - this is both money earned and money saved. In 2021, this figure was 200 billion, told the First Deputy Chairman of the Management Board of Sberbank [4].

According to a Gartner study, by 2023, consumers will manage 85% of all business relationships with banks using chatbots. Banks can offer consultations on a large scale and with greater impact, using chatbots with artificial intelligence that can study the user habits of customers. These mechanisms can access data from the past about the user's transactions, offers, credit card usage, investment strategies, fund management model, etc. and make recommendations to the user based on this data in accordance with best banking practices.

2. Literature Review

The application of AI has been found in multiple fields, including government payments, healthcare, online trading businesses, logistics, the financial industry, etc. [5]. AI can help banks both manage their financial services and engage customers while offering personalized products [6]. It has the fledibility to fulfill the needs of organizations of all sizes, from small to large. The basis of AI is mathematical

algorithms of high complexity, built on the basis of certain logical conditions and implemented through computer systems

According to [7], AI-based digital financial services are more efficient and faster than the traditional methods of performing various financial computational tasks in banking operations.

In the banking industry, avoiding fraud has been made possible by the use of AI technologies [8,9]. These technologies have ensured high efficiency of banking operations as well as the accuracy and reliability of banking services [10].

The banking sector is one of the most reliable and critical sectors, and it accounts for a significant portion of GDP contribution within the servicing sector of the economy. The application of AI technologies intervened and accelerated automation [11], blockchain and Fintech [12]. Artificial intelligence technology involves banking with smartphones, ATMs, cash deposit machines, short message services, and e-mail. These technologies have many applications, from analyzing data to formulating strategies and setting future goals and objectives for banks. The role and importance of AI are increasing rapidly due to the fact that AI processes information from the database faster to respond accurately in a competitive market and make rational decisions [13]. AI is widely used in the areas of banking, such as asset management, risk management, customer service, and data analysis. Given the nature of data in banks, AI has an important role to play in processing data to predict the future of the economy and the banking industry.

The main directions of application of artificial intelligence in the banking system.

1. Cost savings: The use of artificial intelligence in banking has significantly reduced paperwork and printing costs. According to [14], the global banking system will save $416 billion by 2023. The operating costs of banks consist of free access to information for managerial and client personnel.

2. The development of chatbots - one of the most unique and promising artificial intelligence technologies. Chatbot includes software that interacts with customers with pre-programmed customer requests and provides polite, effective communication with customers, as well as instant solutions to problems that arise. The chatbot not only solves customer queries but also collects data about customer inquiries that can be used to solve future problems.

3. Creation of a technological platform that supports all banking and client processes and ensures customer focus, which means providing banking services tailored to client preferences.

3. Methodology

One of the priority areas of the country's development, which is under the special control of the leadership of Kazakhstan, is the digitalization of various sectors of the economy [4]. The prospects of using digital technologies in the financial sector are a fait accompli. The very nature of non-cash payments implies conducting operations not with physical money, but with their digital equivalents, expressed in the form of records in electronic accounts at banks. The banking sector remains a pioneer in this direction. The issue of financial technology, in one way or another, is related to the use of all kinds of non-cash payments. In this regard, digital services in the financial market will always be ahead, they will set the tone for other sectors of the economy, which are also tied to the servicing of cash flows. The financial sector is an important element of the economy that determines the speed and quality of change. E-payments and e-commerce are now an integral part of the financial sector. The financial sector is a leader in the implementation and use of innovative technologies and digital services for customer interaction. The use of digital public services has improved in Kazakhstan [5]. There is every reason to believe that the development of innovative technologies contributes to the transformation of the financial sector in its current state and will have an impact on its modernization in the future. Information technology has evolved from massive computers to ultra-thin and portable laptops and tablets.

When artificial intelligence technologies are introduced into banking practice, they help to effectively explore the database and make it easier for banks to form recommendations, forecasts and perform specialized financial consultations for clients. With these apps, you can quickly get information about financial strategies, credit rates and future market progress [6].

The scientific controversy regarding opportunities in the financial services industry is spreading today against the background of significant interest emerging around technology. The cumulative potential cost savings for banks from AI-based applications are estimated at $447 billion by 2023, with the front and middle office accounting for $416 billion in total [7].

Banks can benefit from artificial intelligence models that can be created by obtaining information from multiple financial market sources, and offer trading platforms based on automated artificial intelligence systems.

There is already a group of leaders among Russian banks in the application of artificial intelligence and machine learning technologies. The rating agency "Expert RA" and RAEX (RAEX-Analytics) have prepared their classification according to the level of use of AI technologies. The survey was attended by the leaders of the Russian market in the field of AI and ML technologies. There is no "below average" class in the classification given in the table, since banks that pay little attention to AI technologies did not consent to filling out the questionnaire. A number of banks that could qualify for the "above average" class refused to disclose information [8].

4. Analysis and results

In recent years, Kazakhstan has done a lot of work on the use of artificial intelligence in banking, the introduction of AI technology.

The implementation of AI technologies in the banking sector of the Republic of Kazakhstan is shown in Figure 1.

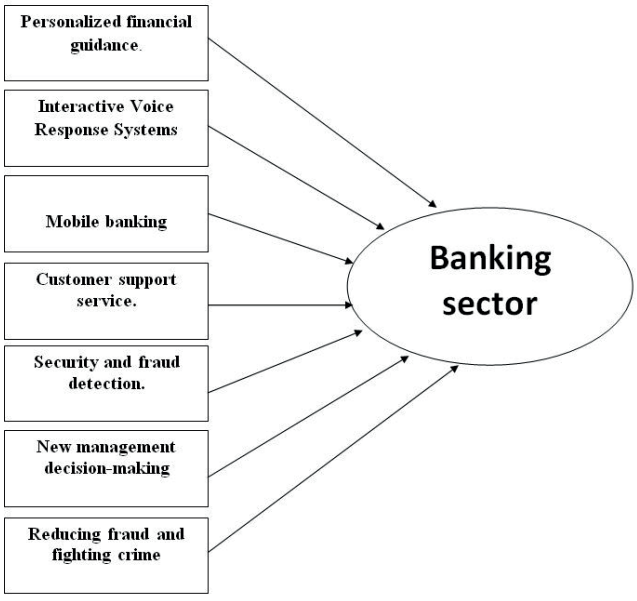

Figure 1 - AI technologies implemented in banking

At present, the application of the above-mentioned AI technologies allows to obtain the following results:

1. Personalized financial guidance.

Artificial intelligence will help clients make simple and quick financial decisions regarding obtaining up-to-date information about the current market structure, proposals for financial products in which it is advisable to invest.

2. Interactive Voice Response Systems (IVRS).

The automated voice system helps in interacting with customers, routing calls to the relevant banking departments, informing and consulting clients [20].

3. Banking services with voice support

For the foreseeable future, customer support services will remain an integral part of banking and other financial services, so machine learning in this area is vital. Investments in call processing and automation chatbots for many of the largest banks, including JPMorgan Chase, Bank of America, Citibank, CNC and American Bank, are a priority, and their developments are largely focused in this area to improve customer service while increasing revenue.

4. Security and fraud detection.

Machine Learning (ML) can use algorithms to identify signs of fraud in relation to specific actions, providing improved user authentication by analyzing various factors. AI and ML - innovations in security and fraud detection directly affect customer service.

5. Mobile banking

And in mobile banking, it fundamentally changes the perception of the client. The basic premise of mobile banking is the provision of banking services around the clock, as well as providing customer support staff with the opportunity to focus on more complex tasks. For example, Erica, a Bank of America chatbot, a virtual assistant based on artificial intelligence, can help customers check their balance, remind them of their accounts and answer questions related to the bank [21].

6. Customer support

With the development of speech processing and natural language technologies, we are approaching the day when computers will be able to handle most customer service requests. This will put an end to waiting in line and therefore lead to happier customers.

7. New management decision-making

Making managerial decisions based on data at low cost can lead to a new management style, when future leaders of banking and insurance will ask the right questions to machines, and not to experts-people who will analyze data and develop recommended solutions that managers and their subordinates will use and motivate their employees to perform.

8. Reducing fraud and fighting crime

Most industries operating on the World Wide Web are susceptible to fraud by users, and the banking sector is no exception. This has led to an arms race between online security service providers and scammers who engage in everything from email fraud to credit card fraud. As security service providers improve, criminals change their methods. Artificial intelligence tools that study and track users' behavioral patterns to identify anomalies and warning signs of fraud attempts and cases, as well as collect the evidence needed to convict, are also becoming increasingly common in the fight against crime [22].

Figure 2 shows the dynamics of the use of AI technology in the banking sector of the Republic of Kazakhstan for the period from 2018 to 2022.

Personalized financial guidance	36%	42%	46%	52%	58%
Interactive Voice Response Systems	18%	20%	24%	28%	32%
Customer support service	46%	50%	52%	62%	70%
Security and fraud detection	38%	42%	46%	50%	56%
Mobile banking	52%	58%	62%	70%	76%
Banking services with voice support	46%	52%	58%	62%	68%
New management decision-making	48%	54%	58%	66%	72%
Reducing fraud and fighting crime	42%	46%	52%	58%	64%
	2018	**2019**	**2020**	**2021**	**2022**

Figure 2 - Use of AI technologies in banks of Kazakhstan in percentage (For 2018-2022)

In the future, by 2025 the use of these technologies in the banks of Kazakhstan will increase by 25-30%. More than 40 billion tenges will be allocated for investment projects to implement AI technologies in the banking sector [23].

Recently, banks around the world have been implementing biometrics to transform and automate KYC processes ("Know your customer"). Banks are increasingly using biometric identification of customers to perform transactions using mobile devices such as a smartphone, PC or tablet. Customers can either use the devices' built-in biometric sensors, or attach portable biometric equipment to them using a USB cable or Wi-Fi connection [24].

Biometrics has already entered the mainstream of customer interests in the world with the emergence of an increasing number of devices currently using biometric authentication as a security system. The technology has gradually become the standard for automating KYC procedures in banks, healthcare, retail and other institutions. It is believed that biometrics has great potential for transforming KYC processes and ultimately providing a better customer experience [25].

With the emergence of new technologies, business models are also changing, and new players are emerging - fintech companies that integrate existing banks and offer innovative solutions to optimize many financial services: making them easier, more accessible and cheaper. Digital transformation will help financial companies attract customers, retain and generate revenue. Due to globalization and fierce competition, major banks from around the world have begun to move to a new business model-digital banking, which allows customers to transact remotely.

Thus, many banks in Kazakhstan are following new trends in digital banking in order to maintain their competitiveness in the financial market.Treaching the processes of digitalization and their active implementation in the banking sector in Kazakhstan, we can say that today this process is in an active stage of development. Each bank uses digital technologies to expand the range of its products, which are focused on specific customer needs.

The active development of digital technology in Kazakhstan has led to changes in business models of service delivery as part of the implementation of the State Program "Digital Kazakhstan", approved by the Decree of the Government of the Republic of Kazakhstan on December 12, 2017.

At present, Kazakhstan is creating favorable conditions for the digitalization of the financial industry, particularly in the banking sector. Today, more than 7 million people receive services through remote banking systems. The services are increasingly being used regardless of time and place. The main difference between digital and traditional services is the cost structure. Digital services are largely related to development and implementation costs because ICT systems need to be installed and configured.

However, operating costs are very low. Traditional services have higher labor costs, and, in particular, working after hours is expensive. Banks are gradually opening up online services to customers in a 24/7/365 format. The increasing pace of life in society as a whole has led to the need for service anytime,

any day of the week. This 24/7 availability is also putting pressure on banking. As consumers use the Internet and mobile services around the clock, they also demand appropriate payments. In addition, as cell phone penetration in many countries approaches 100%, services are used regardless of time or place. Next-generation smartphones have promoted the widespread use of mobile and Internet services. Thus, consumers can create bank accounts, payment cards and deposits online without going to a bank office. Many banks also use biometric technology in their transactions, such as voice recognition or photo-based facial scans. For example, China has its own technology leaders, such as Alibaba and Tencent, which are improving cashless payments and e-commerce. But innovations are being born in Kazakhstan on a global level. According to the information provided by Forbes.kz, the 10 largest commercial banks in Kazakhstan have a stable position. These are JSC "Halyk Bank of Kazakhstan", JSC "Kaspi Bank", JSC "Zhilstroisberbank of Kazakhstan", JSC "Tsesnabank", SB JSC "Sberbank", JSC "ForteBank", SB JSC "Home Credit Bank", JSC "Altyn Bank", JSC "SB "Alfa-Bank", JSC "ATFBank", JSC "First Heartland Jýsan Bank".

Most of these banks have their own online banking services. Halyk can display user credits, payment cards and provides money transfers between accounts and others, payment services, account statements and currency exchange between tenge and major currencies. Kaspi Bank, ForteBank and Sberbank provide one of the most attractive online banking services to the public. To ensure security and fast payments, Sberbank and ForteBank have launched the ApplePay mobile payment system. At the same time, Kaspi Bank offers customers installment purchases of a large number of products without any additional costs and commissions in the Bank's partner stores. The growth of non-cash payments is 120%, which is almost 5 times more than in Russia (25%). Kaspi has also developed a unique terminal for cashless payments, called Kaspi POS. The number of consumers using payment cards is growing every year. In-store payments with payment cards are convenient, efficient and fast from the customer's point of view, as well as secure with a PIN code. The number of cardholders increased by 20%, i.e., 5.2 million units.

Dynamic growth in the volume of non-cash payments in the country is due to the establishment of the infrastructure of POS terminals, the entry of Apple Pay and Samsung Pay in the markets of Kazakhstan, incentives by banks for customers through bonuses and cashback, as well as the active use of non-cash payment in all forms of public transport. One of the drivers of the growth of non-cash payments last year was also the pandemic of coronavirus COVID-19. Under the conditions of strict restrictive quarantine measures, online payment for goods and services becomes important. The main share of non-cash transactions in Kazakhstan last year was carried out electronically via Internet and mobile banking: 81%, or 18.1 trillion tenges. In turn, the number of users of Internet and mobile banking in the country increased by 52% over the year and amounted to 27 million. Meanwhile, the number of active users doubled over the year.

Overall, over the past two years, the number of transactions per day in the format of digital banking has increased by 7.6 times, and the number of transactions - 9 times. Thus, we can already talk about a digital breakthrough and a fundamentally new level of use of digital financial services in the country.

In terms of current trends in the use of artificial intelligence technologies it should also be noted the possibility of using ChatGPT neural network by potential and existing customers of banks to analyze data on the state of banks and information on the characteristics of the functioning and those or other banks. It can answer general questions about banking products and services, help with payments, provide information about banking operations and expiration dates of accounts and credit cards of different banks, analyzing and systematizing it.

ChatGPT can help customers make informed decisions, such as choosing the right loan product or insurance plan, by analyzing banking information. It can explain different options, calculate possible scenarios, and help customers understand the consequences of their decisions.

The proof of the capabilities of the ChatGPT artificial intelligence system is its explosive popularity. ChatGPT is a neural network implemented as a chatbot with artificial intelligence, developed by OpenAI and capable of working in dialog mode, supporting requests in natural languages. ChatGPT was launched on November 30, 2022, and has attracted attention for its broad capabilities: the ability to adequately translate text, get accurate answers to questions, and use the context of the dialogue to answer questions, although its actual accuracy has been criticized. In early February 2023, Reuters, citing the Swiss holding UBS reported that the audience of active ChatGPT users for 2 months reached 100 million people. By doing so, the application set a historical record for the growth of visitors.

The technological development of Kazakhstan's financial market is significantly influenced by the measures taken by the government and the National Bank of Kazakhstan. The NBK actively stimulates the development of non-cash payments and the reduction of cash turnover. In particular, work was carried out to build and develop a mobile payment system to create an alternative opportunity to make payments online using any instruments - payment cards, electronic money or from a bank account - at the customer's choice. Besides, within the framework of stimulating development of contactless payments, the National Bank of the Republic of Kazakhstan, guided by the experience of European countries, has taken measures to increase the limit of transaction amount, which may be executed without entering a PIN-code. This measure will have a positive impact on further development of cashless payments system.

Thus, we can conclude that 2021 was the year of mass digitalization of the banking industry. The banks that managed to build their own digital platforms at the beginning of the epidemic were instantly among the leaders. Customers followed them to digital, and now digital rather than "traditional" services have become the norm. Relationships with banks no longer involve a visit to the office. To use financial services, all you have to do is pick up your smartphone. And now banks that have staked on digitalization are reaping the benefits of their foresight, planning to close some offices in 2022.

It should be noted that the use of AI technologies in banking increases the economic efficiency of banking activities. Indeed, in general terms, the amount of income from any financial transaction by a bank can be represented as follows:

$$\mathbf{D = F \cdot h} \tag{1}$$

where D - income from a financial transaction; F - amount of funds invested in the transaction; h - rate of return on invested capital (transaction profitability). The use of AI technologies in banking activities can increase the transaction profitability of the operation by 25-30%. Then, with an increase in profitability of 25% D1 = F h1, where h1=1,25 h.

The result of the bank's credit operations is the receipt of interest, which, depending on the method of accrual, may be simple or compound interest. Income in the form of simple interest is accumulated throughout the term of the loan agreement on the basis of the original amount, regardless of the number and duration of periods of accrual:

$$D = n \cdot s \cdot F \tag{2}$$

where D - the amount of interest received upon repayment of the loan by a single payment; n - interest accrual period, years; s - interest rate, relative units; F - the amount on which interest is accrued.

If the interest rates change over the course of the loan agreement, the amount of interest due to the bank can be determined using the formula:

$$D = F \times \sum_{t=1}^{t=N} n_t s_t \tag{3}$$

where N is the number of interest intervals, each with a different interest rate.

5. Conclusion

The main objectives of the digitalization of Kazakhstan's financial sector are to optimize business projects, strengthen the fight against corruption, and improve the quality of services. For consumers, convenience is the main advantage of digital banking solutions. One of the priorities of the country's development, which is under the special control of the leadership of Kazakhstan, is the digitalization of various sectors of the economy. The prospects of using digital technologies in the financial sector are a fait accompli. The very nature of non-cash payments implies conducting operations not with physical money, but with their digital equivalents, expressed in the form of records in electronic accounts at banks. The banking sector remains a pioneer in this direction. The issue of financial technology, in one way or another, involves the use of all kinds of non-cash payments. In this regard, digital services in the financial market will always be ahead, they will set the tone for other sectors of the economy, which are also tied to the servicing of cash flows. The financial sector is an important element of the economy that determines the speed and quality of change. E-payments and e-commerce are now an integral part of the financial sector.

Unlike banks in Russia, there are no "pure" digital banks in Kazakhstan yet. The space for development, as the current crisis has shown, remains quite large, and we can expect the emergence of fully digital banks in the Kazakh market. The development of this and other areas of fintech in the country depends on the creation and effective operation of special ecosystems that could provide the necessary capital to fintech companies and good regulation.

It becomes obvious that the future development of AI and ML will also be related to biometrics. The direction of biometric data analysis by artificial intelligence in the selection of financial products, and dynamic tracking of the client's reaction to the intonation of his communication with a bank employee through high-resolution cameras with real-time facial expressions capture have a development perspective. With the collaboration of these technologies, communication between a bank employee and a client will be simplified when selecting credit products, since with the help of the assessment of biometric AI data, the bank will be able to increase the effectiveness of assessing the client's ability to repay loans.

AI and ML with biometrics analytics will deepen the concept of artificial intelligence towards endowing it with a phenomenological characteristic and the ability to abstract thinking [26].

In conclusion, we note that the influence of machine learning does not end with banking and stock trading. One of the promising directions of using AI and ML is the analysis of news stories, social networks and similar sources to predict the impact of social factors on the dynamics of market indicators. These key factors have a much stronger impact on the market, and ML's ability to take them into account in addition to the tough conditions of a competitive market will undoubtedly have an impact on the development of the economy.

The analysis of thousands of data fragments simultaneously allows ML to assess both the expected profit and potential risk, as well as to obtain a reliable assessment based on Q-learning, which will help in making commercial decisions [27]. A striking example of such investments is the Accelerator from Sberbank PJSC and 500 Startups.

Thus, the customer-oriented goal of the introduction of artificial intelligence in the banking sector is to provide personalized and high-quality conditions for the formation of customer satisfaction in parallel with efficient and time-saving services. Artificial Intelligence in the financial sector as a technology is quite promising both in the foreign and domestic markets, because, on the one hand, it allows to generate additional profits and a better understanding of customers, and, on the other hand, it transforms the information space and saves time for bank customers. AI systems help to automate and optimize the processes in the bank branches. Currently, artificial intelligence is in high demand in the banking sector and, as shown by the analysis of banks, is of great benefit to its owners.

In the future, many banks of the republic may become fully digitalized and close their branches in different regions of the country. Bank employees who have been released from their positions will be forced to retrain and leave for other spheres of activity.

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Does E in E- commerce stands for Easy?

Riyad Gasimov

Graduate Student, Necmettin Erbakan University, Faculty of Applied Sciences, Department of Management Information Systems, Konya, Turkey Köyceğiz Mh. Statement. sc. No:42/3

Ahmet Çubukcu

Assistant Professor Necmettin Erbakan University, Faculty of Engineering and Architecture, Department of Forensic Informatics Engineering, Konya, Turkey Köyceğiz Mah. Demeç Sok. No:42/A

Şemseddin Gündüz

Associate Professor, Necmettin Erbakan University, Faculty of Applied Sciences, Department of Management Information Systems, Konya, Turkey Köyceğiz Mh. Statement. sc. No:42/3

Abstract

The study highlights obstacles and difficulties that SME's such as e-retails/ retails, wholesalers, industrial manufacturing and medical tourism firms are facing in e-commerce platforms, aiming to bring attention to the impacts of electronic marketplaces and digital marketing channels on Turkish SMEs, and forms a base for further research on the profit margin of SMEs in e-marketplaces compared to sales and business operations in traditional stores and markets.

The research paper is based on qualitative analyses concluded from unstructured questionnaire form and data collected during an interview with sales managers, directors, and owners of e-retailers/ retailers, wholesalers, industrial manufacturing companies, and the medical tourism firms.

Unstructured interviews were carried out in seven medium and small companies from Istanbul and Konya, in November 2022, with sales managers, directors, and owners with whom we have had business and personal ties for at least 5 years and more.

Eight interview titles for research context were prepared with the contribution of three classmates from the lecture and was cross checked with the literatures and academic researches on similar topic.

In the following work we especially analysed and collected data and literature for different business models such as retails, wholesalers and industrial manufacturing companies. Highlighted distinctions of the business models in adopting the certain e-commerce sales and marketing technologies.

JEL Classification C5, C12, C93, D22, D43, L81, M13, O33

Keywords Digital Marketing, Turkish SMEs, Online Marketplaces, E-Marketplace platforms, E-Commerce, Sales, and Marketing Technology

Purpose and Objectives

This study exhibits challenges of e-retailers/ retailers, wholesalers, and industrial manufacturing SMEs in the era of digital marketing and online marketplaces by comparing various research and published works on similar topics with the results of our quantitative study findings conducted in Turkey.

In traditional sales and marketing, it's difficult and resource-consuming to get more insights and information about customers and feedback regarding provided products and services. But in the digital world, we can be connected via a mobile application and see exactly what the customer does. Digital communication eases the way for the retailer, market research, and product development to directly interact with the customer and find out how to do something good for him (Homburg Christian & Wielgos Dominik M, 2022). But such an advantage arrives with other costs and challenges as well, for small and medium e-retailers/ retailers, wholesalers, and industrial manufacturing companies, and also bears challenges for buyers as well.

The problems of digital marketing and e-commerce platforms from buyers' perspective are financial and product quality risks that arise from the intangible nature of online stores. Buyers simply cannot test or try displayed products from the device screen (Tülin Durukan & Serhat KARAOĞLAN, 2020).

From a business perspective, one of the main problems of SMEs globally is that they cannot promote themselves or market their products to their target customers due to a minor gap between their income and expenditure. As the name implies, small businesses offer small amounts of products with less amount of operating costs and income to an inadequate range of their target customers (Karatum, 2017).

Compared to traditional marketing and product promoting channels, digital marketing is much more cost-effective, and it may seem like an advantage for SMEs with minor income and expenditure gaps (Fraccastoro Sara et al., 2021).

But some studies such as point towards that if digital marketing is not developed and managed properly, it fails to provide benefits, destructs value, increases transaction costs, coordination costs, loss of non-contractible value, and has a negative impact on long-term benefits. Thus, digital marketing can have a negative effect if performed by unskilled service providers. Because in social networks negative word-of-mouth information flows faster than positive word-of-mouth information (Aswani et al., 2018; Dwivedi et al., 2021).

There is also a factor of where the e-retailer or wholesaler operates. Is it in the emerging market zone or the developed market? The key distinguishing features of business markets in emerging economies relative to the developed world: (1) the relative size and nature of government versus business buying, (2) the under-developed legal system in emerging markets, (3) the non-contractual and extensive webs of business relationships, (4) the extent to which business relationships affect a firm's ability to perform in an emerging economy, and (5) the major influence of political ties on business processes in emerging economies (Grewal et al., 2015; Vieira Valter Afonso et al., 2019).

When e-retailers expand across national borders, they are likely to apply learning skills about translating the firm's strategy into the use of digital marketing tactics in their domestic market to be used in foreign markets. Due to the high degree of competitiveness in the domestic market, e-retailers originating from developed e-commerce markets may have gained a greater awareness of the role and value of digital marketing tactics in the execution of their strategic orientations than their counterparts from emerging e-commerce markets.

As such, e-retailers in developed markets may have had greater access to learning, knowledge, and networks related to digital marketing. In contrast, e-retailers from emerging e-commerce markets may have had less access to digital marketing knowledge and experience and, therefore, have less knowledge to implement a more sophisticated integrated digital strategy (Goldman et al., 2021).

Industrial manufacturing SMEs' have a different digital marketing practices compared to e-retailers and wholesalers. In general, industrial manufacturing companies are not at the forefront of adopting new instruments and channels for marketing communications because of the different norms of communication in customer relationships. Open or public discussion with customers on social media can threaten confidentiality and therefore breaks the norms of communication in the industrial business field. Nevertheless, companies now acknowledge the need to listen to their customers more, engage them in conversation, be transparent, and communicate with them openly and empathetically. The marketing specialist's role has evolved from being a broadcaster to being an aggregator who brings content together to enable collaboration and participation in communities. However, such implementation also requires knowledge of the culture of communication. Not all companies value openness, as they fear handing an advantage to the competition (Karjaluoto et al., n.d.). B2B SME marketers cannot use social networks because they lack the power of correspondence and are often flawed in their handling of sensitive information (Rakshit Sandip et al., 2022).

Further on, B2B SMEs' digital marketing practices are influenced by internal and external factors which shape digital marketing practices is developed. Internal factors such as their resources and capabilities, business culture, and organizational structure, influence the slow adoption of digital marketing. External factors such as; the types and characteristics of customers, the nature of the competitive set, and various market and industry characteristics act as barriers to digital marketing (Setkute Justina & Dibb Sally, 2022).

Retailers, wholesalers, and industrial manufacturing SMEs in Turkey might lack marketing departments or experienced personnel in marketing departments. Like some of the small businesses in the production sector, they can only have financial, accounting, and production employees. That will lead them to downsize in a competitive market. But if the business owner develops his/her digital marketing skills, he or she can become versatile in digital channels of marketing which can lead to reaching the target group more easily and more efficiently than the rival entrepreneurs in the sector (Karatum, 2017).

Our research points towards similar obstacles and challenges mentioned above-cited literature that Turkish retailers, wholesalers, and industrial manufacturing SMEs are facing in adopting e-commerce sales and marketing technologies, aiming to bring attention to the impacts of electronic marketplaces and digital marketing channels on Turkish SMEs and investigate efforts of small and medium enterprises to acquire these technologies.

Methodology and Approach

The research is based on qualitative analyses concluded from an unstructured questionnaire form. Research model for e-retailers and wholesaler SMEs' study is adopted from (Vieira Valter Afonso et al., 2019) and (Ozan Bakir & Gözde Akbıyık, 2019). Also to design the survey for industrial manufacturing companies we have used materials and data from (Setkute Justina & Dibb Sally, 2022).

Data was gathered from an interview with sales managers, directors, and owners of e-retailer/ retailers, wholesalers, industrial manufacturing companies, and the medical tourism firms.

The field research is carried out in seven e-retailer/ retailer, wholesaler, and industrial manufacturing SMEs from Istanbul and Konya, in November 2022, with sales managers, directors, and owners with whom we have had business and personal ties for at least 5 years and more.

This approach helps us to conduct a study in a friendly environment to get more profound insight and complete it in a short timeline. And especially with industrial manufacturing companies to overcome privacy and trade secrets concerns.

The subject was explained ahead of a meeting on a phone call and voice recording was taken in two interviews with the permission of the interviewee.

The most interviewees, three out of seven companies were industrial manufacturing companies involved in semi-trailer manufacturing, commercial trucks and trailers spare parts wholesaler, and elevator manufacturing. Thus, in this survey, we have revealed several models and tools used for digital marketing communications (DMC) and sales processes in industrial companies were examined that correlates with our results and findings as well.

Figures (1) (Karjaluoto et al., n.d.)**, (2)** (Järvinen & Karjaluoto, 2015) and **(3)** (Fraccastoro Sara et al., 2021) illustrates use of DMC in industrial marketing, tools used in digital marketing processes and performance measurement mechanisms, and sales communication tools used in B2B sales processes that correlates with our results and findings.

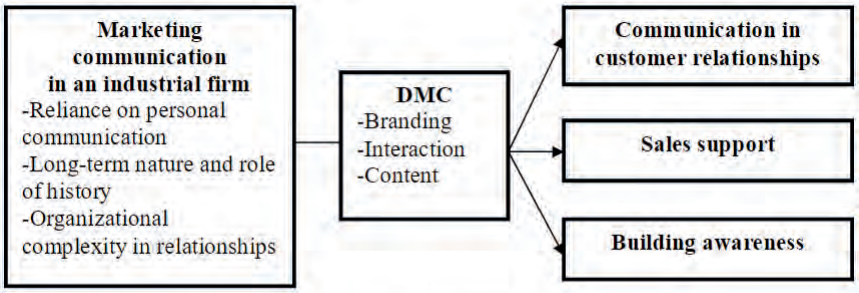

Figure 1 Use of DMC in the industrial marketing context

Figure 1 reveal three important areas in which DMC is already employed, or in which it is hoped to exert a positive influence: (1) communication in customer relationships, (2) sales support, and (3) brand building (Karjaluoto et al., n.d.).

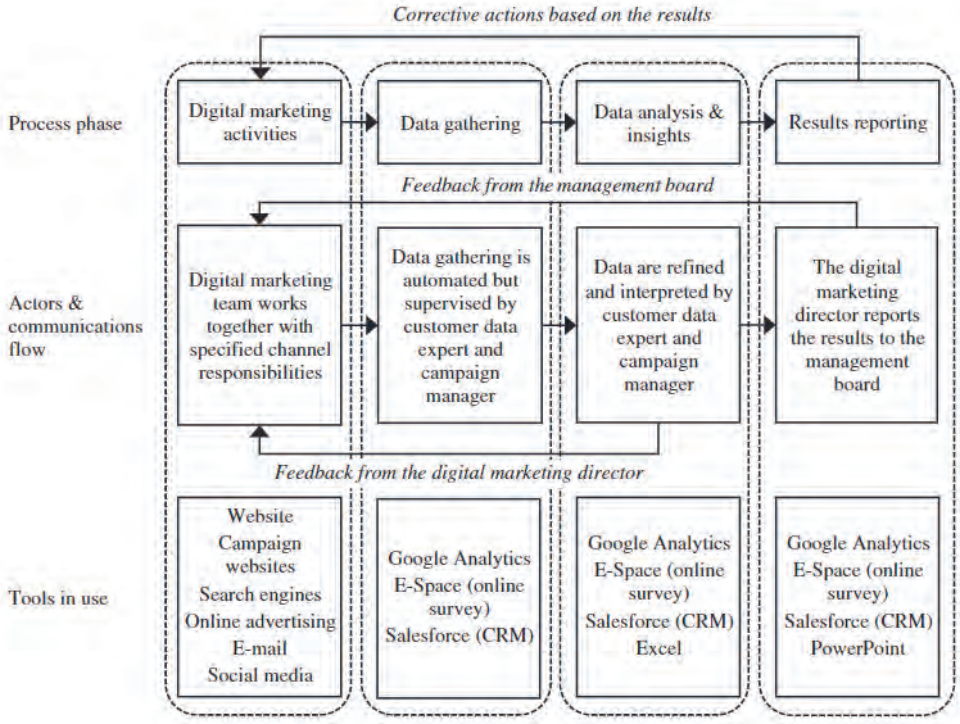

Figure 2 Steel's digital marketing performance measurement process and tools in use.

Figure 2 outline a process and responsibilities for the digital marketing use in firms. The involvement of top management in digital marketing processes and the feedback from the top management to the digital marketers encouraged and motivated them to continuously develop their activities (Järvinen & Karjaluoto, 2015).

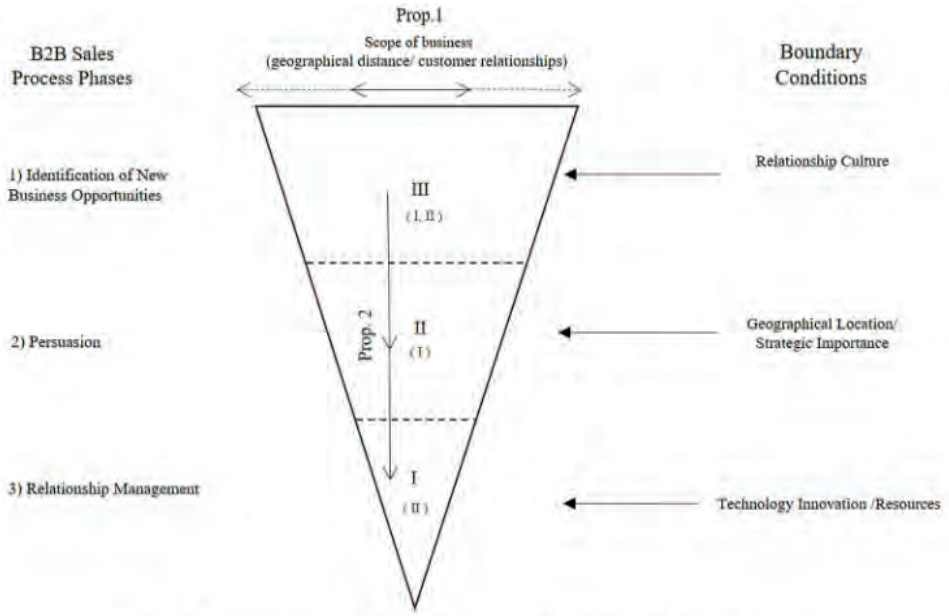

Figure 3 Integrated Use of Sales Communication Tools in the B2B Sales Process.

Figure 3 based on the grounded-theory method, to develop a the integrated use of sales communication tools during the B2B sales process of international SMEs (Rakshit Sandip et al., 2022).

Eight interview titles for research context were prepared with the contribution of three classmates from the lecture and was cross checked with the literatures and academic research on similar topic. For transparency and any detailed examination in a future, the text form of interview summary in Turkish language have been recorded and saved.

Outcomes and responses from the interviews, for further and much-extended researches were cross-checked with the literature and the research works, cited from the surveys mostly within a similar field of studies focused on SMEs.

Findings and Results

The research performed three comprehension tests. First (1), traditional marketing and sales channels are still relevant for retailers and wholesalers as well as in automotive and industrial manufacturing SMEs, even though operational expenses are higher compared to online marketing and sales activities. Second (2), the apparentness of competitors and intense price competition, some pro-Buyer policies of e-marketplaces, make online platforms less attractive for certain e-retailers/ retailers and wholesalers. Third (3), e-marketplaces reduce operation costs, but they do not make business more profitable compared to traditional stores and market sales.

The third (3) statement especially was claimed by the bike shop e-retailer and retailer during our interview. With annual total sales of over 500 bikes from e-commerce platforms and from traditional stores in downtown Konya.

Conclusion, Applications, and Recommendations

Yet the B2B sales process seems to be deeply affected by the introduction of social media and digital communication tools, causing radical changes to how salespeople sell. Firms need to strategically consider the best combination of sales channels for their unique businesses**.** Social media and digitalized tools are critical to today's sales process. Their adoption is underpinned by mechanisms targeting cost

reduction and potential growth in national and international markets. These are factors that have become crucial for the success of SMEs, which are often resource constrained (Fraccastoro Sara et al., 2021).

The number of precedents in our research is not enough to broadly define the role and impact of e-commerce on SMEs in Turkey.

Nevertheless, the following study forms an overview of the problems of SMEs in e-marketplaces, and a groundwork survey for further research on the profit margin of SMEs in e-marketplaces compared to sales and business operations in traditional stores and markets.

Also, it shapes the context to study regulations in Turkey against monopoly and unfair competition practices of bigger e-commerce platforms. Especially pro- buyer regulations of e-commerce platforms and some aggressive marketing practices reviled by one interviewee. The Public Relation manager of one of the biggest e-commerce platforms in Turkey. Thus, further research will focus on the effectiveness of Turkish E-commerce law compared to similar regulations in China, Russia, and the EU.

There are four main challenges for research in social media marketing, each of which also has consequences for practice: (1) the speed of development of both practice and research in social media marketing; (2) the interdisciplinary nature of the field; (3) the diversity of research questions; and (4) the wide range of theoretical perspectives and research methods (Dwivedi et al., 2021).

And what makes this survey more challenging to conduct is that we have gathered and tried to study different business fields and types together. As cited from the literature e-retailers/ retailers, wholesalers and industrial manufacturing companies have different marketing practices and business cultures. And literature and academic researches such as;(Goldman et al., 2021; Grewal et al., 2015) (Setkute Justina & Dibb Sally, 2022) focuses on e-retailers/ retailers, wholesalers eighter on industrial manufacturing companies.

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Investigation of The Attitudes Of The West Balkan Countries And Türkiye Within The Context Of Green Reconciliation By Multi-Criteria Decision-Making Methods

Orhan Ecemis

Assist. Prof. Dr. Gaziantep University, Technical Science VHE, Department of Computer Technology,

orcid.org/ 0000-0002-8270-0857

Ferda Nakipoglu Ozsoy

Assoc. Dr., Gaziantep University, Economics and Administrative Science Faculty, Department of Economics,

orcid.org/0000-0002-5593-413X

Asli Ozpolat

Assoc. Dr., Gaziantep University, Oguzeli VHE, Department of Management and Organization,

orcid.org/0000-0002-1769-3654

Western Balkan Countries and Türkiye are referred to as enlargement countries that aim to enter the European Union. The Green Agenda, followed by the Western Balkan Countries, which is the process of harmonization with the European Union Green Deal, is a strategy document that aims to transform countries from a traditional economic model to a sustainable economy. In this context, the aim of the study is to examine the attitudes of Western Balkan Countries and Türkiye according to the criteria in the Green Agenda with multi-criteria decision-making methods. The data used in the study belong to 2020 and consist of the performances of the countries according to 13 criteria. The criteria are weighted using the CRITIC method. The attitudes of the countries were compared with the TODIM method. According to the findings, the three most successful countries are Montenegro, Bosnia and Herzegovina, Serbia.

Key Worlds: European Green Deal, Western Balkans, Türkiye, MCDM

1. Introduction

In the Limits of Growth report in 1972, it was discussed whether the economic growth of countries should be limited due to reasons such as population growth, use of non-renewable energy sources, and increase in pollution. Since this date, the temperature increase due to human activities has approached 30 (IPCC, 2023). This temperature increase brings along many problems such as drought, famine, deterioration of human health, melting of glaciers, especially the decrease in biodiversity. In order to prevent these problems, it is tried to prevent climate change from reaching much further dimensions with cooperation agreements between countries (Paris agreement, European Green Deal) as well as national action plans of countries.Looking at the trade between the Balkan countries and the EU, the Balkan countries account for two-thirds (67.6 %) of the total trade (EC, 2023a). Türkiye, on the other

hand, is Europe's 6th largest trading partner with a trade share of 3.3%. While Türkiye imports 26% to Europe in 2022, its export rate is 41% (EC, 2023b). The European Commission aimed to realize the European Green Deal, especially by revising its clean energy supply policies. For this purpose, it emphasizes the necessity of preparing action plans for decision makers and policy makers to mobilize various policy proposals for the potential of creating a green economy.

Doukas et al. (2014) evaluated companies' energy and environmental policies by promoting the growth of green energy. As a result of the findings obtained from the TOPSIS method, it has been concluded that SMEs that internalize environmental regulations achieve high overall performance. According to Kabak et al. (2014) conducted a study to reveal how to implement and how to perform an energy code (BEP-TR) that is easy and simple to implement for buildings. In line with the information obtained from the MCDM method, construction companies will be able to determine which criterion will be prioritized in increasing efficiency in this area. Aiming at solving energy management problems, Mardani et al. (2017) used the multi-criteria decision-making method and concluded that decision-making approaches can help decision-makers in solving problems. Although environmental awareness is high in businesses, they should follow the concept of green in their applications. Especially in the textile sector, which has been a competitive market in recent years, it is seen that business activities that take environmental issues into account have an important role. In this direction, Çelik et al. (2021) examined green supplier selection in the textile industry as a multi-criteria decision-making process. In the Turkish textile industry, three green supplier alternatives and forty-two sub-criteria were analyzed. According to the results obtained from the BWM-TODIM method, it was concluded that the most important criteria are ink and print quality, product design and mold suitability, profit from the product, change in price and purchasing cost. On the other hand, while some countries could not reach the target of reducing greenhouse gas emissions, the target of developing renewable energy has been the best achieved target.

In this context, the study analyzes the effect of European Green Deal on Balkans Countries and Türkiye. To analyze the effect, The Multi-Decision-Making Method has been applied.

2. Material and Method

Energy has a very important role in the economic development of countries and in determining the level of welfare (Karaaslan, A. & Aydın, S. 2020) The energy sector is an important sector in the economy because it is closely related to other industries as well as the financial size of the enterprises. In this context, innovative and structural changes in the energy sector have an economic impact at the micro and macro level. Due to the development of technology, it is of great importance for the future to meet our energy needs from ""renewable sources". As awareness in societies increases, interest in renewable energy (RE) sources, which reduces the energy dependence of society on fossil fuels, has increased. In recent years, one of the main reasons for the interest in RE is worldwide The demand for clean energy sources continues to increase significantly and the cost of RE sources is now competitive with conventional energy sources (Ecer, F. 2021). Comparable research on countries' reducing their energy dependency and their attitudes towards renewable energy for their future is limited in the literature.

It can be stated that the decisions to be taken in cases where energy and environment issues are handled together are a complex structure in which more than one purpose, criterion or quality comes together and sometimes contradicts. Due to these structures, the multi-criteria decision-making approach, which is one of the subjects of Management Science and Operations Research, offers effective solutions in taking energy and environmental optimum decisions(Atıcı, K. B. & Ulucan, A. (2009). In this context, MCDM methods were used in the study.

The aim of this study; It is the determination of the European Green Deal attitudes of the Western Balkan countries and Türkiye, which are referred to as the EU enlargement countries, by the multi-criteria decision-making method. The model of the study is to weight the criteria in the data set with

the CRITIC method with multi-criteria decision-making methods, and to compare the attitudes of the countries with the TODIM method. The criteria used in the study are listed in the table 1 below.(organic crop area, Greenhouse gas emissions relative to population data is not available for all countries, so it has been omitted from the data set.

Table 1: Criteria for Analysis

	Criter	Details
1	Energy imports dependency	% of energy consumption covered by imports
2	Exports and imports of all energy products relative to population size	thousand tonnes of oil equivalent per thousand inhabitants
3	Exports and imports of all energy products relative to population size	thousand tonnes of oil equivalent per thousand inhabitants)
4	Primary production from renewables and other fuels	thousandtonnesofoilequivalent
5	Gross electricity production	gigawatt-hour per thousand inhabitants
6	Share of renewable electricity production	final consumption of electricity
7	Share of renewables in final energy consumption	%of total final energy consumption
8	Final energy consumption of renewables relative to population size	Tonnes of oil equivalent of renewable energy per thousand inhabitants)
9	Number of passenger cars	per thousand inhabitants
10	Municipal waste generated, relative to population size	kilograms per inhabitant
11	Final energy consumption of renewables household	% final consumption of renewables
12	Final energy consumption of renewables by industry	% of nalconsumption of renewables
13	Final energy consumption of renewables by others	% of nalconsumption of renewables

Critic (Criteria Importance Through Intercriteria Correlation) method

Diakoulaki et al. (1995) proposed CRITIC method (CRiteria Importance Through Intercriteria Correlation) is one of the objective criteria weighting methods using standard deviations of criteria and correlations between criteria.

The CRITIC (Criteria Importance Through Intercriteria Correlation) method is a decision-making tool that enables decision makers to evaluate the importance of criteria in multi-criteria decision-making (MCDM) problems by considering the relationships among them (Pekkaya ve Dökmen,2019)

One of the main advantages of the CRITIC method is that it takes into account the interrelationships between criteria, which allows for a more accurate assessment of the impact of these interconnections compared to other MCDM methods. Additionally, the method is relatively easy to use.

However, the CRITIC method has a limitation in that it requires the input of expert opinions or the use of questionnaires to determine the relationships among the criteria. Thus, it may be challenging to apply the method in situations where there is limited data to establish these relationships.

CRITIC method consists of Decision Matrix, Normalized Decision Matrix, Correlation Coefficient Matrix, Information Value of Criteria and Calculation of Weights, respectively (Orhan,Aytekin, 2020, Ömürbek et al, 2021).

Todim Method

TODIM (Portuguese acronym for Interactive Multi-Criteria Decision Making) is a multi-criteria decision making method developed to solve decision making problems with conflicting criteria or goals. The TODIM method is based on the "Expectation Theory", which was put forward by Kahneman and Tverski in the 1970s and was awarded the Nobel Prize. Unlike other multi-criteria decision-making techniques, instead of the solution that always corresponds to the highest value, the best decision maker uses a measurement value that can be calculated by applying the "Expectation Theory" in the TODIM method. (Gomes : 2009).Some of the strengths of the TODIM method are:

- Flexibility: TODIM can handle qualitative, quantitative, clear or fuzzy data, making it more flexible than other MCDM methods.
- Simplicity: TODIM is easy to use and understand and does not require complex mathematical calculations.
- Robustness: TODIM can manage uncertainties and inconsistencies in the decision-making process.
- Sensitivity analysis: TODIM allows decision makers to perform sensitivity analyzes to evaluate the soundness of their decisions

In the TODIM method, a problem is presented where n alternatives are ranked based on m criteria. Among these criteria, one criterion is assumed to be the reference criterion. Therefore, a reference criterion should be selected among the criteria by considering pre-determined weight values. The selected reference criterion should have the highest level of importance, designated as "r" . TODIM method consists of Decision Matrix, Normalized Decision Matrix, The relative weights, Dominance degree of the altenative, The overall prospect value of alternative stages, respectively (Gomes, , Rangel, Maranhão,2009; Llamazares, B. 2018 ;Ünal, Z. & İpekçi Çetin, E. 2020;)

3. Empirical Results

Determining Criteria Weights with The Critic Method

The decision matrix, which is the first step in decision making problems, consists of the performances of the Western Balkan countries and Türkiye in the Green Deal adaptation process. It is presented in the table below.

Table 2 Decision Matrix

Country	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
Montenegro	27,4	135,4	90,3	44,9	5,4	62,4	21,3	250	350	486	89,5	6,1	4,4
North Macedonia	63,3	86,6	7,4	31,3	2,6	23,3	12,2	100	205	441	86,9	8,1	5
Albania	35,8	56,5	28,7	41,9	1,9	79,8	15,1	100	175	369	46,6	3,1	50,3
Serbia	29,8	89,5	20,8	22,9	5,5	37,4	18,3	200	299	338	85,7	11,8	2,5
Türkiye	70,6	136,7	10,4	55,2	3,7	48,9	4,4	50	152	424	77,5	6,6	15,9
Bosnia and Herzegovina	25,4	90,1	33,4	36,4	5	48,7	30,8	350	269	352	93,5	1,1	5,4
Kosovo	29,5	50,8	6,6	17,8	3,8	7,4	24,4	200	172	256	92,4	3,7	3,9

The decision matrix is normalized and the results shown in Table 3.

Table 3: Normalized Decision Matrix

Country	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
Montenegro	0,956	0,985	1,000	0,725	0,972	0,760	0,640	0,667	1,000	1,000	0,915	0,467	0,040
North Macedonia	0,162	0,417	0,010	0,361	0,194	0,220	0,295	0,167	0,268	0,804	0,859	0,654	0,052
Albania	0,770	0,066	0,264	0,644	0,000	1,000	0,405	0,167	0,116	0,491	0,000	0,187	1,000
Serbia	0,903	0,451	0,170	0,136	1,000	0,414	0,527	0,500	0,742	0,357	0,834	1,000	0,000
Türkiye	0,000	1,000	0,045	1,000	0,500	0,573	0,000	0,000	0,000	0,730	0,659	0,514	0,280
Bosnia and Herzegovina	1,000	0,458	0,320	0,497	0,861	0,570	1,000	1,000	0,591	0,417	1,000	0,000	0,061
Kosovo	0,909	0,000	0,000	0,000	0,528	0,000	0,758	0,500	0,101	0,000	0,977	0,243	0,029

Correlation values between criteria were calculated presented in matrix form in table 4.

Table 4: Correlation Coefficient Matrix

Criteria	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
k3	1,0000	-0,3513	0,4845	-0,4559	0,5020	0,1232	0,8726	0,8021	0,5865	-0,4239	0,1551	-0,2897	-0,0874
k4	-0,3513	1,0000	0,4858	0,7000	0,4654	0,2809	-0,3549	-0,0331	0,3904	0,7673	0,2693	0,2945	-0,3161
k5	0,4845	0,4858	1,0000	0,3528	0,4835	0,5592	0,3259	0,4719	0,7791	0,5491	0,0813	-0,1092	-0,0546
k6	-0,4559	0,7000	0,3528	1,0000	-0,1357	0,7056	-0,5043	-0,3143	-0,0800	0,7137	-0,3813	-0,1845	0,3996
k7	0,5020	0,4654	0,4835	-0,1357	1,0000	-0,0981	0,4845	0,7064	0,7892	0,0106	0,6872	0,2467	-0,7026
k8	0,1232	0,2809	0,5592	0,7056	-0,0981	1,0000	-0,1336	-0,0416	0,2054	0,4712	-0,6784	-0,2330	0,6914
k9	0,8726	-0,3549	0,3259	-0,5043	0,4845	-0,1336	1,0000	0,9383	0,4938	-0,4413	0,4448	-0,4759	-0,3238
k10	0,8021	-0,0331	0,4719	-0,3143	0,7064	-0,0416	0,9383	1,0000	0,6828	-0,2189	0,5690	-0,3498	-0,4677
k11	0,5865	0,3904	0,7791	-0,0800	0,7892	0,2054	0,4938	0,6828	1,0000	0,3366	0,4316	0,2608	-0,4631
k12	-0,4239	0,7673	0,5491	0,7137	0,0106	0,4712	-0,4413	-0,2189	0,3366	1,0000	-0,0641	0,2317	0,0130
k13	0,1551	0,2693	0,0813	-0,3813	0,6872	-0,6784	0,4448	0,5690	0,4316	-0,0641	1,0000	0,1483	-0,9790
k14	-0,2897	0,2945	-0,1092	-0,1845	0,2467	-0,2330	-0,4759	-0,3498	0,2608	0,2317	0,1483	1,0000	-0,3467
k15	-0,0874	-0,3161	-0,0546	0,3996	-0,7026	0,6914	-0,3238	-0,4677	-0,4631	0,0130	-0,9790	-0,3467	1,0000

The criteria weights obtained from the decision matrix (data set) and CRITIC method are given in the Table 5 below.

Table 5: Decision Matrix

	min	maks	maks	maks	maks	maks	maks	maks	maks	maks	maks	maks	maks
Country	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
Montenegro	27,4	135,4	90,3	44,9	5,4	62,4	21,3	250	350	486	89,5	6,1	4,4
North Macedonia	63,3	86,6	7,4	31,3	2,6	23,3	12,2	100	205	441	86,9	8,1	5
Albania	35,8	56,5	28,7	41,9	1,9	79,8	15,1	100	175	369	46,6	3,1	50,3
Serbia	29,8	89,5	20,8	22,9	5,5	37,4	18,3	200	299	338	85,7	11,8	2,5
Türkiye	70,6	136,7	10,4	55,2	3,7	48,9	4,4	50	152	424	77,5	6,6	15,9
Bosnia and Herzegovina	25,4	90,1	33,4	36,4	5	48,7	30,8	350	269	352	93,5	1,1	5,4
Kosovo	29,5	50,8	6,6	17,8	3,8	7,4	24,4	200	172	256	92,4	3,7	3,9
∑	281,8	645,6	197,6	250,4	27,9	307,9	126,5	1250	1622	2666	572,1	40,5	87,4
Weights	0,088	0,078	0,056	0,082	0,070	0,071	0,073	0,067	0,061	0,070	0,083	0,090	0,111

The decision matrix is normalized according to the benefit and cost characteristics of the criteria.

Table 6 Normalized Matrix

Country	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
Montenegro	0,181	0,210	0,457	0,179	0,194	0,203	0,168	0,200	0,216	0,182	0,156	0,151	0,050
North Macedonia	0,079	0,134	0,037	0,125	0,093	0,076	0,096	0,080	0,126	0,165	0,152	0,200	0,057
Albania	0,139	0,088	0,145	0,167	0,068	0,259	0,119	0,080	0,108	0,138	0,081	0,077	0,576
Serbia	0,167	0,139	0,105	0,091	0,197	0,121	0,145	0,160	0,184	0,127	0,150	0,291	0,029
Türkiye	0,070	0,212	0,053	0,220	0,133	0,159	0,035	0,040	0,094	0,159	0,135	0,163	0,182
Bosnia and Herzegovina	0,196	0,140	0,169	0,145	0,179	0,158	0,243	0,280	0,166	0,132	0,163	0,027	0,062
Kosovo	0,168	0,079	0,033	0,071	0,136	0,024	0,193	0,160	0,106	0,096	0,162	0,091	0,045

In the sensitivity analysis, the TODIM method results according to the current situation scenario 1, scenario 2 where the maximum and minimum criteria weights are replaced, and scenario 3 where all criteria are equally weighted are given in the table below (Table 7).

Table 7 Sensitivity Analysis Results

Country	scenario 1	scenario 2	scenario 3
Montenegro	1	1	1
North Macedonia	6	6	6
Albania	5	5	5
Serbia	2	2	2
Türkiye	4	4	4
Bosnia and Herzegovina	3	3	3
Kosovo	7	7	7

When Table 7 is examined, there was no change in country rankings in all three scenarios. This situation can be interpreted as being self-consistent for the TODIM method within the limitations of the study.

Conclusion

Environmental degradation caused by climate change is tried to be prevented by national and international policies of countries. Among the policies created recently, one of the most effective is the European Green Deal. EGD includes the emission trading system and aims to reduce the carbon emissions of the companies below the determined critical levels with this system. The most important effect of the EGD is that it is valid not only among EU countries, but also for other countries that trade with the EU. In this way, it is aimed to reduce carbon emissions and to make these levels sustainable.

In this context, when the trade partners of the European countries are evaluated, it is seen that the trade share of the Balkan countries and Türkiye is important. In the study, the economic performances of the countries were evaluated according to the 15 criteria determined by the EGD According to the results obtained, the most successful countries in the criteria are Montenegro, Bosnia and Serbia.

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A Qualitative Research on Outsourcing Practices of Travel Agencies Operating in Gaziantep Province

Umut Sarı

Dr. Mehmet DÜZGÜN

0000-0003-4318-0729

Doç. Dr. Atınç OLCAY

0000-0003-0407-5467

Abstract

Businesses have been involved in very important change processes in order to survive and survive in the face of the rapid change and transformation process that emerged with globalisation. In this context, businesses have had to reach a number of auxiliary resources or other businesses in order to maintain their positions. This situation, which is referred to as outsourcing in the literature (outsourcing), has basically been accepted as the business of businesses to other businesses. The main purpose of this research is to determine the outsourcing practices of Group A travel agencies operating in Gaziantep. In addition, within the scope of the research, the determination of the service categories that these agencies apply to outsourcing and the preference criteria that are at the forefront in outsourcing have been revealed. In this research, which was designed according to qualitative design, interview method was used as data collection technique. Face-to-face interviews were conducted with nine travel agencies through a semi-structured interview form. According to the findings, travel agencies within the scope of the research tend to outsource legal procedures, insurance procedures, visa-customs procedures, guidance and occupational health and safety. In addition, the criteria that these agencies prioritise in outsourcing are listed as customer satisfaction, reliability, corporate nature of the enterprises, and command of foreign language.

Keywords: Outsourcing, Travel Agencies, Gaziantep

1.Introduction

In the 1990s, major changes have occurred in thinking and management practices. The new views put forward in this direction have led to a series of changes in business structures and activities. This change, together with the impact of globalisation and technology, has led to the emergence of the concepts of core competence and outsourcing (Özbay, 2004). Prahalad and Hamel (2003) used the term core competence for the first time and it is accepted as one of the important instruments in terms of providing competitive advantage in the field of management and organisation. In the aforementioned study, core competencies were defined as the knowledge and integration of knowledge on how to coordinate different production skills of the organisation. However, in the related literature, it is emphasised that core capabilities developed through the effective and efficient use of strategic resources (Wernerfelt,

1984; Wernerfelt, 1995; Prahalad and Hamel, 2003; Hamel and Prahalad, 1996) are closely related to the creation, maintenance and continuous improvement of core competencies in providing competitive advantage of the organisation. According to Williams (1992), core competencies are the skills associated with the creation, improvement, renewal and use of resources that enable organisations to achieve sustainable competitive advantage. According to Hill and Jones (1998), for an organisation to have core competencies, it is necessary to have unique resources (tangible and intangible resources). Similarly, Barney et al. (2001) argue that resources and capabilities are very important for an organisation when they are rare and difficult to imitate.

As a result of specialisation and economies of scale, outsourcing can lead to sufficient savings for an organisation to perform its business functions more economically compared to other companies (Edvardsson and Durst, 2019: 171). Outsourcing refers to the process of transferring the responsibility for a specific business function from an employee group to a non-employee group. However, it is possible to say that outsourcing undertakes a certain leverage mission to perform more efficiently and better than the departments of an organisation (Zhu et al., 2001: 374). On the other hand, outsourcing represents a result-oriented relationship with an external service provider for the activities traditionally performed within the organisation. In this context, in addition to traditional outsourcing based on business tactics to reduce costs and increase efficiency and flexibility, transformational outsourcing focusing on innovation and business development may also be preferred for organisations. However, purchasing products or services from another organisation does not always mean outsourcing. Critically important aspects of outsourcing are always the existence of significant two-way information exchange, coordination and trust (Rebernik and Bradač, 2006: 1005-1006). In the literature on outsourcing, the main reason for outsourcing is shown as reducing direct and indirect costs (Lacity et al. 2011; Kremic et al. 2006; Quinn, 1999). Outsourcing, which is especially preferred by hotel businesses in the tourism sector, has been addressed in many studies (Hemmington & King, 2000; Gilley & Rasheed, 2000; Lam & Han, 2005; Chatzoglou & Sarigiannidis, 2009; Sakhuja et al. 2015). In this context, the main purpose of this study is to determine the outsourcing levels of Group A travel agencies operating in Gaziantep, since there is not enough research questioning the outsourcing of travel agencies. In addition, as a result of the results obtained within the scope of the research, it has been tried to determine the outsourcing outsourcing status of travel agencies, to determine which services, if any, are outsourced by the agencies, to determine the criteria that are effective in outsourcing selection, to explain the reason if the agency does not prefer outsourcing and to reveal the future outsourcing request. In this direction, in the first part of the study consisting of three sections, outsourcing, historical development and importance, in the second part, the literature review on the activities and classification of travel agencies is given, and in the last section, the method of the research and the findings obtained from the interviews conducted are given.

2.Outsourcing

Outsourcing continues to become widespread in an increasing number of sectors, especially in the service sector and specialised knowledge-based areas. Outsourcing is basically a strategic decision involving the contracting of certain non-strategic activities or business processes that are necessary to produce goods or provide services. In order to gain competitive advantage, these activities or business processes are realised through agreements or contracts with companies with greater capacity. In this respect, outsourcing can be considered as the transfer of certain functions or activities to specialised private suppliers (Espino-Rodrigez, 2023: 21). In a strategic sense, outsourcing involves the purchase of missing activities that firms may not have developed in-house in the past, or the substitution of internal activities by transferring them to a third-party supplier (Edvardsson et al. 2020: 180).

Different definitions of outsourcing are given below.

Walton (1996), outsourcing is when an organisation entrusts a task to a third party or provides some of its various functions.

Barthelemy (2003), outsourcing is the transfer of all or part of organisational activities to external partners.

Geyskens et al. (2006), firms make outsourcing choices guided by efficiency through the lowest possible combination of production and transaction costs.

Elmuti and Kathawala (2000), outsourcing is the transfer of jobs that are not among the core competencies of the enterprises to a different organisation with expert qualifications.

Zhu (2001), It is the transfer of some of the activities carried out by the enterprise to another organisation in which its own employees cannot take part.

Budak et al. (2004) defined outsourcing as not performing all the activities required to be performed by an enterprise within its own structure, leaving the performance of certain activities to other enterprises specialised in this field, or outsourcing the work outside the main field of activity of the organisation to external enterprises instead of performing all the work itself.

Iqbal and Dad (2013), it is generally seen as the process of delegating certain activities of an organisation to third party providers

Çetinsöz (2010) stated that outsourcing is primarily the fulfilment of planning, coordination (harmonisation) and control functions by the enterprises themselves, while other business activities are provided by other enterprises.

Based on the above definitions, outsourcing can be defined as the specialisation of an enterprise in its own field after establishing a strategic alliance with another enterprise and sharing business and risks. In the literature, the most prominent strategic reasons for outsourcing are listed as enabling organisations to better focus on their core competencies and providing access to the unique resources of other businesses (Kremic et al, 2006; Parkhe, 2007; Di Gregorio et al, 2009). On the other hand, some researchers have argued that outsourcing may lead to a decrease in competitiveness and disruption of business operations as a result of knowledge transfer (Ranganathan and Balaji, 2007; Trkman and Desouza, 2012). Today, outsourcing practices applied in many sectors are also applied in the tourism sector. In order to support the large organisations operating in the tourism sector to provide the best services in their class, new businesses that have emerged have given the opportunity to outsource to these businesses. In this context, it is of great importance for the tourism sector that sector managers decide which services are important in terms of outsourcing (Sakhuja et al. 2015: 321).

2.1.Historical Development and Importance of Outsourcing

It is possible to say that the historical background of outsourcing dates back to ancient times. In official sources, the assignment of this task to someone outside the administration for the regular and systematic implementation of the tax collection system during the Roman Empire is referred to as outsourcing (Kakabadse and Kakabadse, 2002: 189). On the other hand, in the 18th and 19th centuries, the UK made agreements with the private sector and left the realisation of activities such as the maintenance and operation of street lights, the management of prisons, the construction of public highways, the collection of taxes and the provision of services to the private sector. In the USA, Australia and France, it is possible to see practices on outsourcing in the 19th century. For example, postal distribution in the USA and Australia is largely carried out by the private sector (Aksu and Ehtiyar, 2007: 270). The growth in outsourcing in all sectors between 1970-1990 is estimated to be approximately 30 per cent. In the late 1990s, especially manufacturing sectors made good use of technological developments and the benefits of globalisation in order to spread their production processes all over the world. In this process, firms increasingly relied on outsourcing across national borders to reduce costs and increase efficiency. In particular, organisations that incorporate business processes such as call centres and information technology, such as accounting and logistics services, expected the process of outsourcing the production process to have a positive impact on small economies (Valiyattoor and Bhandari, 2020:3).

Some enterprises apply to outsourcing in order to produce some of their products or to realise some of their processes. Nike, one of the sports equipment manufacturers, and Boing, one of the aircraft manufacturers, are the best examples of such enterprises (Öztemel, 2007: 6). In Turkey, outsourcing started in the construction sector and progressed towards contract manufacturing. Organisations such as Koç Holding and Sabancı Holding have made outsourcing a comprehensive strategy in order to gain advantage. For example, Koç Holding has withdrawn from some of its fields of activity and transferred its resources to sectors in which it aims to operate in the long term. Thus, it has increased its competitiveness day by day and outsourced its accounting, data processing and logistics services in order to reduce its costs (Çoğan, 2003: 41).

2.2.Types of Outsourcing

It is possible to say that the types of outsourcing are varied by different researchers. Espino-Rodrigues and Padron-Robania (2004) argue that there are two different approaches to outsourcing: strategic and tactical. On the other hand, outsourcing types differ according to the classification criteria. The types of outsourcing that vary depending on the stage of the decision analysis, depending on the range, depending on integration, depending on the nature of the relationship, depending on administrative control and depending on the ownership relationship are shown in Table 1.

Table 1. Types of Outsourcing

Classification Criteria	Outsourcing Type
Classification depending on the stage of decision analysis	Strategic outsourcing; tactical or traditional outsourcing
Interval-dependent classification	Total outsourcing; selective or partial outsourcing
Classification based on the degree of integration	Outsourcing, semi-outsourcing
Classification based on relationship characteristics	Group or internal outsourcing, external or external outsourcing
Outsourcing subject to administrative control	Outsourcing of performance; externalisation of resources Welding
Outsourcing based on ownership relationship	Private outsourcing, public outsourcing Usage

Source: Zöngür et al., 2016: 92

3.Travel Agencies

As a commercial organisation, travel agencies have an important place in tourism activities as well as being an intermediary business. In this section, the definition and activities of travel agencies and information on their classification are presented below.

3.1.Definition and Activities of Travel Agencies

There are many opinions and information on the definition of travel agency in the literature. As a commercial organisation, travel agencies provide intermediary services for individuals to relocate for touristic purposes and offer local transportation services along with service options to tourists (Alaeddinoğlu and Can, 2007: 6). Travel agencies are the organisations that market and sell the goods and services produced by the tourism and travel industry, which is in continuous development, with modern and advanced methods (Mısırlı, 2008: 37). According to the definition in Article 1/e of the Law No. 1618 on "Travel Agencies and Association of Travel Agencies", a travel agency is defined as "a commercial organisation that is authorised to provide tourists with tourism-related information for profit, to create package tours and independent tours, to provide accommodation, transportation, sightseeing, sports

and entertainment services for tourism purposes, and to market the product it creates through its own or other travel agencies" (Mevzuat.gov.tr, 2023). The concept of travel agency should not be considered only as an intermediary business. Because in countries where there are no tour operators legally, it is very important in terms of fulfilling the activities of businesses of this nature (Demir, 2014: 85). While the main activities of travel agencies are reservation, operation and information, other activities are customs-visa procedures, car rental, tour organisation and sales, ticketing, etc. The activities of travel agencies can be summarised as follows (TÜRSAB, 2019: 8):

- Organising Tour,
- Reservation,
- Transfer,
- Information,
- Currency Exchange Transactions,
- Ticket Sales,
- Rent a Car,
- Health and Insurance Services,
- Passport Transactions,
- Visa and Customs Procedures,
- Guide Training,
- Marketing of Tours,
- Organisation of special events,
- Accounting for Tours,
- Organisation organisation,
- Selling Travel Agency Product,
- Organising Promotional Trips.

Classification of Travel Agencies

Travel agencies are classified in different ways due to their different characteristics, different target markets and different activities. In this respect, travel agencies can be classified as structural, functional, field of activity and legal. In structural classification, the size of the enterprise is taken as a criterion. While many variables such as the financial status of the enterprise, its capital, the number of tourism enterprises it does business with, the number of vehicles it uses, etc. are considered as quantitative criteria, variables such as the organisation and management structure of the enterprise, market share, organisational values are considered as qualitative criteria. In structural classification, travel agencies can be classified as international chain travel agencies, large-scale travel agencies and independent local travel agencies (Mısırlı, 2010: 54-57).

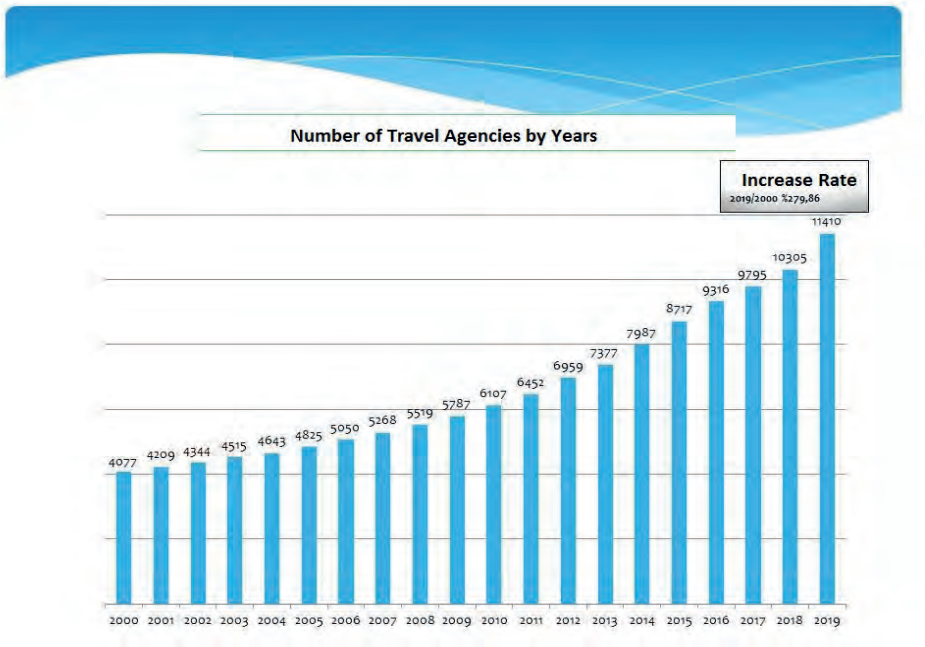
According to their function, travel agencies are classified as incoming, outgoing and domestic travel organisations, while according to their field of activity, they are classified by specialising in certain areas such as congress-meeting, ticket-sales, car rental, yacht tourism (Demir, 2014: 86). In legal terms, travel agencies are divided into three groups with the Law No. 1618. The services offered by travel agencies determined by the law are as follows (Kozak et al., 2015: 88; Alaeddinoğlu and Can, 2007: 54-55):

Group A Travel Agencies are the most comprehensive agencies that have the right to carry out all travel agency activities. Some of their duties are as follows; currency exchange, visa-passport procedures, car rental, selling tickets of transport companies, organising domestic and international tours.

Group B Travel Agencies are responsible for selling the tickets of transportation vehicles (road, railway, maritime, airway) and tours to be organised by Group A travel agencies.

Group C Travel Agencies can only operate within Turkey. For this purpose, they are responsible for organising domestic tours. Travel agencies registered to the Association of Turkish Travel Agencies by years are shown in Figure 2.

Figure 2. Number of Travel Agencies Registered to TÜRSAB by Years



Source: Ministry of Culture and Tourism, 2022.

The increasing number of travel agencies registered with the Association of Turkish Travel Agencies shows how much these businesses are needed in the tourism and travel industry. While there were 4077 agencies affiliated to the association in 2000, there are 11410 agencies registered in 2019. The increase in the number of agencies from year to year is shown in Figure 2. In the literature research, studies on outsourcing in travel agencies were found. According to the results of the research conducted by Özdoğan and Esen (2011), hotel, boat, entertainment and photography are the main services that agencies in the Fethiye region benefit from outsourcing. Arıca (2014) found that travel agencies operating in Eskişehir province prefer outsourcing in the fields of bus rental, guidance services, car rental, information technologies, accommodation reservations and accounting; Tavukçu et al. (2016), as a result of their study conducted in Batman province, found that travel agencies prefer outsourcing in car rental, guidance services, visa and customs procedures, accounting and information technologies.

4.Method

In this section of the study; the research model, the purpose and importance of the research, the participant group and the explanations about the data collection and analysis processes of the research are given.

4.1.Research Model

Qualitative research model was preferred as the method in the study. Qualitative research method has become an increasingly preferred method in social sciences in recent years. Karataş (2015) stated that there is an effort to reach a deep understanding of the subject in qualitative research, and in this respect, the researcher acts like an explorer and traces the reality with additional questions and attaches importance to the subjective point of view of the interlocutor. In qualitative research, the size of the sample should be determined according to the nature of the research problem and the limitations of the resources available to the researcher. For this purpose, non-probability purposive sampling method was used in the study. In the selection of individuals to be interviewed in the non-probability purposive sampling method, it is considered whether they are directly related to the research subject rather than their power to represent the universe (Yıldırım & Şimşek, 2008: 87).

4.2.Purpose and Importance of the Research

The main purpose of the study is to determine the level of outsourcing practices of Group A travel agencies in Gaziantep province. In addition, within the scope of the research, it is also aimed to determine the outsourcing status of the travel agencies, to find out which services, if any, are outsourced by the agencies, to determine the criteria that are effective in outsourcing selection, to reveal the reasons if the agency does not prefer outsourcing and to reveal the future outsourcing desire. When the researches on outsourcing in the tourism industry are examined, it is seen that the researches are concentrated in the field of hotel management and not sufficiently addressed in the field of travel businesses and travel agencies.

4.3.Participant Group

In this research, purposeful sampling method, one of the non-probability based sampling types, was preferred in determining the participants for the research. In the purposive sampling method, it is possible to reach individuals with in-depth knowledge of the research subject through a limited number of participants (Yıldırım & Şimşek, 2011). It has been determined that there are 124 Group A travel agencies in Gaziantep province as of May 2022 (Gaziantep Provincial Directorate of Culture and Tourism, 2022). In this context, interviews were conducted with 9 Group A travel agencies.

4.4.Collection and Analysis of Research Data

In this research, nine Group A travel agency officials were interviewed. In line with the selected method, three general data collection techniques, namely interview, observation and document analysis, were used. Semi-structured interview technique was preferred because of its flexibility. In this technique, the researcher prepares the interview protocol including the questions he/she plans to ask in advance. However, depending on the flow of the interview, the researcher can affect the flow of the interview with different side or sub-questions and open the answers given by the person (Türnüklü, 2000: 547). In the preparation of semi-structured interview questions, similar studies on outsourcing in travel agencies were used (Özdoğan & Esen, 2011; Arıca, 2014; Tavukçu et al. 2016).

5.Findings

In the study conducted to determine the outsourcing levels of Group A travel agencies operating in Gaziantep, nine travel agency officials were interviewed. The data obtained through content analysis conducted within the scope of the research and the findings obtained from these data are presented respectively. Firstly, the demographic characteristics of the travel agency officials participating in the research are shown in Table 2.

Table 2. Demographic Characteristics of Travel Agency Authorities

Participant	Age	Gender	Marital Status	Education Level	Agency Task
P1	27	M	Single	Licence	Operation/Transfer
P2	54	M	Married	High School	Director
P3	27	M	Single	Associate Degree	Operation/Transfer
P4	25	M	Single	Associate Degree	Reservation
P5	38	M	Single	Licence	Manager (Branch)
P6	36	M	Single	High School	Director
P7	41	M	Married	Licence	Director
P8	35	W	Married	Licence	Reservation Manager
P9	28	W	Married	High School	Reservation

*Participants are indicated with the letter K.

According to Table 2, when the demographic characteristics of the nine travel agency officials who participated in the study are analysed, five agency officials are between the ages of 25-35, three agency officials are between the ages of 36-45, and one agency official is over the age of 46. In terms of gender, seven agency officials are male and two agency officials are female. According to marital status, four agency officials are married and five agency officials are single. In terms of education level, three agency officials are high school graduates, two agency officials are associate degree graduates and four agency officials are bachelor's degree graduates. The travel agency officials participating in the study differ in terms of their duties in the agency, and the majority of them are agency managers/owners who have a good command of the subject. Information on the number of employees and the year of operation of the nine travel agencies included in the study is shown in Table 3.

Table 3. Characteristics of Travel Agencies

Participants	Year of Activity of the Agency	Number of Employees in the Agency
P1	2017	4
P2	2017	7
P3	2018	4
P4	2014	11
P5	2017	7
P6	2015	4
P7	2018	5
P8	2017	8
P9	2017	8

According to Table 3, ten of the travel agencies participating in the study started to operate in 2015 and before, while twelve travel agencies started to operate in 2016 and after. The number of employees in the agency varies according to the field of activity of the agency. According to the results of the interviews, when the outsourcing status of the travel agencies is examined, it is determined that all nine travel agencies benefit from outsourcing. The activities that travel agencies use in outsourcing practices are shown in Table 4.

Table 4. Activities Used by Travel Agencies in Outsourcing Practices

Activities Utilised	Frequency of Repetition (f)
Agency Services (Advertising and promotion, social media management and consultancy, etc.)	9
Rent a Car	9
Information Technology	8
Call Centre Services	5
Legal proceedings	9
Occupational Health and Safety Services	9
Accommodation Services	9
Accounting Transactions	8
Organisation	3
Staff Training	3
Guidance Services	9
Insurance Transactions	9
Visa and Customs Transactions	9
Food and Beverage Services	8

According to Table 4, when we look at the activities that the travel agencies participating in the research benefit from outsourcing; it is revealed that all outsourcing agencies benefit from outsourcing in Occupational Health and Safety services. Law No. 6331 on Occupational Health and Safety entered into force after being published in the Official Gazette dated 30/06/2012 and details about the application area of this law are available on Türsab's web page. For this purpose, according to the "List of Workplace Hazard Classes" published in the Official Gazette, Travel Agencies are in the "less dangerous" class (Türsab Regulation). On the other hand, travel agencies stated that they prefer to outsource agency services (advertising and promotion, social media management and consultancy, etc.), car rental, insurance and legal transactions. Accommodation services, guidance services, food and beverage services are also among the areas where outsourcing is utilised. In addition, travel agency officials stated that the demand for call centre services and information technologies will increase with the developing communication tools. According to the interview results, the reasons that lead travel agencies to outsourcing are shown in Table 5.

Table 5. Reasons that lead travel agencies to outsourcing

Reasons	Frequency of Repetition (f)
Focus on Core Activities	9
Increasing Knowledge and Skills	8
Need for Consultancy Service	7
Providing Activity Flexibility	9
Improving Service Quality	9
Improving Business Image	6
Inadequacy of the Organisation in Relevant Activities	5
Efficient Use of Resources	6
Cost Saving - Less workload	9
Cash Flow Provision	8
Improving Competitiveness	8
Sharing Risks - Mutual Trust	9
Making Fixed Costs Variable	4
Following Technology Closely	3

According to Table 5, the main reasons that lead Group A travel agencies operating in Gaziantep to outsourcing are focusing on core activities, ensuring service quality, sharing risks and mutual trust. The other reasons are, respectively, providing cash flow, following technology closely, providing operational flexibility, increasing knowledge and skills, improving business image, need for consultancy services, using resources efficiently, and making fixed costs variable. On the other hand, the characteristics that travel agencies look for in the choice of outsourcing are reliability, familiarity, interest, relevance, customer satisfaction, being international, the guide having a good knowledge of the region by mastering a foreign language, and the contracted insurance companies being corporate. When travel agencies were asked about their opinions on outsourcing in the coming periods; P1: "*Outsourcing will always continue. It will even continue to increase because the lower the cost, the better.*" P2: "*Agencies are less cost, more profit. For example; if I hire a guide all the time, I have to pay a fee. If I use it only when lifting a tour, the cost decreases. Outsourcing will not end, especially in this process*." P5: "*Being like this will bring profit, not every activity can be done by the business alone anymore*." P7: "*I have to say that we will continue, everyone is already earning this way. In the coming years, companies with high quality will win*." P8: "*We have been renting vehicles since we opened and we will continue to do so, we also outsource the guidance and we will continue to do so*."

6.Conclusion and Recommendations

Businesses have been in search of a number of approaches in order to keep up with the increasing competition conditions with globalisation. In this context, they have benefited from outsourcing applications in order to follow innovations, to maintain or expand their market share and to make profit. Tourism enterprises have also focused on their core competences and left the services other than their core competences to specialists. Travel agencies have also developed by adopting a tactical management approach from the past to the present, and have preferred experts in the field other than the main activities.

As a result of the answers given by the nine travel agency officials who participated in the research, it was determined that Group A travel agencies operating in Gaziantep have turned to outsourcing and will benefit from outsourcing strategies in the future. This result supports the results of the research conducted by Arıca (2014). Arıca (2014) concluded that the majority of Group A travel agencies operating in Eskişehir benefit from outsourcing and will prefer outsourcing practices in the future. According to the results of the research, the main reasons for outsourcing by travel agencies operating in Gaziantep are focusing on main activities and improving competitiveness. In addition, it has been observed that the travel agencies participating in the research in Gaziantep, where tourism activity is intensively experienced, have determined what their core competencies are. Agencies that correctly determine their core competences also correctly decide which services they will outsource. These results support the studies conducted by Çevirgen (2009) and Tavukçu et al. (2016). The main issue that needs to be emphasised here is the selection of the most suitable supplier that is expert in its field, has a sound financial structure, has good references and can adapt to the organisational culture of the enterprise (Çevirgen, 2009). It was concluded that the main services that travel agencies do not perform themselves but outsource are legal procedures, insurance procedures, visa-customs procedures and occupational health and safety. As a result of the study conducted by Özdoğan and Esen (2011), hotel, boat, entertainment and photography are the main services that travel agencies in Fethiye region utilise from outside. Tavukçu et al. (2016), as a result of their study conducted in Batman province, stated that travel agencies prefer outsourcing in car rental, guidance services, visa and customs procedures, accounting and information technologies.

The characteristics that Group A travel agencies operating in Gaziantep province look for in outsourcing applications are reliability, familiarity, interest, customer satisfaction, internationality, the guide's knowledge of the region in a foreign language, and the contracted insurance companies being corporate. It is concluded that the most important reason for travel agencies to prefer outsourcing

applications is the lack of financial resources. Özdoğan and Esen (2011), Arıca (2014) found that the factor that pushes agencies to outsourcing is financial inadequacies.

As a result of the interviews, another result of the study is that travel agencies are inadequate in outsourcing knowledge. It is among the striking results of the research that although many travel agencies outsource, they are not fully aware that the strategy they apply is outsourcing. The most important limitation of the research is that the research was conducted in Gaziantep province. In future studies, regional level or Turkey scale can be taken as a subject. In this way, it can be investigated whether there is a difference in outsourcing practices between regions. In addition, studies using quantitative method or mixed method can be carried out.

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Modelling the relationship between financial assets and geopolitical, economic policy uncertainty, and oil volatility: evidence from quantile approaches

Remzi GÖK

Associate Professor, Department of Business Administration, Dicle University, Diyarbakır, Turkey, http://orcid.org/0000-0002-9216-5210

Eray GEMİCİ

Associate Professor, Department of Business Administration (Islahiye), Gaziantep University, Gaziantep, Turkey, http://orcid.org/0000-0001-5449-0568

Erkan KARA

Assistant Professor, Faculty of Applied Sciences, Department of Accounting and Finance, Necmettin Erbakan University, Konya, Turkey, http://orcid.org/0000-0001-7228-0396

Abstract

We examine the impacts of the geopolitical risk, economic policy uncertainty, and oil volatility indices on the commodity, Islamic equity, and green bond markets across all quantile distributions, utilizing both the quantile cointegration and causality-in-quantile tests. Our dataset, covering from February 2013 through April 2023, includes daily observations of the Bloomberg commodity index (BCI), Dow Jones Islamic markets index (DJIM), S&P green bond index (SPBG), Geopolitical Risk Index (GPRD), the daily news-based economic policy index for the US (NEPU). The quantile cointegration test results reveal evidence of non-linear cointegration relationships between the commodity and oil volatility indices at the medium and upper quantiles of the conditional distribution. Further, the causality tests show casual impacts from the three risk factors across all quantiles, with the exception of the lowest and middle quantiles, at different lags. We obtain comparable results from the quantile regression models, where the impact varies in magnitude, significance, and direction. The negative impacts observed at the lower quantiles signify the hedging capabilities of commodity, Islamic, and green assets against fluctuations in geopolitical, economic policy, and crude oil market volatility. DJIM arises as the most positively sensitive asset to GPRD and NEPU during the bullish market conditions, that is, heightening the geopolitical risks and economic policy uncertainties result in higher returns in Islamic markets.

Keywords: EPU, GPR, OVX, Islamic markets, commodity, green asset.

1. Introduction

During times of high uncertainty, businesses delay investments, while investors seek safe-haven assets to safeguard portfolio value during market recovery (Diniz-Maganini et al., 2021; Flavin et al., 2014). Notably the COVID-19 pandemic in the first half of 2020 caused significant shocks to

global economic activity, leading to increased unemployment rates, surging economic and financial uncertainties, and drastic declines in energy and financial assets, disrupting the international financial system and posing risks to global financial stability (Li et al., 2021). For instance, major developed stock market indices such as the S&P500, FTSE-100, and Nikkei-225 experienced substantial declines following the announcement of the pandemic (Maghyereh & Abdoh, 2022).

Geopolitical tensions have been shown to significantly impact asset price forecasting, emphasizing the importance of considering geopolitical factors in financial market analysis. Events like the Russia-Ukraine crisis in 2014 and the US-North Korea cold war in 2017 had noticeable effects on financial markets. The Dow Jones Global stock index and Dow Jones Islamic Market (DJIM) world indices experienced declines during the Russia-Ukraine crisis but rose during the US-North Korea cold war (Hassan et al., 2022).

By shedding light on the complex relationships between risk factors and asset classes, this research offers valuable insights for investors, policymakers, and financial practitioners. Understanding and navigating the dynamics of commodity, Islamic equity, and green bond markets in the face of geopolitical risk, economic policy uncertainty, and oil market volatility can aid in better risk management and decision-making.

This study aims to investigate the interplay between geopolitical risk, economic policy uncertainty, and oil volatility indices, and their impacts on commodity, Islamic equity, and green bond markets. The research specifically examines how these risk factors influence different asset classes across various quantile distributions.

The remainder of the paper comprises four sections. Section 2 reviews the relevant literature, while Section 3 describes the dataset and methodologies. Section 4 presents and discusses the empirical findings. Lastly, Section 5 concludes the paper, discussing its policy implications.

2. Literature Review

Numerous studies have investigated the relationship between financial or uncertainty/risk factors and various financial assets, employing diverse techniques and methodologies. Lee et al. (2021) analyze the causal relationship between oil price, geopolitical risks, and the green bond index in the United States, finding unidirectional Granger-causality from geopolitical risk to oil price at extreme quantiles. Dogan et al. (2023) examine the dynamic relationship between crude oil market returns and four key indices, highlighting the intensified volatility transmission from oil markets to green bond markets during crisis periods. Long et al. (2022) investigate the connection between uncertainty and green bonds in the U.S., Europe, and China, revealing that stock market and oil market uncertainty have a stronger influence on green bonds, particularly in emerging markets. Hassan et al. (2022) explore the impact of risk and uncertainty indices on Islamic equity indices, demonstrating positive links between geopolitical risk and Dow Jones Islamic Market (DJIM) World and adverse effects of oil market volatility on Islamic equity indices. Dong et al. (2023) examine the effects of geopolitical, economic policy, and climate policy uncertainty on the long-term correlations between conventional/energy stocks and conventional/green bonds, highlighting the safe-haven characteristics of both conventional and green bonds during high geopolitical risk. Pham and Nguyen (2022) investigate the impact of stock volatility, oil volatility, and economic policy uncertainty indices on green bond returns, concluding that green bonds can serve as a hedge against uncertainty during periods of low uncertainty. Ahmadi et al. (2023) explores the impact of oil price shocks on the volatility of agricultural and metal commodities by utilizing the structural vector autoregressive (SVAR) model. The findings reveal that the response of commodity volatility to oil price shocks varies significantly depending on the underlying cause of the shock in each period. Ahmed and Sarkodie (2021) examines the impact of the COVID-19 pandemic and economic policy uncertainty on commodity prices using a Markov regime-switching dynamic model. Their findings reveal that COVID-19 outcomes and economic policy uncertainty affect the returns of widely traded

commodities to varying degrees. Albulescu et al. (2019) investigates the causal relationship between U.S. economic policy uncertainty and the connectedness of crude oil and currency markets, particularly focusing on commodity currencies from advanced and emerging nations. The findings indicate that U.S. economic policy uncertainty influences the connectedness of crude oil and currency markets. Bouri et al. (2019) investigates the causal relationship between geopolitical risks and return and volatility dynamics in Islamic equity and bond markets using a non-parametric causality-in-quantiles test. They reveal that geopolitical risks primarily affect volatility measures in Islamic equity markets, while both returns and volatility measures of Islamic bonds are predicted by geopolitical risks.

3. Data and methodology

3.1. Sample data and descriptive statistics

In this study, we consider daily closing prices of three assets—Bloomberg commodity index (BCI), Dow Jones Islamic Markets Index (DJIM), S&P Green Bond Index (SPBG)—and three risk factors—Geopolitical Risk Index (GPRD), News-based economic policy uncertainty index (NEPU), Oil Volatility Index (OVX)—over the sample period from February 2013 till April 2023, with 2568 observations. BCI and OVX are obtained from Yahoo Finance; DJIM and SPGB are available at https://www.spglobal.com/, GPR (Caldara and Iacoviello, 2022) and NEPU (Baker et al., 2016) are, respectively, downloaded from https://www.matteoiacoviello.com/gpr.htm and https://fred.stlouisfed.org/. The continuously compounded returns, described in Table 1 and plotted in Figure 1, are natural logarithms of two consecutive index prices.

Table 1 Descriptive Statistics for Return Series

Panel A: Summary Statistics						
	DBCI	**DSPGB**	**DDJIM**	**DGPRD**	**DNEPU**	**DOVX**
Mean	-0.00011	-0.00005	0.00031	-0.00007	-0.00045	0.00015
Variance	0.00008	0.00001	0.00009	0.18947	0.25975	0.00370
Skewness	-0.444***	-0.322***	-0.821***	-0.03	0.083*	1.871***
Kurtosis	2.944***	5.008***	12.922***	1.692***	2.302***	29.849***
JB	1011***	2727***	18149***	307***	570***	96796***
Q(20)	26.945***	59.747***	140.994***	642.508***	553.136***	72.437***
Q2(20)	875.385***	680.519***	3090.228***	401.116***	243.374***	506.894***
Panel B: Correlation Coefficients						
DBCI	1					
DSPGB	0.18***	1				
DDJIM	0.33***	0.232***	1			
DGPRD	-0.01100	-0.04**	0.03000	1		
DNEPU	-0.02300	-0.035*	-0.01100	0.049**	1	
DLOVX	-0.326***	-0.033*	-0.353***	0.01500	0.038*	1

Note: *, **, and *** indicates the rejection of the null hypothesis at a 10%, 5%, and 1% significance level.

The results, given in Panel A, show negative average returns for BCI and SPGB indices, whereas DJIM posts a positive return. The same is true for the risk factors, two indices have negative and one index has positive daily return. Risk factors are more volatile than financial indices, where NEPU has the highest standard deviation, followed by GPRD and OVX. Three financial indices as well as GPRD are significantly and negatively skewed, whereas NEPU and OVX exhibit positive skewness. All

variables are significantly leptokurtic and non-normally distributed given their positive excess kurtosis and rejections of the null hypothesis, respectively. The Ljung–Box Q(20) and Q2(20) tests indicates, respectively, the presence of serial correlation of residuals and squared residuals. The financial indices are positively and significantly correlated with each other but move in the reverse direction with the risk factors. Likewise, we observe positive and weak correlation coefficients among three risk factors.

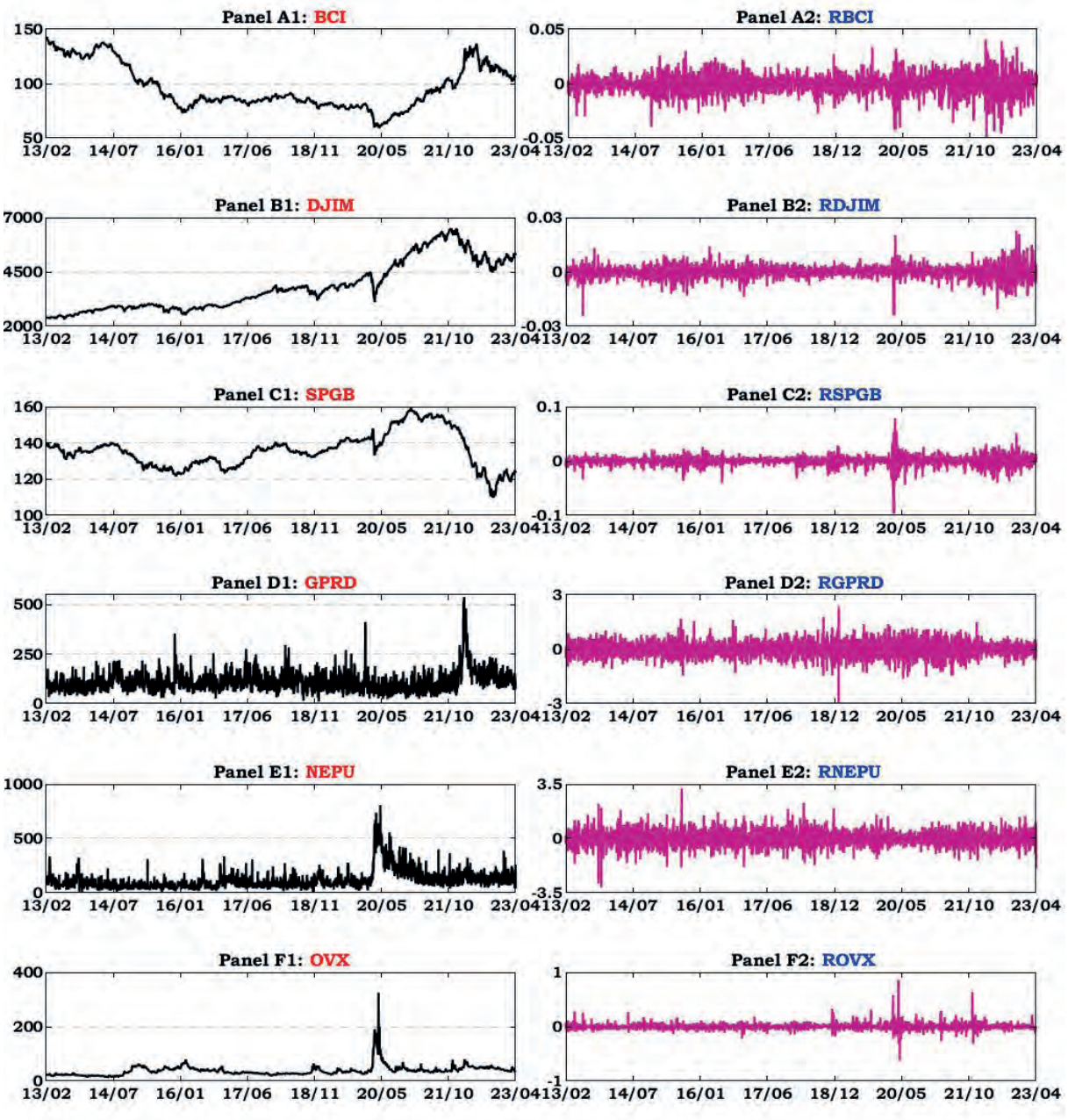

Figure 1. *Plot of Times Series in Level and First Log-Difference*

Feb 1, 2013 to April 14, 2023, with 2568 daily observations

3.2. Methodology

3.2.1. Quantile Unit Root Test (Koenker and Xiao, 2004)

Koenker and Xiao (2004) propose a new unit root test that is derived from the quantile regression form and extension of the Augmented Dickey-Fuller unit root test. The advantage of this unit root test is it permits various mechanisms to adjust long-run equilibrium levels at various quantiles and a more powerful unit root test for series that are behaving heavy-tailed distributions (Bahmani-Oskooee and Ranjbar, 2016).

Koenker and Xiao (2004) recommend the following equation below to get t-statistic value:

$$t_n(\tau_i) = \frac{\hat{f}(F^{-1}(\tau_i))}{\sqrt{\tau_i(1-\tau_i)}} (S'_{-1} P_x S_{-1})^{1/2} (\hat{\rho}_1(\tau_i) - 1) \quad (1)$$

In above equation (1), S_{-1} represents lagged dependent variables (y_{t-1}) and P_x denote space orthogonal matrix to $X = (1, \Delta e_{t-1}, \dots, \Delta e_{t-p})$. Asymptotically consistent estimator of $f(F^{-1}(\tau_i))$ by $\hat{f}(F^{-1}(\tau_i))$ can be taken in the following equation:

$$\hat{f}(F^{-1}(\tau_i)) = \frac{(\tau_i - \tau_{i-1})}{G'(\omega(\tau_i) - \omega(\tau_{i-1}))} \quad (2)$$

The null hypothesis of this unit root test is based on Kolmogorov-Smirnov (QKS) statistics, which is:

$$QKS = Sup_{\tau_i \in [\underline{\lambda}, \bar{\lambda}]} |t_n(\tau)| \quad (3)$$

3.2.2. Quantile Cointegration Test (Xiao, 2009)

Xiao (2009) proposes a new method in which the effect of coefficients change by any shocks may vary over diverse quantiles across different periods. This new cointegration model catches, as being an extension of classical cointegration models, the effect of conditioning variables on the scale, location, and shape of the conditional distribution. This new quantile cointegration model has advantages for allowing further volatility from dependent variables as well as independent variables and further grants conditional heteroskedasticity.

Xiao's (2009) quantile cointegration model, by showing, $\alpha(\pi)$ as the vector of drift can be written as follows:

$$X_i = \beta + \alpha' Y_i + \sum_{k=-s}^{s} \Delta Y'_{i-k} \prod_k + v_i \quad (4)$$

In equation (4), the error term can be shown as:

$$v_i = \varepsilon_t + (\beta_t - \beta)' x_t + \sum_{k=-s}^{s} \Delta Y'_{i-k} \left(\prod_{kt} - \prod_k \right) \quad (5)$$

$$Q_\pi^X (X_i, M_i^X, M_i^y) = \beta(\pi) + \alpha(\pi)' Y_i + \sum_{k=-s}^{s} \Delta Y'_{i-k} \prod_k + F_v^{-1}(\pi) \quad (6)$$

$Q_\pi^X(., M_i^X,)$ described in equation (4), $\beta(\pi)$ is the constant term and $\alpha(\pi)$ displays the persistent parameters, and to indicate errors of conditional distribution $F_v^{-1}$is displaced in equation (6).

Then this can be shown in the form of quadratic term in equation (7). This equation is used to calculate the stability of coefficients.

$$Q_\pi^X (X_i, M_i^X, M_i^y) = \beta(\pi) + \alpha(\pi)' Y_i + \theta(\pi)' v_i^2 + \sum_{k=-s}^{s} \Delta Y'_{i-k} \prod_k + \sum_{k=-s}^{s} \Delta Y^2_{i-k} \prod_k + F_v^{-1}(\pi) \quad (7)$$

4. Empirical Results and Discussions

As a yardstick, we first check the integration order of each variable. To this aim, we use four traditional unit root tests, i.e. the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979), the Phillips-Perron (PP) test (Phillips and Perron, 1988), the ADF-GLS test (Elliott et al., 1996) and the KPSS test (Kwiatkowski et al., 1992). The results of unit root tests, given in Table 2, reveal that BCI, DJIM, and SPGB are first-difference stationary, while all three risk factors are level stationary. Given the different integration orders of dependent, I(*1*) and independent variables, I(*0*), we proceed to establish whether our variables are stationary or not at different conditional distributions.

Table 2 Traditional unit root test results

	Level				Return			
	ADF	PP	ERS	KPSS	ADF	PP	ERS	KPSS
LBCI	-1.321	-1.319	-0.485	1.156***	-50.467***	-50.467***	-8.148***	0.527**
LDJIM	-1.204	-1.198	-2.617*	0.456***	-16.109***	-49.909***	-1.7*	0.044
LSPGB	-2.654	-2.56	-1.471	0.476***	-32.186***	-46.317***	-2.313**	0.182
LNEPU	-10.212***	-49.007***	-3.18**	0.329***	-28.694***	-462.405***	-0.955	0.098
LGPRD	-6.697***	-44.29***	-4.302***	0.299***	-24.634***	-532.544***	-0.362	0.052
LOVX	-4.477***	-4.115***	-3.796***	0.209**	-52.142***	-53.236***	-1.329	0.031

Note: All series are taken in natural logarithms. The null hypothesis is that the series has a unit root in the ADF (Dickey and Fuller, 1979), PP (Phillips and Perron, 1988), and ADF-GLS (Elliott et al., 1996) tests, whereas the series is stationary under the null hypothesis of the KPSS test (Kwiatkowski et al., 1992). *** and ** indicates the rejection of the null hypothesis at a 1% and 5% significance levels, respectively. Dataset is daily, spanning between February 1, 2013 and April 14, 2023, with 2568 daily observations.

Table 3 Quantile autoregression (QAR) unit root test results

	LBCI		LDJIM		LSPGB		LGPRD		LNEPU		LOVX	
τ	$\hat{a}$	t-stat	$\hat{a}$	t-stat	$\hat{a}$	t-stat	$\hat{a}$	t-stat	$\hat{a}$	t-stat	$\hat{a}$	t-stat
0.05	0.996	-0.750	1.020	4.095	1.014	1.752	0.468	-4.791*	0.464	-12.842*	0.933	-5.082*
0.10	0.995	-2.307	1.014	6.437	1.008	1.826	0.492	-15.024*	0.523	-16.318*	0.949	-8.609*
0.15	0.999	-0.728	1.011	5.652	1.005	1.633	0.491	-16.285*	0.552	-18.447*	0.961	-9.027*
0.20	0.999	-0.454	1.007	4.487	1.004	1.549	0.487	-17.249*	0.575	-19.86*	0.966	-9.499*
0.25	0.999	-1.117	1.005	3.983	1.001	0.455	0.496	-18.616*	0.585	-19.961*	0.971	-9.133*
0.30	0.999	-0.610	1.005	4.166	1.001	0.456	0.477	-20.441*	0.607	-19.267*	0.975	-8.383*
0.35	0.999	-0.644	1.004	3.414	0.999	-0.642	0.459	-23.376*	0.622	-19.091*	0.979	-7.194*
0.40	0.999	-1.310	1.002	2.320	0.999	-0.369	0.454	-24.452*	0.634	-18.757*	0.981	-6.654*
0.45	0.999	-0.719	1.001	0.874	1.000	-0.104	0.459	-25.58*	0.639	-18.483*	0.984	-5.679*
0.50	1.000	-0.060	1.000	-0.256	1.000	-0.231	0.454	-27.681*	0.644	-18.355*	0.988	-3.924*
0.55	1.00	0.03	1.00	-1.466	1.00	-0.78	0.453	-27.466*	0.66	-16.853*	0.991	-2.903*
0.60	1.000	0.463	0.998	-2.106	0.996	-2.041	0.451	-27.329*	0.647	-16.892*	0.994	-1.83
0.65	1.000	0.125	0.997	-3.057*	0.996	-2.253	0.455	-26.416*	0.658	-16.635*	0.998	-0.58
0.70	1.000	0.527	0.995	-4.371*	0.993	-3.41*	0.459	-25.861*	0.657	-16.049*	1.000	-0.02
0.75	1.001	0.809	0.994	-4.778*	0.990	-4.426*	0.454	-24.412*	0.644	-15.902*	1.003	0.73
0.80	1.001	0.758	0.992	-5.844*	0.988	-5.488*	0.467	-23.881*	0.629	-16.925*	1.006	1.39
0.85	1.002	1.559	0.988	-7.428*	0.986	-5.881*	0.483	-22.349*	0.610	-15.736*	1.011	2.01
0.90	1.000	0.129	0.985	-7.237*	0.981	-5.901*	0.472	-20.936*	0.606	-13.632*	1.010	1.36
0.95	0.999	-0.283	0.977	-5.932*	0.967	-4.701*	0.464	-16.405*	0.565	-11.39*	1.020	1.10

Note: τ indicates the quantile while $\hat{a}$ and t-stat denote the estimated persistence parameter and the t-statistic for different quantiles, respectively. Shaded areas denote rejection of the null hypothesis at the 1% significance level. Dataset is daily, spanning between February 1, 2013 and April 14, 2023, with 2568 daily observations.

Since the traditional unit root tests are stationarity tests for the conditional mean, we examine whether unit roots persist in a grid of 19 quantiles using the quantile unit root test proposed by Galvao (2009). Table 3 shows the persistence estimates and the corresponding t-statistics of the null hypothesis that H0: $\varrho(\tau) = 1$ in Equation (8) below for an equally spaced grid of 19 quantiles. Note that we include 10 lags of the difference of the dependent variable to avoid the serial correlation of the residuals. The results suggest that the null hypothesis of a unit root can be strongly rejected for LGPRD and LNEPU for all quantiles, while it is not possible to reject the null hypothesis for LBCI for any quantiles. In addition, LDJIM (LSPGB) is nonstationary in all quantiles lower than or equal to $\tau = 0.60$ (0.65), becomes stationary at level for the remaining quantiles. Likewise, LOVX is stationary at level at all quantiles lower than or equal to $\tau = 0.55$, but it is nonstationary at the remaining quantiles.

$$Q_t^Y(Y_t|I_t^Y) = \mu_1(\tau) + \mu_1(\tau)t + \varrho(\tau)Y_{t-1} + \sum_{j=1}^{p} \varrho_j(\tau)\Delta Y_{t-j} + F_u^{-1}(\tau) \quad (8)$$

Having established the order of integration for each series at various conditional distributions, we proceed to examine whether the first-differenced stationary series are cointegrated or not at the same quantiles by employing the quantile cointegration test of Xiao (2009). The cointegration results for the pairs of LBCI-LOVX and LSPGB-LOVX are given in Table 3. The results suggest a nonlinear cointegration association between LBCI and OVX variables, while we cannot reject the null hypothesis for the pair of LSPGB-OVX. The findings also show that all the estimated coefficients for the pair of LBCI-OVX are negative and statistically significant at the 1% level of significance for all quantiles greater than or equal to $\tau = 0.60$. Furthermore, the estimated coefficient of the model between green bond and oil implied volatility indices is significantly negative for $\tau = 60$, but becomes negative and insignificant at quantile $\tau = 65$.

Table 4 Quantile cointegration test and estimated coefficients

Panel A: Estimated Coefficients				
	$LBCI_t$ vs. $LOVX_t$		**$LSPGB_t$ vs. $LOVX_t$**	
quantile	β(τ)	γ(τ)	β(τ)	γ(τ)
0.60	-0.956***	0.080***	-0.127*	0.016*
0.65	-0.978***	0.087**	-0.036	0.005
0.70	-1.943***	0.242***	-	-
0.75	-2.315***	0.297***	-	-
0.80	-2.091***	0.268***	-	-
0.85	-2.472***	0.331***	-	-
0.90	-2.300***	0.309***	-	-
0.95	-1.223***	0.161***	-	-
Panel B: Quantile cointegration test				
	$\sup_\tau \lvert\widehat{V}_n(\tau)\rvert$		$\sup_\tau \lvert\widehat{V}_n(\tau)\rvert$	
SupVn β	3973.924	[10286.5; 8361.5; 7094.8]	230.929	[10286.5; 8361.5; 7094.8]
SupTn γ	615.648*	[1041.4; 685.6; 516.7]	23.7	[1041.4; 685.6; 516.7]

Note: Critical values in squared parenthesis are at 99%, 95%, and 90% confidence level, respectively. Furthermore, two lags and two leads of were included in the quantile cointegration model.

Next, we implement the quantile causality of Troster (2018) for three different lag specifications and present the findings between commodity index and three risk factors in Table 5, along with the subsampling p-values of S_T test across the grid of 19 quantiles ranged from 0.05 to 0.95. If we take into account all quantiles, all three risk factors significantly Granger-cause variation in commodity index

at the 1% significance level over three lag specifications. In addition, the results provide evidence of Granger-causality from changes in geopolitical risks, economic uncertainty, and oil implied volatility to the commodity index returns at all quantiles; with the exceptions for quantiles $\tau = 0.05$ and 0.55 for GPRD and OVX and for quantile $\tau = 0.05$ for NEPU. The results suggest that all risk factors have predictive powers for BCI regardless of the market conditions.

Table 5 Granger-causality to ΔBCIt subsampling p-values

	Panel A: GPRDt to BCIt			Panel B: NEPUt to BCIt			Panel C: OVXt to BCIt		
τ	$I_t^{\Delta BCI_t}=1$	$I_t^{\Delta BCI_t}=2$	$I_t^{\Delta BCI_t}=3$	$I_t^{\Delta BCI_t}=1$	$I_t^{\Delta BCI_t}=2$	$I_t^{\Delta BCI_t}=3$	$I_t^{\Delta BCI_t}=1$	$I_t^{\Delta BCI_t}=2$	$I_t^{\Delta BCI_t}=3$
0.05 -0.95	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.05	0.0804	0.6629	0.6563	0.1253	0.8653	0.8820	0.0004	0.6237	0.6147
0.1	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.15	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.2	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.25	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.3	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.35	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.4	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.45	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.5	0.0012	0.0016	0.0033	0.0004	0.0004	0.0004	0.0020	0.0004	0.0004
0.55	0.4380	0.2792	0.2110	0.0041	0.0824	0.0698	0.1261	0.2473	0.2171
0.6	0.0098	0.0045	0.0094	0.0004	0.0653	0.0616	0.0098	0.0020	0.0049
0.65	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.7	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.75	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.8	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.85	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.9	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.95	0.0065	0.0506	0.0327	0.0004	0.0367	0.0298	0.0804	0.0400	0.0286

Note: P-values in gray shaded areas represent no causality at quantile τ. ΔBCI_t is the log-difference of Bloomberg Commodity Index and $I_\tau^{\Delta BCI_t}$ is the number of lags of the dependent variable, ΔBCI_t.

Table 6 shows the subsampling p-values of the quantile Granger non-causality test from three risk factors to Dow Jones Islamic market index returns. We obtain relatively stronger causation impacts from GPRD, NEPU, and OVX, considering all quantiles of the distribution [0.05; 0.95] and across various quantiles. That is, GPRD and OVX Granger-cause the changes in DJIM at all quantiles for two lag specifications: 1 and 2; across all quantiles for lag =1 specification, except for quantile $\tau = 0.55$. The results also confirm that NEPU Granger-causes returns in DJIM across all quantiles for lag = 1 and across all conditional distributions but two quantiles $\tau = 0.05$ and 0.55.

Table 6 Granger-causality to ΔDJIMt subsampling p-values

	Panel A: $GPRD_t$ to $DJIM_t$			Panel B: $NEPU_t$ to $DJIM_t$			Panel C: OVX_t to $DJIM_t$		
τ	$\Gamma_t^{\Delta IM_t}=1$	$\Gamma_t^{\Delta IM_t}=2$	$\Gamma_t^{\Delta IM_t}=3$	$\Gamma_t^{\Delta IM_t}=1$	$\Gamma_t^{\Delta IM_t}=2$	$\Gamma_t^{\Delta IM_t}=3$	$\Gamma_t^{\Delta IM_t}=1$	$\Gamma_t^{\Delta IM_t}=2$	$\Gamma_t^{\Delta IM_t}=3$
0.05 -0.95	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.05	0.0314	0.0661	0.0902	0.0004	0.1322	0.2237	0.0004	0.0531	0.0751
0.1	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.15	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.2	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.25	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.3	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.35	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.4	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.45	0.0004	0.0004	0.0004	0.0033	0.0004	0.0004	0.0029	0.0004	0.0004
0.5	0.0127	0.0082	0.0053	0.0155	0.0102	0.0041	0.0131	0.0078	0.0029
0.55	0.0988	0.0624	0.1147	0.0033	0.1314	0.2363	0.0955	0.0743	0.1498
0.6	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.65	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.7	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.75	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.8	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.85	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.9	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.95	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004

Table 7 Granger-causality to ΔSPGBt subsampling p-values

	Panel A: $GPRD_t$ to $SPGB_t$			Panel B: $NEPU_t$ to $SPGB_t$			Panel C: OVX_t to $SPGB_t$		
τ	$\Gamma_t^{\Delta GB_t}=1$	$\Gamma_t^{\Delta GB_t}=2$	$\Gamma_t^{\Delta GB_t}=3$	$\Gamma_t^{\Delta GB_t}=1$	$\Gamma_t^{\Delta GB_t}=2$	$\Gamma_t^{\Delta GB_t}=3$	$\Gamma_t^{\Delta GB_t}=1$	$\Gamma_t^{\Delta GB_t}=2$	$\Gamma_t^{\Delta GB_t}=3$
0.05 -0.95	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.05	0.0343	0.3400	0.4461	0.1355	0.2612	0.3265	0.0004	0.2478	0.2376
0.1	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.15	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.2	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.25	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.3	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.35	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.4	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.45	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.5	0.0073	0.0065	0.0008	0.0053	0.0020	0.0037	0.0045	0.0024	0.0020
0.55	0.9073	0.4371	0.5747	0.1265	0.2233	0.2445	0.7539	0.5294	0.6355
0.6	0.0004	0.0004	0.0008	0.0004	0.0004	0.0008	0.0004	0.0004	0.0008
0.65	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.7	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.75	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.8	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.85	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.9	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
0.95	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004

We present the subsampling p-values of the quantile Granger non-causality test from three risk factors to the SP Green bond index returns in Table 7. It is quite evident that, all three factors Granger-cause SPGB index returns if we take into account all quantiles; across all quantile distributions, with the exceptions for quantiles $\tau = 0.05$ and 0.55 for GPRD, NEPU, and OVX indices. The results provide evidence that all three factors can be identified as useful predictors for green bond markets regardless of the market conditions.

Next, we utilize the quantile regression approach of Koenker and Bassett (1982) to quantify the impacts of three factors on the returns of commodity, green bond, and Islamic stock market indices and present the results in Table 8. The results show that three risk factors exert heterogeneous impacts on market returns over different quantiles. In Panel A, we observe that the impacts of risk factors on commodity market returns are, whether positive or negative, close to zero and mostly are significant. For example, the influence of OVX on commodity market returns is mostly profound and significantly negative as compared to GPRD. There is a negative effect from GPRD at quantiles lower than or equal to $\tau = 0.75$, while the impact switches sign from negative to positive at upper quantiles. Conversely, OVX index negatively and significantly influence the market returns at all quantiles, except quantile $\tau = 0.55$, where the impact strengthens at the upper quantiles. The results suggest relatively higher negative returns in commodity market during the heightened volatility in oil markets.

In Panel B, we present the regression results from the risk factors on the Dow Jones Islamic market index returns across various quantiles. The results show weak and negligible, whether negative or positive, impacts until quantile $\tau = 0.65$. After that, we find an almost hump-shaped pattern at the upper quantiles; the effect strengthens first and then starts to decline as the level of conditional distribution increases. Among three factors, NEPU emerges as the strongest factors at the upper quantiles, followed by GPRD and OVX. The results imply that rising uncertainty in economic uncertainty and geopolitical risks results in higher returns in Islamic market at the upper quantiles. On the contrary, DJIM acts as a strong safe haven instrument against the uncertainty in oil market.

Table 8 Quantile regression impacts on commodity, stock, and green bond indices

	Panel A: ΔBCI			Panel B: ΔDJIM			Panel C: ΔSPGB		
τ	GPR	NEPU	OVX	GPR	NEPU	OVX	GPR	NEPU	OVX
Panel A: Lower Quantiles (Bearish)									
0.05	-0.003***	-0.0024**	-0.012***	-0.0008	-0.004***	-0.012***	-0.002***	-0.001***	-0.0036***
0.10	-0.0015**	-0.0009	-0.009***	-0.0018**	-0.002***	-0.009***	-0.001***	-0.0006**	-0.0024***
0.15	-0.0015**	-0.0003	-0.007***	-0.002***	-0.002***	-0.008***	-0.001***	-0.0005***	-0.002***
0.20	-0.001	0.0001	-0.005***	-0.0009	-0.001**	-0.007***	-0.001***	-0.0003*	-0.0013***
0.25	-0.0008	0.0003	-0.004***	-0.0004	-0.0006	-0.005***	-0.001***	-0.0002	-0.001***
0.30	-0.0007	0.0004	-0.003***	-0.0005	-0.0002	-0.004***	-0.001***	-0.0001	-0.0008***
Panel B: Middle Quantiles (Normal)									
0.35	-0.0006	0.0007**	-0.0023***	-0.0003	0.0001	-0.0029***	-0.0005***	0	-0.0006***
0.40	-0.0009**	0.0009***	-0.0019***	-0.0001	0.0003	-0.0019***	-0.0004***	0	-0.0004**
0.45	-0.0009*	0.0009***	-0.0008	-0.0003	0.0005	-0.0016***	-0.0004***	0.0001	-0.0003*
0.50	-0.0005	0.0009***	-0.0003	-0.0001	0.0008***	-0.0007	-0.0005***	0.0001	-0.0003
0.55	-0.0003	0.001***	0.0003	-0.0003	0.001***	-0.0002	-0.0004**	0.0002*	0
0.60	-0.0001	0.0011***	-0.0465***	-0.0002	0.0012***	-0.0452***	-0.0004**	0.0002	-0.0005
0.65	-0.0003	0.0011***	-0.0478***	0.0466**	0.2577***	-0.045	-0.0004**	0.0002*	-0.0008
Panel C: Upper Quantiles (Bullish)									
0.70	-0.0003	0.0013***	-0.0456***	0.1285***	0.2669***	-0.0979	-0.0202***	0.0422***	0.0059
0.75	-0.0003	0.0013***	-0.045***	0.1169***	0.2679***	-0.0967	-0.0232***	0.048***	0.0118
0.80	0.0002	0.0011***	-0.0404***	0.0748***	0.2795***	-0.1294	-0.0403***	0.0525***	0.0338
0.85	0.0007	0.0014***	-0.0363***	0.0441***	0.2611***	-0.0332	-0.0495***	0.0564***	0.0115
0.90	0.0016***	0.0022***	-0.0333***	0.0113	0.2219***	0.0578	-0.0398***	0.0566***	-0.0098
0.95	0.003***	0.0025***	-0.019***	-0.0225***	0.1068**	-0.006	-0.0329***	0.0494***	-0.0023

Notes: *, **, or *** denote that the null hypothesis is rejected at the 10%, 5%, or 1% significance levels, respectively. The dataset spans from Feb 1, 2013 to April 14, 2023, with 2568 daily observations.

5. Conclusions

We study whether the magnitude of effects from the geopolitical risk, economic policy uncertainty, and oil volatility indices on the commodity, Islamic equity, and green bond markets vary across quantiles. To this aim, we implement the quantile cointegration and causality-in-quantile tests for the sample period from February 2013 through April 2023. On the one hand, the findings provide evidence of non-linear long-run linkages between the commodity and oil volatility indices at the medium and upper quantiles of the conditional distribution. On the other hand, the causality tests show casual impacts from the three risk factors across all quantiles. For example, if we consider all quantiles, the results show variations in the geopolitical, economic uncertainty, and oil implied volatility indices Granger-cause variations in the commodity, Islamic equity, and green bond indices at the 1% significance level. We observe comparable results across quantiles and find that all risk factors significantly Granger-cause three asset prices at all quantiles, with exception for the quantiles $\tau = 0.05$ and 0.50. These results suggest that the current information of all three risk factors could be used to predict the futures changes in commodity, equity, and green bond markets regardless of market conditions. However, their predictive powers weaken at the lower extreme and the median quantiles (0.05 and 0.50) and this result implies that three markets are hardly resilient to shocks from risk factors when markets are bearish and normal. Overall, DJIM index is the most sensitive market and NEPU index is the least dominant factor. The results of quantile regression show the impacts of risk factors differ in magnitude, significance, and direction. The negative impacts observed at the lower quantiles is a sign of the hedging capabilities of commodity, Islamic, and green assets against fluctuations in geopolitical, economic policy, and crude oil market volatility. Furthermore, DJIM appears to be the most positively sensitive asset to shocks from GPRD and NEPU during the bullish market circumstances; heightening the geopolitical risks and economic policy uncertainties result in higher returns in Islamic markets.

Our results provide relevant enlightenment on investors in building portfolio management strategies and policymakers in constructing monetary policies. On the one hand, nearly identical distributional causality structures towards financial markets may help policymakers in developing a solid policy framework to protect commodity, equity, and green bond markets against geopolitical, economic uncertainty, or oil volatility risks, thereby fostering market stability. On the other hand, investors in commodity, Islamic equity, and green bond markets should track the unfavorable movements in geopolitical risk, economic uncertainty, and oil indices before taking portfolio allocation decisions to avoid potential losses during the extreme adverse market conditions. Futures studies may utilize more novel approaches, such as the quantile correlation, quantile coherency, etc., to analyze the impacts of risk/uncertainty factors on the financial markets

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The Effects Of Natural Disaster On Financial Markets: The Emprical Analysis Of 2023 Earthquakes In Türkiye

Burak Buyukoglu

Dr, Gaziantep University, Nizip VHE, Deparment of Management and Organisation

Ferda Nakipoglu Ozsoy

Assoc. Dr., Gaziantep University, Economics and Administrative Science Faculty, Department of Economics

Asli Ozpolat

Assoc. Dr., Gaziantep University, Oguzeli VHE, Department of Managent and Organisation

Abstract

The study examines the effects of the Turkey earthquake that occurred in 2023 on financial markets. The 7.7 and 7.6 magnitude major earthquake disaster that occurred on 06.02.2023 greatly affected 11 provinces in Turkey (Gaziantep, Kahramanmaraş, Hatay, Malatya, Diyarbakır, Kilis, Şanlıurfa, Osmaniye, Adıyaman). Not only cities but also financial markets were affected by the earthquake disaster. The banking sector, which is one of the most important intermediary institutions of the financial markets, has used many opportunities for the earthquake region after the earthquake. The aim of the study is to investigate the effects of the earthquake disaster on the banking sector within the scope of financial markets. In this context, before and after the earthquake, the BIST100 index and the BIST Bank index were analyzed by cross cantilogram method. According to the findings obtained, there are no major differences in the BIST banking index after the earthquake.

Keywords: Earthquake, Financial Markets, CAR

Introduction

Turkey is one of the most active earthquake regions in the world and is geographically located where many large earthquakes have occurred from past to present. In the earthquakes that occur, there are many damages both materially, morally and economically. Although it is not compared to the loss of life in the financial markets economically, it has been greatly affected. In the earthquakes that occurred on February 6, 2023, first search and rescue operations continued, and then the Ministries of Treasury and Finance, Trade, Agriculture and Forestry, Labor and Social Security, Banking Regulation and Supervision Agency (BRSA), Capital Markets Board (CMB), Borsa İstanbul A.Ş. (BIST) and the Banks Association of Turkey (TBB) in order to protect the financial markets and the real sector from the negative conditions created by the earthquake. A series of preventive and remedial arrangements have been put into practice (Selçuk, 2023). These decisions were implemented in order to establish price stability in stocks by ending the declines experienced in the first 2 days of the earthquake in BIST, to prevent volatility in financial markets, to ensure the continuation of real sector activities in the disaster zone by ensuring the healthy functioning of the credit mechanism in the banking sector and to

limit the negative effects of the disaster on the country's economy in general (Selçuk, 2023). Summary information on the decisions taken regarding the economy after the earthquake is given in table 1 below.

Table 1: Economic Policy after Earthquake

Date of Issue	Issuing Authority	Subject of Regulation
February 6, 2023	Banks Association of Turkey	Loan Installment Deferral
	Borsa İstanbul A.S.	Suspension of the Order of Transactions of 8 Companies in the Earthquake Zone
	Capital Markets Board	Changes to the Equity Market
February 7, 2023	Banking Regulation and Supervision Agency	Loan Maximum Maturity and Credit Card Installment Limits
February 8, 2023	Ministry of Treasury and Finance	Tax Returns
	Borsa İstanbul A.S.	Closure of Share and Share Index Derivatives Markets
	Capital Markets Board	Suspension of TEFAS and BEFAS Transactions
February 9, 2023	Capital Markets Board	Amount of Donations Companies Can Make
10 February 2023	Banking Regulation and Supervision Agency	Loan Installment Deferral, Credit Card Maximum Limit and Minimum Payment Amount
13 February 2023	Banking Regulation and Supervision Agency	Contactless Payment
14 February 2023	Banks Association of Turkey	Loan Installment Deferral, Debt Write-Off, Fees
	Borsa İstanbul A.S.	Changes to the Equity Market
	Capital Markets Board	Share Repurchase and Credit Transactions
	Ministry of Treasury and Finance	VAT Regulation on Prefabricated Buildings and Containers
	Ministry of Commerce	Export Ban on Prefabricated Buildings and Containers
	Ministry of Treasury and Finance	Withholding Tax Rate Applied to the Share Repurchase of Companies
	Ministry of Treasury and Finance	Postponement of Tradesmen and Craftsmen Credit and Bail Cooperatives Loans
15 February 2023	Insurance and Private Pension Regulation and Supervision Agency	Private Pension System State Contribution portfolio
16 February 2023	Capital Markets Board	Disclosure of Financial Reports
17 February 2023	Banking Regulation and Supervision Agency	Banking Law Donation Limit
	Energy Market Regulatory Authority	Electricity and Natural Gas Assurance Price
	Ministry of Agriculture and Forestry	Agriculture and Livestock Supports
22 February 2023	Ministry of Agriculture and Forestry	Postponement of Agricultural Loans
	Ministry of Labour and Social Security	Dismissal, Short-Time Working and Unemployment Benefits
23 February 2023	Ministry of Treasury and Finance	VAT Regulation on Prefabricated Buildings and Containers (Application Extended)

Source: Official Journal, BIST, BDDK, CMB, TBB (2023)

After the earthquake we experienced on the morning of August 17, 1999, the stock market was closed until Thursday, August 26 with the decision taken before the opening of the session. Thus, there was no trading on the stock exchange for 7 working days after the earthquake. The stock market, which

closed trading at 5,807 on August 16, lost 10.38% of its value on August 26, the first trading day after the earthquake. The stock market, which showed a tendency to recover in the following days, completed the day at the level of 5.824 on September 6 and saw above the point where it was before the earthquake (Habertürk 2023).After the earthquake we experienced on the morning of August 17, 1999, the stock market was closed until Thursday, August 26, with the decision taken before the opening of the session. Thus, there was no trading on the stock exchange for 7 working days after the earthquake. The stock market, which closed trading at 5,807 on August 16, lost 10.38% of its value on August 26, the first trading day after the earthquake. The stock market, which showed a tendency to recover in the following days, completed the day at the level of 5.824 on September 6 and saw a rise above the point where it was before the earthquake (Habertürk 2023).

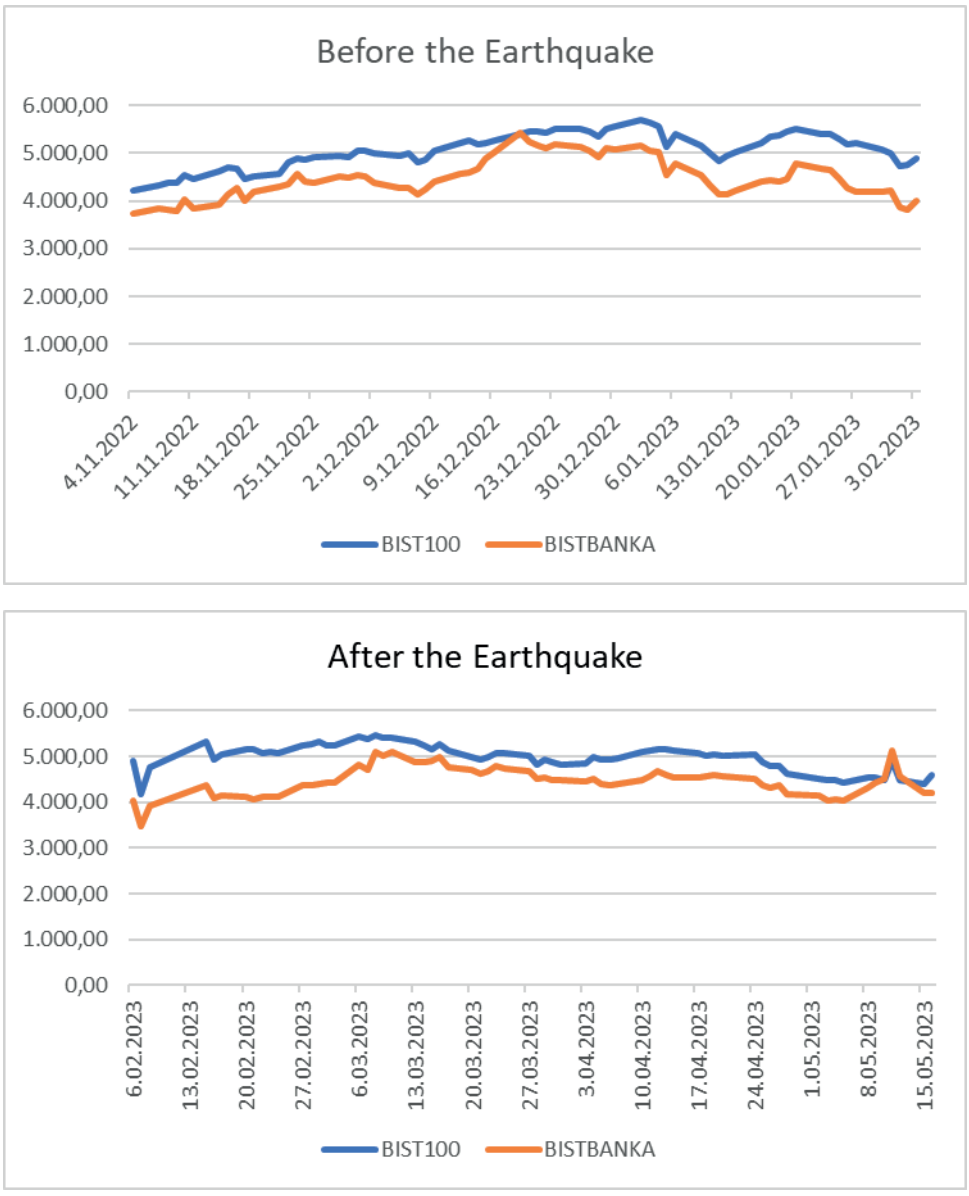

Figure 1: BIST100 and BISTBANKA Data before and after Earthquake (investing, 2023)

As can be seen in the pre-earthquake chart, there is an upward trend in both indices until the end of 2022, but it can be said that the increase in the banking index at the end of the year is even higher than the bist100 index. The reason for this is that after the New Year, speculatively, with the effect of the hikes that will come, we will borrow money to meet our needs. When the post-earthquake chart is examined,

there was a break in both the BIST100 and the BISTBANKA index on the date of the earthquake, and a sharp decline was observed in the reverse of the upward trend. The effect of this decline lasts less than a week; the upward trend continues until mid-March, and it is seen that it continues steadily after March until the election date. The fact that BIST was closed to trading on the 3rd trading day after the February 6 earthquake after a total decline of 16.2% and that the transactions made on the first two days were not canceled was criticized by stock investors. The main basis of the criticisms is that, considering the conditions in the earthquake region, the openness of the stock exchange was considered to be contrary to the "equal treatment principle" expressed in Article 357 of the Turkish Commercial Code (TCC). According to the Central Registration Agency (CRA) data, the fact that the number of investors in the 10 provinces affected by the earthquake is approximately 10% of the total number of investors (381,383) shows that a significant number of investors cannot benefit from the equal treatment principle due to the conditions of the earthquake region (VAP 2023). However, despite considerable public opinion on the issue, the proceedings carried out in the first two days have not been canceled.

The World Bank published its assessment report on the Kahramanmaraş earthquakes on February 20, 2023, as part of the "Global Rapid Post-Disaster Damage Estimation (Grade)" approach developed to determine the extent of the disaster experienced in the first few weeks after major disasters. According to the report, the direct cost of earthquakes is calculated at $34.2 billion (4% of GDP in 2021), of which $18 billion is residential, $9.7 billion is non-residential buildings, and the remaining $6.4 billion is infrastructure damage. It has also been stated that, in light of global experience, the potential cost of an earthquake can be up to twice the estimates. The report states that the estimated cost includes physical damage but does not include humanitarian and emergency response costs, indirect costs (production disruption, reduction in sales, etc.), or secondary effects (World Bank 2023, 6).

The European Bank for Reconstruction and Development (EBRD) has also included its estimates on the effects of the Kahramanmaraş earthquakes in its report titled "Regional Economic Prospects," published on February 16, 2023. In the report, it is stated that despite the great uncertainty created by the continuation of the rescue process, the negative impact of the earthquake on the growth rate of 2023 will probably be less than 1 point, and since the earthquake is in the first months of the year, the reconstruction process to be carried out during the year can largely offset the negative effects of the earthquake on the economy (EBRD 2023, 13–15). In its report titled "Turkey: The Economic Implications of the Eartquake," published on February 16, 2023, JP Morgan stated that the physical damage caused by the earthquake will cost the Turkish economy 25 billion dollars (2.5% of GDP) and that there are upside risks (Reuters 2023).

1. Literature

Yamori and Kobayashi (2002) investigated the effect of the 1995 Tokyo earthquake on the stock prices of Japanese insurance companies using the ordinary least squares method. This earthquake put a huge burden on insurance companies, so the Japanese earthquake insurance system was established. As a result of the findings, negative stock price reactions were detected in the period from the 0th day to the 9th day after the earthquake occurred. In addition, Aktürk and Albeni (2002) examined the impact of the 1999 Marmara-Bolu-Düzce earthquake on the Turkish economy. The similarity of the conditions of the period to the present day is remarkable. The 1994 economic stabilization measures pointed to the economic recession that began in mid-1998 and the contraction in the Gross Domestic Product (GDP), the decline in economic performance and the decline in domestic demand. Worthington and Valadkhani (2004) examined the impact of natural disasters on the Australian capital market for the period December 31, 1982, to January 1, 2002, using daily price and savings returns. It was concluded that the shocks caused by various 42 severe natural disasters such as storms, floods, hurricanes, earthquakes, and forest fires that occurred during this period were effective on market returns. Wang and Kutan (2013) examined the impact of natural disasters on both the insurance sector and the composite stock market using GARCH models for Japan and the USA. As a result of the findings, while no wealth effect of natural disasters

could be detected on the composite stock markets in the USA and Japan, they concluded that there were significant wealth effects in the insurance sectors. Except for the composite stock market in Japan, all other markets are exposed to the risks of natural disasters. In addition, Scholtens and Voorhorst (2013) examined how financial markets were affected by earthquakes in which the death toll was more than 100 in 21 countries on five continents during the 1973–2011 period. As a result of the empirical findings, they concluded that there are significant negative effects on the stock market's value. In addition, there was no difference in the responses given according to the severity of the earthquakes or according to different income groups in the countries. Miyakawa et al. (2014) examined the lending capacity of banks in the aftermath of the Great Hanshin-Awaji (Kobe) earthquake in Japan and its effects on export firms. The findings concluded that both large and intensive export margins of firms located outside the earthquake-affected region but with a main bank within the region were significantly adversely affected. Moreover, Snapolitano (2020) examined the effects on small and medium-sized enterprises operating in Van and concluded that the earthquake caused a total of 5 billion lira in damage to businesses.

2. Data and Methodology

In this part, data and methdology has been explained.

2.1. Data

Our main data sets used in the study, the BIST100 index and BISTBANKA index data, were obtained from the Investing database. The variables in the data set were examined in two groups: the period before the earthquake and the period after the earthquake. For the period between 04.11.2022 and 03.02.2023, the period before the earthquake, 66 trading days between 06.02.2023 and 16.05.2023 were included in the data set, and two different analyses were performed in order to see the effects of the earthquake.

Table 2: Before the Earthquake

	Observation	Average	S.Hata	Minimum	Maximum	Skewness	Kurtosis	Jarque-Bera
BİST100	66	5060.227	363.7614	4230.000	5698.000	-0.369033	2.301361	2.840302
BİSTBANKA	66	4474.561	425.6014	3739.000	5432.000	0.317372	2.259207	2.617106

Table 3: After the Earthquake

	Observation	Average	S.Hata	Minimum	Maximum	Skewness	Kurtosis	Jarque-Bera
BİST100	66	4971.606	287.6857	4186.000	5458.000	-0.590573	2.810853	3.934926
BİSTBANKA	66	4460.591	316.5688	3465.000	5118.000	-0.146305	3.407855	0.692908

The summary statistics made separately for a total of 132 trading days, both before and after the earthquake, and the preliminary tests required for the cross-cantilelogram method to be applied are shown in the tables.

Table 4: Unit Root Test

	Before the Earthquake			After the Earthquake		
	ADF	Q	Q2	ADF	Q	Q2
BİST100	-0.100099**	55.516***	100.17***	-0.188330**	43.230***	73.144***
BİSTBANKA	-0.088345*	55.234***	99.369***	-0.200632***	43.142***	68.456***

According to the tables, it is seen that the distributions of the series are not normal in the Jargue-Bera test. In both variables, obliques are close to 0 and flattenings are close to 3. It means that the farther away the oblique value is from 0 and the flattening value is from 3, the less likely it is to disperse normally. Ljung-Box statistics on returns and the square of returns show that all series experience series correlation and volatility clustering, and Jarque-Bera tests show that series do not follow a normal distribution. Finally, since the series are not stationary in the ADF unit root tests, the analysis was continued in this way after the first difference was taken and the series were stabilized.

2.2. Methodology

For the application part of the study, the cross-cantil dependence between BIST100 and BISTBANKA Index returns will be examined in order to determine how the strength and duration of the spreads between the indices will change under downward and upward market movements. Cross-cantilogram is a method developed by Han et al. in 2016. This method is based on quantile points and does not include moment conditions. For this reason, it gives good results in the analysis of variables in financial time series. In addition, since the cross-centilogram approach can accommodate long delays at relatively small computational costs, it allows the determination of the direction, magnitude, and duration of dependence in all parts of the return distributions at the same time. The cross-cantilogram method has some advantages over other techniques. First, this method measures the predictability from one time series to another in the quantities of the distribution of each variable. Thus, as in the case of charts, it also allows the measurement of a wide range of market conditions, i.e., the directional spreads of decline, normality, and rise between financial assets. Another advantage is that, compared to traditional regression-type models, this method also has very long delays. Therefore, it can measure the strength of directional spreads in short-, medium-, and long-term investments. A prerequisite for the cross-cantilogram method is that the series be stationary. The study was discussed and visualized in 2 periods of 66 delays from both the BIST100 index to the BISTBANKA index and the BISTBANKA index to the BIST100 index in the same delay at 5% and 10% quantile values. The study used the Ljung-Box test described in the methodology section of the cross cantilelogram to determine the statistical significance of each cross cantilelogram. In charts, black columns above 0 represent positive cross correlation, and black columns below 0 represent negative cross correlation. Red dashed lines indicate a confidence boundary. Bars that went beyond the trust boundary expressed significant correlations at the 5% severity level.

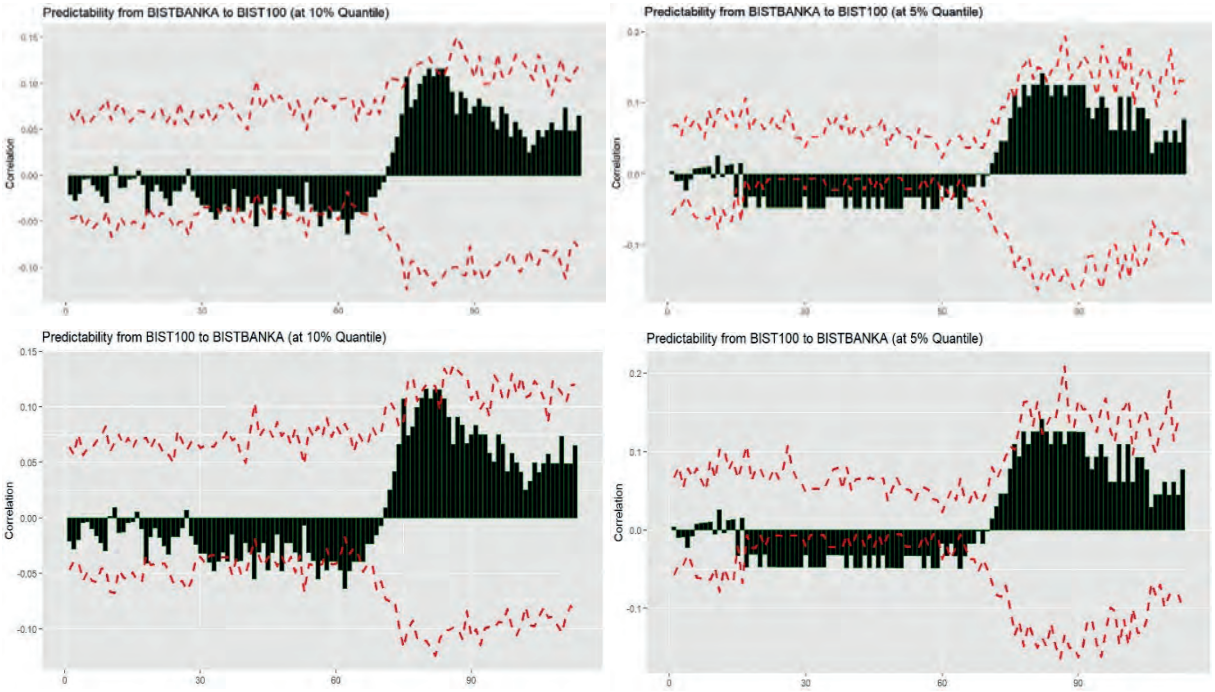

Figure 2: Charts before Earhquake

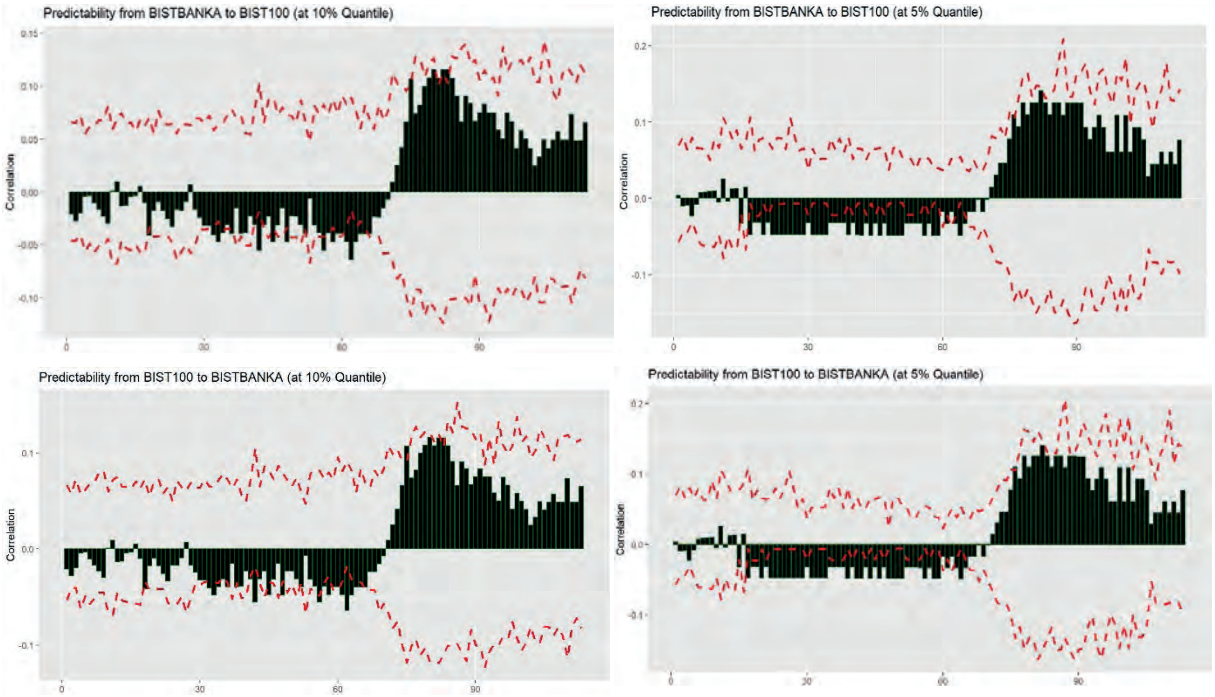

Figure 3: Charts After Earhquake

As can be seen in the charts, both in the BIST100 index and in the BISTBANKA index, there are no major breaks or changes.

Conclusion

Natural disaster can cause many destructions in human life. Many problems arise such as damage to cities, loss of life of people and animals, destruction of nature, and psychological problems. In addition to psychological, sociological, and structural problems, natural events have many effects economically. The 7.8 and 7.6 magnitude earthquakes affecting 11 provinces in Turkey made the cities uninhabitable and caused many people to die. Although it has not been fully clarified yet, it is estimated that the economic effects of the earthquake are 104 billion dollars, and this figure constitutes approximately 9% of the national income in 2023. Therefore, the catastrophic effects of the earthquake on a human scale also point to a great economic loss. Considering all these effects and reasons, the effects of the Turkey earthquake in 2023 on financial markets are examined in this study. In this context, the reactions of the stocks in the BIST-100 index to the earthquake disaster were analyzed by the event study method. In the analysis, it has been tested whether there is variation in the cumulative abnormal return (CAR) of the stocks in the 15-, 30- and 45-day time periods before and after the earthquake date. According to the findings obtained from the analysis method applied in the study, it was concluded that the earthquake created negative effects in 15, 30, and 45-day time periods.

In the study, When we consider this situation through the banking sector, the capital adequacy ratios of 8% recommended in the Basel criteria are around 16% in the banking sector of our country. The capital adequacy ratio acts as a buffer of protection against unexpected risks that banks may face. This is an indication that the sector has not been affected by the earthquake compared to the past. Another reason is that the banking sector is more prepared than normal due to election economics and election policies since the election process is outside the Basel criteria. In light of international developments, since the central bank's tightening policies and the communiqués issued on foreign currency coincided with the election policy period, the banking sector quickly recovered from the effects of the earthquake and continued its upward trend.

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Indonesia Macroeconomic Development Analysis (1972-2021)

Fadli Agus Triansyah

Department of Economic Education, Faculty of Economics and Business Education, Universitas Pendidikan Indonesia, Indonesia

Denny Andriana

Department of Accounting, Universitas Pendidikan Indonesia, Indonesia

Amir Machmud

Department of Economic Education, Universitas Pendidikan Indonesia, Indonesia

Suwatno

Department of Economic Education, Universitas Pendidikan Indonesia, Indonesia

Abstract

This study examines the relationship between Gross Domestic Product (GDP), Imports (IMP), Inflation (INF), and Unemployment (UNP) in Indonesia using the vector error correction model (VECM), cointegration, and Granger causality tests over the period from 1972 to 2021. The data used is annual time series panel data from the World Bank database. Data performed tests for unit root processing using the Augmented Dickey-Fuller test statistic before proceeding to the Johansen cointegration technique, the results of which motivated the choice to adopt panel VECM over panel vector autoregression in the methodology. The Vector Error Correction Model (VECM) analyzes the relationship or causality between variables in the short and long term. The results are that the relationship between variables refers more to short-term causes. From the estimation results, especially on the variables studied, there is a positive and statistically significant relationship between Gross Domestic Product (GDP), Imports (IMP), Inflation (INF), and Unemployment (UNP) which refers more to short-term cause and effect relationships. Impulse Response Function (IRF) analysis is used to determine the impact between variables where the results that have a positive effect during the Covid-19 pandemic are import shocks to GDP and unemployment shocks to GDP. In contrast, those that have a negative impact are the inflation rate shocks to GDP in Indonesia during the covid pandemic -19.

Keywords: *Macroeconomic, Indonesia, Vector Error Correction Model (VECM)*

1. Introduction

Economic growth is one of the important indicators in developing a country's economy that can increase the prosperity and welfare of the community at the level of per capita income (Castro & Lopes, 2022; Schandl et al., 2018). Economic growth can describe the success of economic development in a country (Ridzuan et al., 2020). Then economists can use economic growth to explain other macro

indicators such as inflation, unemployment, and poverty rates (Murjani, 2019). Economic growth is a process of increasing output per capita long-term. The higher a country's economic growth, the greater its ability to meet the demands of its people and, therefore, the greater its capacity to prosper its people (Anokhina, 2022). They can also say that economic growth is when the economy grows, and more goods and services are made (Widarni & Bawono, 2021). Based on the knowledge above, economic growth increases the economy's production capacity and creates more significant national income. The rate of economic growth that is dependent on initial production as a measure of economic growth can encourage the government through policies in the fields of macroeconomics, investment, trade, law, and legislation so that the government plays a crucial role in fostering an environment conducive to optimal market function. In addition, the central bank, in its capacity as a monetary policymaker, plays a vital role in facilitating the efficient operation of the market mechanism. To boost economic growth, sectoral and regional initiatives are equally crucial. (Onder & Nyadera, 2020; Sappewali & Hasanuddin, 2022).

Since the end of 2019, Wuhan, the key city in China, has reported the first cases of an unexpected coronavirus illness 2019 (COVID-19), which has been spreading over the globe (Kim & Lee, 2021). In March 2020, multiple scholars and media outlets will report on the economic effects of this terrible pandemic on the impacted nations. The COVID-19 pandemic might have significant economic and financial repercussions since the gross domestic product (GDP) and the number of hours worked plummeted by 20%. (from trend). The GDP is the most common indicator of a nation's worldwide economic activity. It is the sum of all final goods and services produced in a country during a given period, such as one year. Several studies indicate that it is challenging for nations to return to their pre-pandemic economic levels. The rest of the globe could reproduce the correlation between US returns, uncertainty, and COVID-19 cases during the first and second waves of the outbreak (de la Fuente-Mella et al., 2021).

Indonesia became one of the countries that experienced a fall when COVID-19 spread globally from China because it was not immune to the effects of the COVID-19 pandemic. The impact of this virus made the economy respond to it and created the biggest shock to the Indonesian economy since the Asian Financial Crisis (AFC) two decades earlier (Olivia et al., 2020). In the first quarter of 2020, the economic growth rate fell from a little over 5%, a rate related to the Jokowi years, to a little under 3%, compared to the first quarter of 2019. Compared to the fourth quarter of 2019, the economy contracted by 2.4% at the end of March. The slowdown was mostly caused by a drop in consumption, which makes up more than half of the GDP. In the first quarter, the annual change in consumption was only 2.8%, much lower than the 5.0% change in the same period in 2019 (Olivia et al., 2020). The following is data related to macroeconomic variables in Indonesia, which will be the focus of this research.

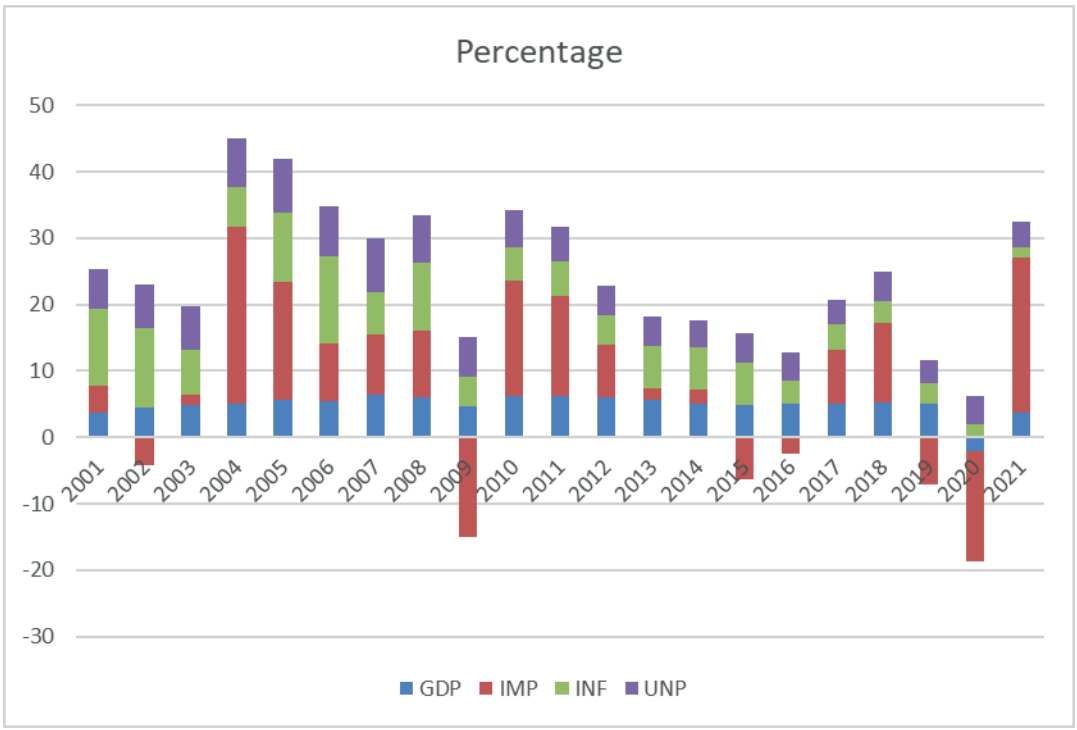

Figure 1. **Percentage data for GDP, IMP, INF and UNP in Indonesia last 20 years**

Based on the picture above, it is explained that the GDP in Indonesia has experienced stagnant growth. However, in 2020 it underwent a decrease caused by the Covid-19 shock, namely -2.06%. Imports (IMP) in Indonesia have experienced fluctuating percentages over the past twenty years, with the biggest decline peak in 2020, namely -16.7%. Inflation (INF) has also experienced a significant increase in the last twenty years. In 2020, it decreased from the previous year to 1.92%. Then unemployment (UNP) in Indonesia always experiences a fairly stable increase and decrease. In 2020 it increased from the last year to 4.25%. Seeing the distribution of this data, it is necessary to study macroeconomic variable shocks in Indonesia to see the variables that persist when there is a Covid-19 pandemic.

The objective of this study is to reexamine the relationship between macroeconomic indicators for Indonesia's GDP, inflation, imports, and unemployment or underemployment (UNP) from 1972 to 2021 by using a current, dependable methodology to address the shortcomings of past investigations. This framework will work based on cointegration analysis and a vector error correction method (VECM). The cointegration approach's strength rests in its ability to consider long-term equilibrium correlations between variables and short-term dynamics. We employ the model created by Johansen (1988) and expanded by Johansen and Juselius in 1990 is the one we utilize (1991). Since it makes managing multivariate analysis easier, this technique is viewed as more dependable and productive than other maximum likelihood strategies. The Johansen process outperformed the other four cointegration methods in a recent Monte Carlo simulation, according to Gonzalo (1994), evaluated all five options and found that the Johansen process outperformed the other four cointegration methods in a recent Monte Carlo simulation. Although this model has been around for a while, it is frequently used to create economic models because it can be utilized to construct causal linkages between variables in both the long and short term (Hossin & Hamid, 2021; Nkalu et al., 2020; Osuagwu, 2020; Yadav et al., 2022; Ybrayev, 2022).

2. Methodology

This study uses a causal research design with time series data or time series data to provide an overview of the links between independent factors and the dependent variable using the vector error correction model (VECM) method. Before data analysis, the model undergoes various steps, including Estimation definition and model examination, which includes the unit root test, Johansen cointegration test, Model Estimation, and Examination, followed by Causality Analysis, Forecasting, and Structural analysis (Khan & Yoon, 2021; Ziesemer, 2021). The data contained in this study is secondary data. This data is sourced from the world bank data (https://databank.worldbank.org/source/world-development-indicators), which consists of data on GDP, Inflation, Imports, and Unemployment Rate in Indonesia from 1972 to 2021.

3. Results and Discussion

Table 1. Descriptive data for GDP, INF, IMP, and UNP in Indonesia from 1972 to 2021

	UNP	INF	IMP	GDP
Mean	4.038446	10.59453	8.368011	5.302592
Median	3.940000	8.009324	8.394715	5.660138
Maximum	8.060000	58.45104	27.17391	10.00000
Minimum	1.290000	1.560130	-40.67524	-13.12673
Std. Dev.	1.911218	9.867638	13.64610	3.328754
Skewness	0.480488	3.063016	-1.078144	-3.648824
Kurtosis	2.158523	13.79462	4.858400	20.32108
Jarque-Bera	3.399083	320.9418	16.88173	735.9907
Probability	0.182767	0.000000	0.000216	0.000000
Sum	201.9223	529.7265	418.4005	265.1296
Sum Sq. Dev.	178.9850	4771.144	9124.592	542.9494
Observations	50	50	50	50

The GDP development in Indonesia is at a maximum value of around 10%, while the lowest value is -13.12% from 1972 to 2021. Then for Inflation (INF), the highest value is 58.45%, while the lowest value is 1.56%. The highest Import Value (IMP) is 27.17%, while the lowest value is -40.67%, followed by Unemployment (UNP) which has the highest value of 8.06%, while the lowest value is 1.29%. The first stage is to conduct a unit root test of the four variables, including GDP, INF, IMP, and UNP data in Indonesia from 1972 to 2021. The results of the unit root test calculation can be seen in table 2.

Table 2. Undifferentiated GDP, INF, INP, and UNP data

Data	Critical Value (α)	Level	
		Stat. ADF	p value
GDP	5%	-7.676651	0.0000*
IMP	5%	-7.141801	0.0000*
INF	5%	-9.175675	0.0000*
UNP	5%	-7.278548	0.0000*

*MacKinnon (1996) one-sided p-values.

Table 2 shows that the GDP, INF, and UNP data in Indonesia from 1972 to 2021 contain unit roots at the level or not stationary. This can be seen from the unit root test technique, namely the level technique. The results of the first difference can be seen in the p-value of the ADF statistic for each variable, which is smaller than 5%. This means that hypotheses 0 and 1 are rejected. Namely, the data does not contain unit roots or is stationary. Thus, GDP, INF, and UNP are first-order non-stationary variables.

Table 3. Johansen Cointegration Test Max-Eigen Statistic

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.755650	66.23028	27.58434	0.0000
At most 1 *	0.624313	46.01300	21.13162	0.0000
At most 2 *	0.537233	36.21498	14.26460	0.0000
At most 3 *	0.344508	19.85137	3.841465	0.0000

From the data contained in table 3, it can be seen that the results of the hypothesis test using the maximum Eigenvalue statistic, the presence of cointegration at a p-value greater than the value of $\alpha = 0.05$. There is cointegration at a p-value below $\alpha = 0.05$.

Table 4. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-506.3159	NA	83218.71	22.68071	22.84130	22.74057
1	-473.9626	57.51689*	40379.29*	21.95390*	22.75686*	22.25323*
2	-461.4867	19.96151	48092.05	22.11052	23.55585	22.64932
3	-446.9140	20.72555	53646.25	22.17396	24.26166	22.95223
4	-426.4459	25.47144	48115.70	21.97537	24.70544	22.99312

In table 4, we can interpret that lag 1 has the smallest AIC and SC values. Thus, we will use lag one to process the Vector Error Correction Model (VECM) parameter estimation. Based on the optimum lag analysis results, the VECM equation's estimated form is VECM(1).

Table 5. Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
INF does not Granger Cause UNP	49	3.06591	0.0866
UNP does not Granger Cause INF		1.50263	0.2265
IMP does not Granger Cause UNP	49	0.90598	0.3462
UNP does not Granger Cause IMP		0.94509	0.3361
GDP does not Granger Cause UNP	49	0.94941	0.3350
UNP does not Granger Cause GDP		0.68730	0.4114
IMP does not Granger Cause INF	49	8.03547	0.0068
INF does not Granger Cause IMP		2.58887	0.1145
GDP does not Granger Cause INF	49	1.78611	0.1880
INF does not Granger Cause GDP		1.57708	0.2155
GDP does not Granger Cause IMP	49	15.9120	0.0002
IMP does not Granger Cause GDP		0.00285	0.9577

Based on the existing data, as a whole, in equation (1), there is a short-term causality relationship between the levels of GDP, PMI, INF, and UNP levels in Indonesia from 1972 to 2021. Next, Impulse Response Function (IRF) Analysis will be explained as a description of shocks to macroeconomic variables.

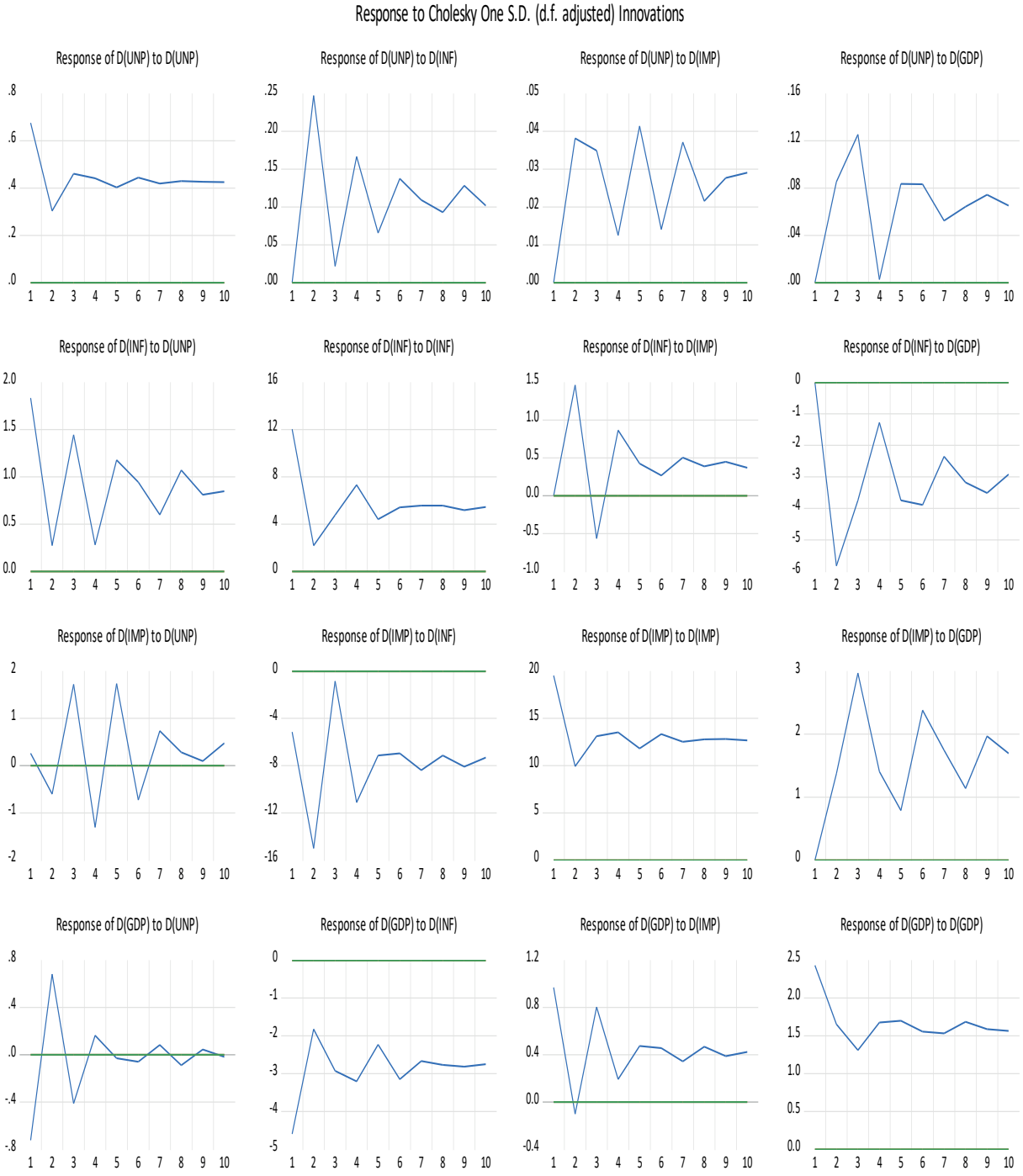

Figure 1. Impulse Response Function (IRF)Analysis

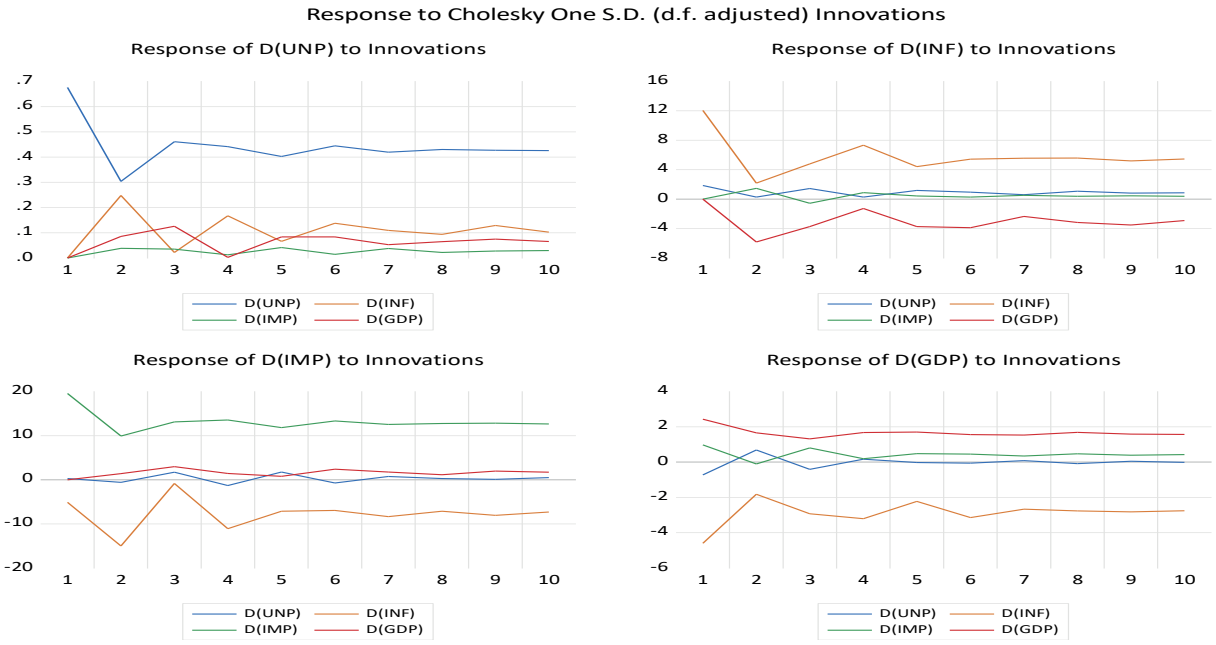

Figure 2. Impulse Response Function (IRF)Analysis Innovations

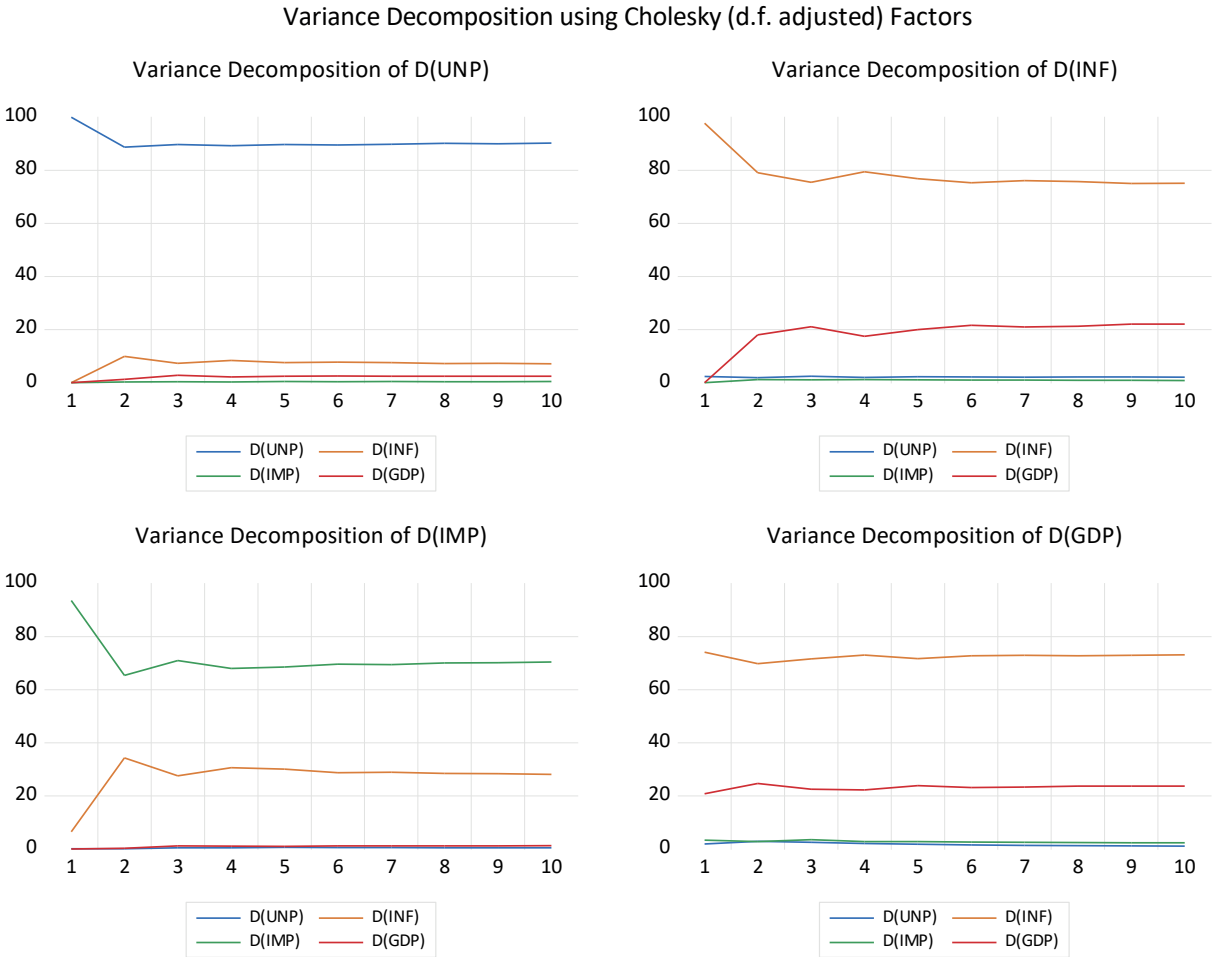

Figure 3. Impulse Response Function (IRF)Analysis Innovations

4. Conclusion

The effects of the Covid-19 pandemic which has spread to numerous nations, including Indonesia. In Canada, the impacts of Covid-19 include a decline in several macroeconomic sectors, such as GDP revenues and Indonesian imports in 2020, followed by an increase in unemployment and inflation. After conducting an in-depth analysis of the macroeconomic factors that affect the Covid-19 pandemic in Indonesia, including inflation rate shocks that are highly influential in GDP receipts, inflation also surprises the unemployment rate, with unemployment harming the economic state of Indonesia in 2020.

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Investigating The Interaction Between The Behavior Of The Government And The Central Bank: The Use Of Stackelberg's Differential Game In Stabilizing Inflation

Aylin Erdoğdu

Assoc. Prof. Dr. İstanbul Arel University, Faculty of Economics and Administrative Sciences, Finance and Banking Department

Abstract

The coordination of monetary and financial policies to achieve economic growth in the context of price stability is investigated in game theory based on the interaction of people and their decisions. central bank, monetary and financial policies) in the form of Stackelberg's differential game with open-loop information structure and feedback. By defining the government as a leading player and the central bank as a follower, more favorable economic consequences will be achieved for the society, in such a way that financial leadership causes a further reduction in the level of government debt and budget deficit, according to this approach of the equilibrium model based on the Phillips curve for two variables. We examine inflation and unemployment in the economy. For this purpose, we express the relationship between the variables of the real public expenditure growth rate, the monetary growth rate, and the inflation rate for two monetary and financial policymakers, in order to determine the changes in the inflation rate in the form of a differential equation. The results of investigating the behavior of two policymakers in the differential Stackelberg game of inflation stabilization show that the level of changes in the equilibrium inflation rate in the steady state in the game with feedback information is lower than in the game with open-loop [1]information. To provide monetary and financial policy in order to achieve the goals.

Keyword: Stackelberg game, monetary and financial policy, inflation rate, game theory, risk taking.

1.Introduction:

Game theory is one of the concepts that has been widely used in recent decades in various branches of science such as economic science, political science, military science, biological science, computer science, etc. The question that arises is why is game theory so important? If we want to take a deep look at the concept of game theory and its definitions, we will find that the concept of game theory is related to human interactions and interactions between people. In their decisions, people are faced with interactive modes[2] with others (interaction with others).And the consequences of each person or group of people depend not only on the decisions and behavior of the individual or group, but also on the

1 Open-loop controller(https://en.wikipedia.org/wiki/Open-loop_controller)

2 Interactive (https://tr.wikipedia.org/wiki/Etkile%C5%9Fimlilik)

behavior and decisions of other people; That is, unlike classical and neoclassical competitive economic models in which each person seeks to maximize his own utility, game theory states that people cannot easily seek to maximize their own individual utility, because each person's decisions and behaviors The decisions and reactions of other people are also dependent. The history of game theory goes back to the 17th and 18th centuries. But game theory in its modern form, in the 20th century, with the works of Van Neumann and Morgenstein[3] in 1944 in connection with zero-sum two-player games, cooperative games, the concept of strategy and games in the normal and extended form, as well as John Nash[4] in 1950-1953 with works In connection with non-cooperative games and Nash equilibrium, it has been formed in this type of games. In 1935, German economist Frierfen Steckelberg[5] introduced the theory of Steckelberg's equilibrium, or the follower-leader game, by publishing a book entitled "Market Structure and Equilibrium". In the 1970s and 1980s, game theory entered the modern macroeconomics and the most important achievements in this field were Kydland and Prescott [6] 1977 was related to the game between the government and economic agents and the discussion of time inconsistency. In his famous article, Phillips[7] showed that there is a negative relationship between the wage growth rate and the unemployment rate, using data from England. The growing unemployment has caused various economic, social and cultural problems in the society. Also inflation is generally to It means a disproportionate increase in the general price level, which imposes serious costs on the society. These two variables are socially important for policy makers. The high values of both of these variables are evaluated negatively by the people of the society and as a result by the policy makers; Therefore, policy makers aim to lower these two variables.

Various definitions related to game theory have been expressed by thinkers. For example, Bruin [8] 2005 states that game theory is a branch game theory is a branch of applied mathematics that is used to investigate human social behavior and strategic conflict and the logic of human conflict. Carmichael[9] In 2005, he states that game theory is a type of technique used to analyze situations related to two or more people, in which the consequences of one person's behavior are not only related to the behavior created by the person himself, but also to the behavior of others. Formed by other people is also dependent. Solan and Zamir[10] (2013) state that game theory is a methodology that uses mathematical tools to model and analyze situations that include several decision makers (players). As it is clear from the definitions, a shared opinion in many There are definitions, and that is that the theory of games is nothing but the theory of decision in interactive situations, and this is the concept that is agreed upon among theorists in game theory. Game theory thinkers including Von Damme [11] (2014) have defined the economy as described in Robbins's definition, but the only difference in his definition is that instead of "human behavior" he used "human confrontation"[12]; that is, the economy is nothing but the confrontation of people with each other. It is not. Here, the presence of at least two people in this confrontation and exchange is necessary and essential. In the previous sections, in connection with the concept of game theory, we used human interactions and confrontations between people. These two definitions can show the close relationship between the concept Economics and game theory

3 John Von Neumann and Morganestern (https://en.wikipedia.org/wiki/Von_Neumann%E2%80%93Morgenstern_utility_theorem)

4 John Nash (https://en.wikipedia.org/wiki/John_Forbes_Nash_Jr.)

5 Heinrich Freiherr von Stackelberg(https://de.wikipedia.org/wiki/Heinrich_Freiherr_von_Stackelberg)

6 Kydland and Prescott(https://www.jstor.org/stable/1830193)

7 Phillips (https://onlinelibrary.wiley.com/doi/full/10.1111/j.1468-0335.1958.tb00003.x)

8 Bruin(https://www.researchgate.net/publication/226727576_Game_Theory_in_Philosophy)

9 Carmichael(https://www.researchgate.net/publication/220657451_Complex_Adaptive_Systems_and_Game_Theory_An_Unlikely_Union)

10 Maschler; Solan, andZamir(https://books.google.com.tr/books?id=lqwzqgvhwXsC&printsec=copyright&redir_esc=y#v=onepage&q&f=false)

11 Von Damme(https://www.annualreviews.org/doi/10.1146/annurev-polisci-052615-025442)

12 Human interaction(https://en.wikipedia.org/wiki/Human%E2%80%93computer_interaction)

exist in the form of the concept of human confrontation. Of course, it is true that both economics and game theory discuss human confrontation, but it should be noted that the applications of game theory are broader and include confrontation. between animals and molecules and so on. Game theory is different from optimization; In optimization, there is a single player who seeks to maximize his final outcome. To be more precise, this person seeks to maximize the objective function with respect to some constraints. Here, the meaning and concept of "optimal decision" [13] is clear and specific; But in the framework of interactive decision-making or multi-person decision-making (the theory of games), the concept of optimal decision-making is unclear and no person can fully Kamel does not seek to control the final consequences, but in this process, people are looking for "concepts of solutions" [14] and examining the characteristics of these solutions. Also, game theory differs from optimization with multiple objective functions, which includes a player and multiple outcomes. There is another branch of game theory that deals with multiple decision makers[15] with a common win, which is known as team[16] theory. This division can be seen in Table 1 (Bauso [17], 2014).

Table 1: The position of game theory:

	A consequence	N consequence
1 player	Optimization	Optimization with multiple objective functions
N **player**	Team theory	Game theory

The place of game theory, especially in modern macroeconomics, is clearly visible.

1.1 The role of game theory in modern macroeconomics:

After the game theory was used as a powerful tool to analyze the conflict of strategies, economists used this tool in the best way to examine the conflict between monetary and fiscal policies in determining the optimal goals of inflation, output as well as achieving stable rates. They used debt, budget deficit, money circulation, etc. It is possible to categorize the fundamental articles that have been published in connection with the optimal monetary policy and the confrontation of strategies between the government, the central bank and economic agents using game theory.[18] The first category can be attributed to the fundamental work of Kydland and prescott [19] 1997 in his famous article entitled "Rules versus Discretion: Time Inconsistency of Optimal Programs". This article was a turning point in relation to the application of game theory in discussions of optimal monetary and financial policy[20].

13 Optimal decision(https://en.wikipedia.org/wiki/Optimal_decision)

14 Solution concepts(https://en.wikipedia.org/wiki/Solution_concept)

15 Multiple decision makers(https://ieeexplore.ieee.org/abstract/document/4717830/)

16 Team theory(https://link.springer.com/chapter/10.1007/978-3-319-10407-2_18#:~:text=Team%20theory%20is%20a%20mathematical,achieve%20a%20common%20control%20objective.)

17 Bauso(https://scholar.google.com/citations?user=jIzjehIAAAAJ&hl=en)

18 This classification is based on the studies of the researcher of this treatise, and maybe other researchers and professors will show another classification of this issue by studying other sources.

19 Kydland and prescott (https://www.jstor.org/stable/1830193)

20 Of course, it should be noted that people like Debrow 1952 in an article titled "Existence of Social Equilibrium" and Arrow and Debrow 1954 titled "Existence of Equilibrium for a Competitive Economy" of solutions similar to the Nash equilibrium solution for the existence of equilibrium in a competitive economy

1.2 Theory of differential games:

Differential game theory is a branch of applied science that was developed as a tool for modeling conflicts. As stated by Lewin 1994[21], military applications [22] were perhaps the strongest driving force for the development of this type of games. Issacs[23] can be named as the pioneer of differential game theory because of his memorable work at the RAND Corporation with a tendency towards modeling and solving the Pursuit-evasion problems [24] in the military space(Lewin, 1994). It provides a generalization of optimal control theory where there is more than one controller or player. Differential games are conceptually more complicated than the problem of optimal control in such a way that the formation of a solution is not clearly visible. In differential games, there are different types of solutions such as mini-max, Nash, Pareto optimal with possibilities of non-cooperative games, Stackelberg, bargaining, etc. (Sethi and Thompson, 2006[25].) Now the question that arises is, what kind of games is the differential game theory used in? It has a wide range. We distinguish two types of games that play a very important role in game theory analysis: one is cooperative games and the other is non-cooperative games. The difference between these two types of games is that non-cooperative games include a strategic situation in which decision makers and players cannot make binding agreements to cooperate during the game. But in cooperative games, players can make binding agreements and negotiations before the game. (Dockner *et al*., 2000[26].) They state that many of the studies that are examined and studied in relation to the theory of differential games are in the framework of non-cooperative games. In recent years, most of the economic and management applications in game theory are in the framework of non-cooperative game theory, and most of the development studies in differential game theory have been carried out in the form of non-cooperative games[27].

On the other hand, we can make two other important distinctions that play a fundamental role in the application of game theory ,Let's say it has a differential. This distinction is related to static and dynamic games. In dynamic games, players' movements are formed sequentially; That is, first one player makes his move and then the other player responds to it according to this player's action. So that "time" plays an important role in this type of games. But in static games, the players move simultaneously. Most of the differential games are in the form of dynamic games. According to the mentioned cases, it can be stated that the theory of differential games is a type of non-cooperative dynamic games, and this type of games is closely related to optimal control theories, and after the development of Pontriagin's maximum principle, this connection became clearly visible. (Basar and Olsdar,1999[28]) in a division, determined the position of the theory of differential dynamic games and its difference with the theory of optimal control and mathematical programming, which is shown in the Table 2 below.

Table 2: Position of the theory of differential dynamic games:

	A player	More than one player
static	Mathematical programming	Static game theory
dynamic	Optimal control theory	Dynamic differential game theory

21 Lewin(https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=1446298)

22 Military applications(https://sdi.ai/blog/the-most-useful-military-applications-of-ai/)

23 Issacs(https://en.wikipedia.org/wiki/Rufus_Isaacs_(game_theorist)

24 Pursuit-evasion problems(https://en.wikipedia.org/wiki/Pursuit%E2%80%93evasion)

25 Sethi and Thompson(https://link.springer.com/book/10.1007/0-387-29903-3)

26 Dockner et al(https://pubmed.ncbi.nlm.nih.gov/11136261/)

27 https://en.wikipedia.org/wiki/Non-cooperative_game_theory

28 Basar and Olsdar(https://www.scirp.org/(S(351jmbntvnsjt1aadkozje))/reference/referencespapers.aspx?reference-id=1795889)

2. Major achievements in game theory:

The evolutionary and historical course of game theory is fully specified in table number 2,

Table3: The formation process of fundamental concepts in game theory:

The period	1910-1930	1930-1950	1950-1960	1960-1970	1970-1990
Important events	In the early years, during this period of time, game theory mostly included strictly competitive games, and it is more famous for the theory of two-player zero-sum games.	The prominent event during this period was the publication of the book “Game Theory and Economic Behavior” in the university Princeton was written by mathematician Van Neumann and economist Morgenstein in 1944.	The 50s were a period of excitement in game theory. Game theory in this era with works John Nash’s work on non-cooperative games and the bargaining problem became a discipline.	The 60s were a decade of growth. Development of concepts such as incomplete information, coalition games with Non-transferable utility made game theory more practical. Also, fundamental concepts such as General knowledge was formed. The core theory was widely developed for the market economy Was used	Meanwhile, political models and political economy in the framework of game theory studied in depth. Non-cooperative game models for many It was applied from economic models. Game theory was applied in biology, computer science, psychology, cost allocation.
Important events	Of course, this type of games in reality was not very suitable for use in economics and politics, but the reason The formation of basic concepts in the theory of games.	Van Neumann Morgenstein is mentioned as the founder of game theory.	The bargaining set was defined and reviewed. Deeply studied multiplayer games took And also the lasting relationship between game theory and mathematical economics and economic theory.	Also, Shapley’s achievements to define the value for the coalition game, Milnor’s work by developing the game model with a chain of players, Tucker’s discovery of the prisoner’s puzzle was recognized as the most important decade in game theory.	Also, many journals related to game theory This era was published. Centrally important research in game theory, other than America and Princeton University to other countries such as France, Holland, Japan, England and India was also transferred
concepts	Doubles games with zero sum	Collaborative games	The concept of balance	Coalition game with non-transferable utility	Application in biology
concepts	The concept of strategy	Play in coalition form	Random and dynamic games	Incomplete information	Refinement of strategic balance
concepts	Expanded form of the game	The concept of solution	Repetitive games	public knowledge	limited rationality

concepts	The concept of player strategy	dominance	The mystery of the prisoner	Bargaining set	Distributive computing
concepts	The concept of random or mixed strategy	Stable collections	Bargaining problem	Principle of equivalence	Stability
concepts	The concept of individual rationality	Transferable and non-transferable utility	The concept of value	Many players	Cost allocation
concepts	Mini Max case	Expected utility and Kakotoni's fixed point theory	Axiomatic methods	The core of limited games and markets	-

Despite the valuableness of the conducted studies, it should be mentioned that the upcoming study is a study related to the optimal combination of unemployment and inflation in order to minimize social losses with the Stackelberg differential game approach. Therefore, based on the assumptions of the Phillips curve, the relationship between the variables of the growth rate of real public expenditure as a tool of the financial policy maker, the monetary growth rate as a tool of the monetary policy maker and the inflation rate for two monetary and financial policy makers, in order to determine the changes in the inflation rate We have modeled and solved this model using Stackelberg's differential game and simulating it in the economy.

3.Model:

First, we consider a deterministic model of the reference dynamic economic model, which expresses the short-term relationship between unemployment and inflation and their stabilization policies based on the Phillips curve. Based on this, considering that p depends, it can be written: inflation rate $p(t)$to the total demand of goods and labor market $h(t)$and the expected inflation rate $p^*(t)$:

(3.1) $p(t) = \lambda h(t) + p*(t), \lambda > o$

Assuming that the expected inflation rate changes are adaptive expectations, we have:

(3.2) $p^{\cdot} * (t) = \eta[p(t) - p*(t)], \eta > 0$

On the other hand, the unemployment rate $u(t)$ depends on the total demand of goods and labor markets $as\ 0 > \delta), t(\delta h - uN) = t(u)$, while uN is the natural unemployment rate and $uN) - t(u) = t\hat{}(u)$ is considered the real deviation from the unemployment rate. On the other hand, the total demand of goods and labor markets is defined by the following equation:

(3.3) $h(t) = \beta[m(t) - p(t)] + \gamma g(t), \beta > 0, \gamma > 0,$

Substituting equation (2.3) in equation (2.2) and the constants $n = \frac{\gamma\lambda\eta}{1+\beta\lambda}, \varphi = \frac{\beta\lambda n}{1+\beta\lambda}$ we have:

(3.4) $p^{\cdot} * (t) = \phi m(t) + ng(t) - \phi p*(t),$

Now, assuming that the government is the controller of real public expenditure and the central bank is the controller of the monetary base in the economy, the objective function for both players, the government and the central bank, respectively, is considered as follows:

$$j_1 = \frac{1}{2}\int_0^{\infty} exp(-rt)[a_1 v^2(t + c_1 g^2(t)]dt$$

$$j_2 = \frac{1}{2}\int_0^{\infty} exp(-rt)[a_2 v^2(t + c_2 g^2(t)]dt$$

We assume that the weights of $a_i, b_i, c_i > 0, i = 1,2$ also the weights of $a_i, b_i, i = 1,2$ They are different according to the political preferences of the government and the central bank. By placing the equations $p * (t)$ and $u(t)$ in the objective functions for, $i = 1,2$ we have:

$$(3.5)\ j_1 = \frac{1}{2}\int_0^{\infty} exp(-rt)[f_1 n^2(t) + f_{2i} g^2(t) + f_{2i} p^{*2}(t) + 2f_{3i} m(t)g(t) + 2f_{5i} m(t)p^*(t) + 2f_{0i} g(t)p^*(t)]dt$$

In order to be more compatible with Turkish 's economy, the game between the government and the central bank is considered in the framework of the Stackelberg game, in which the government is the leader and the central bank is the follower. On the other hand, the information structure in this game is an open-loop information structure, that is, players simultaneously commit to a specific strategy of the game, and each player only knows the initial state of the game at the time of $t \in [0,T]$ knows In this type of game, each player assumes the present and future behavior of his opponent as given. According to the mentioned assumptions, to review the policies We pay a balance for this economic model. At first, the monetary policy maker as a follower seeks to minimize his loss function according to condition (3.4) So we define the Hamiltonian function[29] for the monetary policy maker as follows:

4. Optimal Policy Path For The Central:

$$(4.1)\ H_2(t, \lambda 0, g, m) = \frac{1}{2} e - rt[f1^2 M^2(t) + f2^2 g^2(t) + f3^2 p * 2(t) + 2f4^2 m(t)g(t) + 2f5^2 m(t)p * (t) + 2f6^2 g(t)p * (t)] + \lambda 0[\phi m(t) + ng(t) - \phi p * (t)]$$

According to Pontriagin's[30] maximum principle, the optimal policy path for the central bank is obtained as follows:

$$(4.2)\ m^s(t) = \frac{\arg\min}{mem} H_2 = \frac{\partial H2}{\partial M} = 0 = M^2(T) = \frac{\varphi \varepsilon^{rt}}{f12}\lambda_0 - g(t) - \frac{f^{\varphi 2}}{f12} p^*(t)$$

By inserting the optimal policy path, the Hamiltonian function for the financial policy maker is obtained as follows $m^s(t)$:

$$(4.3)\ H_1(t, \lambda_0, \lambda_1, \lambda_2, g, m) = \frac{1}{2} e^{-rt}[f_{11} m^{s2}{}_1(t) + f_{21} g^2(t) + f_{31} p^{*2}(t) + 2f_{41} m^s(t)g(t) + 2f_{51} m^s(t)p^*(t) + 2f_{61} g(t)p^*(t)] + \lambda_1[\varphi m^s(t) + ng(t) - \varphi p^*(t)] - \lambda_2[e^{-rt}(f_{32} p^+(t) + f_{52} m^2(t) + f_{62} g(t) - \lambda_0 g]$$

According to Pontriagin's maximum principle, the government's optimal policy path with constants $Ai, i = 1, \ldots, 4$ as follows:

$$(4.4)\ m^s(t) = \frac{ar\ g\ min}{mem} H_2 = \frac{\partial H2}{\partial M} = 0\ gs(t) = A_{1p} * (t) + A_{2\lambda 0} - A_{3\lambda 1} + A_{4\lambda 20}$$

By inserting $gs(t)$ in equation(3.3)the optimal strategy of the central bank is obtained as follows:

$$(4.5)\ m_s(t) = -B_{,p} * (t) - B_{2\lambda 0} + B_{3\lambda 1} - B_{4\lambda 2}, B_i, i = 1, \ldots, 4$$

Finally, by solving two boundary value differential equations, the optimal value of the expected inflation rate state variable $p * (t)$ It is obtained, the results of which are presented in the simulation section.

29 https://en.wikipedia.org/wiki/Hamiltonian_mechanics

30 https://mode2016.sciencesconf.org/91839/resume_Bourdin.pdf

5. Optimal Monetary And Financial Policy Of Policy Makers With Feedback Information Structure:

Now we assume that the information structure in this type of game is feedback. The main difference between feedback Stackelberg equilibrium and open-loop Stackelberg equilibrium is that in open-loop Stackelberg strategy, players will shape their behavior based on the initial state of the game, but in feedback strategies, players will shape their behavior based on the current state of the system and execute The feedback strategy requires that each player must, at any point in time, from Know the exact status of the system. To find the pairs of feedback Stackelberg strategies, we solve the optimal Hamilton-Jacobi system of equations in two steps as follows. First, the optimal Hamilton-Jacobi equations systemfor the central bank is considered as follows:

$$rV_2^S[P^*(t)]\frac{min}{m(t)}\left\{\frac{1}{2}\left[f_{12}m^2(t)+f_{22}(g^s(t))^2+f_{32}p^{*2}(t)+2f_{42}m(t)g^s(t)+2f_{52}m(t)p^*\right]\right.$$
$$(t)+2f_{62}g^s(t)p^*(t)$$
$$\left.+V_2^S[P^*(t)][p^*(t)][em(t)+ng^s(t)-cp^*(t)]\right\}$$

From the minimization of equation (5.1) The optimal policy path of the Central Bank in terms of $g^s(t)$ is obtained as follows:

(5.2) $$m^t(t)=m^s[p^*(t),g^s(t),t]=-\left(\frac{f_{42}}{f_{12}}\right)g^s(t)-\left(\frac{f_{52}}{f_{12}}\right)p^*(t)-\left(\frac{e}{f_{12}}\right)v_2^{s\prime}[p^*(t)]$$

By placing the optimal policy path$m^t(t)$in the system of Hamilton-Jacobi equations of the government and derivation with respect to the optimal control variable $g(t)$the optimal Hamilton-Jacobi[31] equation system$V_2^S[P^*(t)]$for the government is obtained as follows:

(5.3) $$rV_2^S[P^*(t)]\frac{min}{g(t)}\left\{\frac{1}{2}\left[f_{12}m^2(t)+f_{22}(g^s(t))^2+f_{32}p^{*2}(t)+2f_{42}m(t)g^s(t)+2f_{52}m(t)p^*\right]\right.$$
$$(t)+2f_{62}g^s(t)p^*(t)$$
$$\left.+V_2^S[P^*(t)][p^*(t)][em(t)+ng^s(t)-cp^*(t)]\right\}$$

As a result, by placing $m^s(t)$in relation to the government's optimal strategy and then by placing (5.3).to Obtained in the equation $g^s(t)$optimal strategy of the central bank with the constants (5,2) and $g_i^s, m_i^s$are obtained as follows:

$$g_s(t) = g_{1s}p_*(t) + g_{2s}V_{1s'}[p_*(t)] + g_{rs}V_{rs'}[p_*(t)], g_{1s}, i = 1,2,3.$$

$$m_s(t) = m_{s\,1}p_* + m_{s\,2}V_{1s'}[p_*(t)] + m_{s\,3}V_{2s'}[p_*(t)], m_{s\,1}, i = 1,2,3.$$

Finally, by solving the differential equations with partial derivatives, the optimal value of the expected inflation rate is obtained, the results of which are presented in the simulation section.$(p^*(t))$.

6.Experimental analysis and model simulation:

Table3: Parameter values:

Parameters values Amounts	g	r	p	$d(0)$	d^-	m^-	f^-	Θ	τ	φ	n
	0,02	0,02	0,07	0,4	0,1	0,01	0,02	0,05	0,05	0,05	0,05

31 https://en.wikipedia.org/wiki/Hamilton%E2%80%93Jacobi_equation

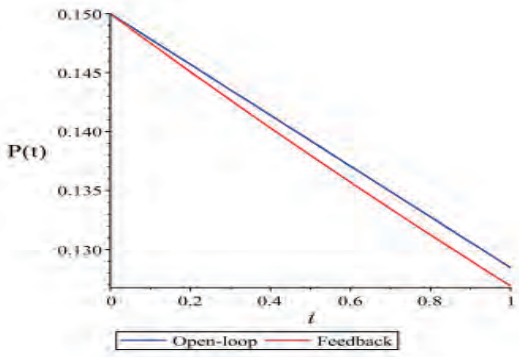

Figure 1: Comparison of the graph of the approximate answer of the equilibrium path of inflation in the game with feedback information and open- loop.

As a result, by placing $m^s(t)$ in relation to the government's optimal strategy and then by placing (5.3).to Obtained in the equation $g^s(t)$ optimal strategy of the central bank with the constants (5,2) and g_i^s, m_i^s are obtained as follows:

$$g_s(t) = g_{1s}p_*(t) + g_{2s}V_{1s'}[p_*(t)] + g_{r_s}V_{r_s'}[p_*(t)], g_{is}, i = 1,2,3.$$

$$m_s(t) = m_{s\,1}p_* + m_{s\,2}V_{1s'}[p_*(t)] + m_{s\,3}V_{2s'}[p_*(t)], m_{s\,i}, i = 1,2,3.$$

Finally, by solving the differential equations with partial derivatives, the optimal value of the expected inflation rate is obtained, the results of which are presented in the simulation section.$(p^*(t))$.

6. Model simulation:

In this section, we will simulate the equilibrium models obtained in the previous section using the parameters available in the economy. Now, according to the determination of the parameters for Turkey's economy[32], using Matlab software[33] We will examine the equilibrium values and stability of debt, budget deficit, and monetary base variables in the framework of the Stockberg game where the government is the leader and the central bank is the follower. bank We will pay as follows. Considering the optimal level of zero inflation, the comparison of two types of games with different information structures shows that considering that the feedback graph below is the open-loop diagram, we conclude that the steady-state equilibrium inflation level is lower in the game with feedback information than in the game with open-loop information. Therefore, it can be said that it is better for the relationship between the government and the central bank, which is in the form of Stackelberg's game, to balance inflation with a feedback information structure.

32 https://docs.google.com/spreadsheets/d/1H9-itYfpBfB5WywXwbI0AfNWoOkF_aK/edit?usp=share_link&oui-d=114565363668448528666&rtpof=true&sd=true.

33 https://en.wikipedia.org/wiki/MATLAB

6.1 Simulation for Stackelberg games with open loop information:

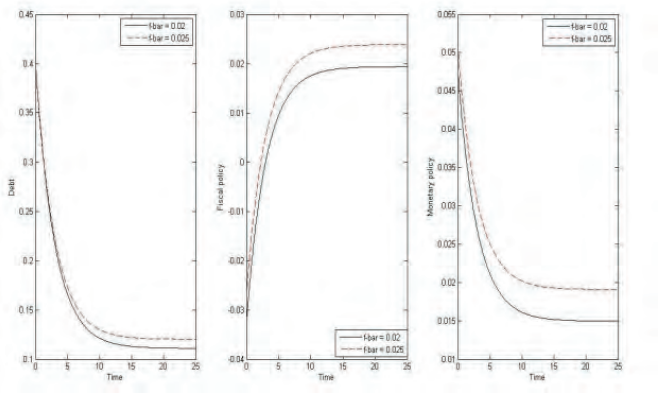

Figure 2 shows the state of movement of variables of debt, budget deficit and money circulation towards desired goals. As we proved in the previous parts, in the steady state, the equilibrium debt equation (ed) in the Stackelberg game with open loop information is equal to $-\delta 1$. According to the initial data, in the steady state, the equilibrium debt is equal to 0.1104 and on the other hand, the convergence speed towards the balance is equal to 0.333. When the government considers 0.02 as a target for the budget deficit, then in a steady state, the amount of government debt approaches its desired direction and the debt converges at the level of 0.1104, and therefore the budget deficit And money circulation converges to its desired state in a time period of approximately 10 rounds. Now if we assume that the government's oil revenues will decrease, then the government will consider the optimal targeting level for debt, for example, equal to 0.022, and as in It is clear that by increasing the target level for the budget deficit to 0.022, then the debt will converge to a higher level than before, and in a stable situation, the debt is equal to 0.1200, and on the other hand, there will be a higher budget deficit and more monetary release.

Figure 2: Equilibrium paths in the game with open loop information.

Also, on the other hand, the more the government as a leader in the game, the more weight you give to the target level compared to the central bank $(increase\ in\ \theta)$ causing the equilibrium debt to decrease to a lower level in a steady state, and as it is clear from $Figure\ (3)$, the equilibrium debt level is always decreasing with the increase of $\theta\ to\ 0.1$. But on the other hand, we observe that if the central bank, as a follower, gives more weight to debt than the government (increase in τ), initially for lower weights, the equilibrium debt level increases, but for higher weights, the equilibrium debt level decreases with a downward slope. And approximately when $\theta = \tau = 0.05$, the equilibrium debt level is the same.

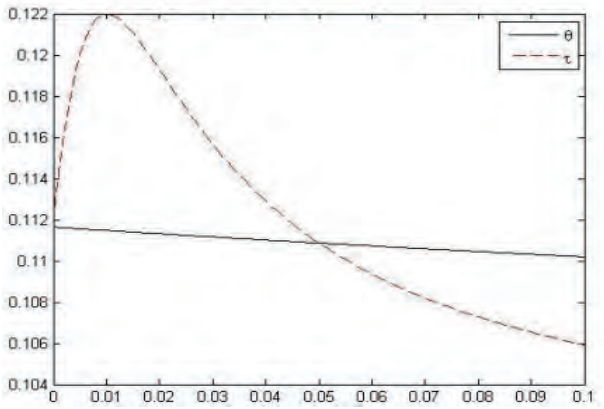

Figure 3 :Effects of changes in debt weights.

6.2 Simulation for Stackelberg games with feedback information:

In this part, we will simulate the Stackelberg game with feedback information between the government and the central bank. As we mentioned before, in this type of game, the players are aware of the situation at that point of time at any point of the game. But an important point in this game is that the optimal[34] equilibrium solution cannot be easily achieved as in the previous game. Because in this game we have to reach the best equilibrium solution through the method of solving points. In this part, first, through numerical solution, we are trying to obtain the optimal values for the financial policy parameters, i.e. $f\alpha \ and \ f\beta$. The optimal values for the parameters are $\alpha f = -0.0150$ and $\beta f = 0.005$. Therefore, the corresponding value for $\alpha = -0.2061$ and $\beta = 0.0210$. These numbers show that in a steady state with feedback information, the amount of equilibrium debt is equal to 0.1021 and the speed of convergence towards equilibrium is equal $to \ 0.2061$. Here, it can be seen that the speed of convergence to equilibrium is faster in the game with open-loop information than in the game with feedback information. But on the other hand, the level of equilibrium debt in the steady state is lower in the game with feedback information than in the game with open-loop information. On the other hand, in $figure \ (4)$, we compare the equilibrium paths of debt, budget deficit and monetary base in two models. As the figure shows, the equilibrium debt level in the game with open loop information is lower than the debt level with feedback information structure until the $first \ 12$ periods, but after $period \ 12$, in the steady state, the equilibrium debt level is lower in the game with feedback information. Since the equilibrium debt level in the first periods, in the game with open loop information is lower than the game with feedback information, therefore, the government with a smaller budget deficit and the central bank with less money issuance are trying to stabilize the debt. that's mean,The government and the central bank make less effort to stabilize the debt. But in the long run, when the equilibrium level of debt is greater in the open-loop information game than in the feedback game, the government and the central bank will make more efforts to stabilize the debt.

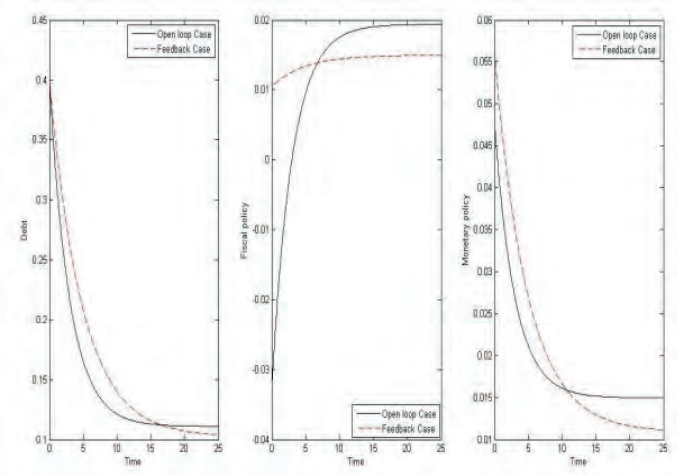

Figure 4: Comparison of equilibrium paths in the game with feedback information and open loop.

7.conclusion:

Since then, the theory of games played an important role in the strategic confrontation between the government and the central bank, and one of the models that played an important role in this type of modeling was the theory of differential games. Therefore, in line with the Stackelberg game between the government and the central bank with an open-loop information structure and feedback in the Turkish

34 Walsh, C. E. (1995); Optimal contracts for central bankers. American Economic Review 85, 150-167.

economy, a model for the Turkish economy using the extension of 1960 to examine the stability of the debt level of the budget deficit increases inflation and the monetary base. Also, the results show that even in the absence of income, the debt level can be brought closer to the desired level by increasing the economic growth rate or decreasing the time preference rate, or decreasing the real interest rate. Also, the more weight the government gives to inflation and debt targets, the lower the debt level. On the other hand, the comparison of two types of games with different information structures shows that the speed of convergence towards equilibrium is faster in the game with open-loop information than in the game with feedback information. Also, the level of equilibrium debt in the steady state is lower in the game with feedback information than in the game with open-loop information. It should be kept in mind that the acceleration in the increase of the GDP [35]and the increase in the interest rate are effective in reducing the production gap and reducing inflation, and as a result, a positive increase in the policy supply. For work, make another appointment policy. Money and finance should be treated as if there is a difference between GDP. By closing the production deficit, the improvement period and perihelion decreased and its effects on inflation decreased.

8.Suggestion for the future:

It can be seen in Table number 4 Suggested solution to curb inflation:

Table4: Suggested solution to curb inflation:

Providing liquidity to economic enterprises through people's capital.	Considering the adoption of contractionary policies by banks and the problems that may arise for small and medium-sized enterprises, the use of people's and wandering liquidity with an agreed profit between economic enterprises and people can return a huge part of the available liquidity to the production cycle and the banking system And the government can take a step towards the implementation of this proposal by providing guarantees to these companies in addition to building trust between the private sectors.
Joint and public investment with foreign investors.	The government can create an environment where after securing the foreign investor's income, the general public and capitalists can participate in the formation of large and medium-sized economic enterprises by providing any amount of their liquidity, and the counterparty of private and foreign sector investors, cooperative sectors and other people's organizations in this to be the basis and in this way liquidity is directed towards the flow of production.
Reducing the growth rate of wages and fixing the price of government services.	One of the most important ways to stabilize prices in the country's current inflated conditions is to prevent any factor that can increase the cost of goods. In these factors, which are fixed and variable costs, state banks can obtain the necessary stability; Especially government services, including energy, transportation and consulting sectors, etc., which can stop the process of increasing prices in favor of reducing inflation.

35 https://en.wikipedia.org/wiki/Gross_domestic_product

Shrinking the government.	The subject of privatization and transfer of public companies to the private sector and the executive mechanism and its positive and negative consequences are not a new issue. The basis of the insistence on privatization has actually been to make the government more efficient through its downsizing. The least effects of shrinking the government and strengthening privatization are the reduction of many government expenses and, as a result, the reduction of liquidity and the reduction of inflationary pressures. Privatization; It means changing the atmosphere governing government institutions; In such a way that while maintaining the main context of the activity, only the mentioned space has changed and the market conditions affect the way the institution works in such a way that the motivation and mechanisms of the private sector are the criteria for decision-making, and it is in this situation that an economic enterprise will find anti-inflationary properties.
Bitcoin digital currency	Bitcoin digital currency has been able to perform well against inflation and perform better in this field than assets such as; Have real estate, gold and stocks. Bitcoin as an asset has amazingly managed to beat them by a wide margin. Bitcoin has emerged as an inflation hedge in recent years. Since this digital asset is not dependent on any specific government or central bank, it is immune from the damage of inflation. As a result, for those who are looking to protect their money and assets against price fluctuations, we recommend investing in Bitcoin.

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Prediction Of Stock Index Movement Using Machine Learning Methods: An Application On Bist 100 Index

Nazif Ayyıldız

Harran University, Suruç Vocational School, Sanlıurfa, Türkiye, Orcid:0000-0002-7364-8436

Ömer İskenderoğlu

Omer Halisdemir University, Faculty of Economics and Admisintrative Sciences Nigde,Türkiye, Orcid:0000-0002-3407-1259

Abstract

Stock markets are constantly affected by macroeconomic events, political factors, international developments, and investor behavior and expectations, making it crucial to accurately predict the direction of the market or the main stock index. Therefore, determining the most appropriate analysis method for the markets and accurately predicting trends has become an important issue. In recent years, the use of machine learning algorithms for predicting stock index movements has become increasingly common. In this study, the movement direction of the BIST 100 index was predicted using machine learning classification methods, and the performances of different methods were compared to determine the best prediction method. To achieve this goal, decision trees, random forests, k-nearest neighbor, naive Bayes, logistic regression, support vector machines, and artificial neural networks were used to predict the movement direction of the BIST 100 index. The daily data set for the period from 01.01.2012 to 31.12.2021 and technical indicators such as moving average, weighted moving average, exponential moving average, MACD, CCI, RSI, Stochastic %K, Stochastic %D, William's %R, and Momentum, calculated based on this data set, were used as input data. According to the results, artificial neural networks were found to be the best method for predicting the movement direction of the BIST 100 index. Additionally, logistic regression and support vector machines were also found to be successful in predicting the BIST 100 index along with artificial neural networks.

Keywords: Stock Index Prediction, Machine Learning, Classification Algorithms

1. Introduction

Macro-economic events, political factors, and international developments are constantly affecting stock markets, and changes in stock price trends are seen as the biggest concern for investors. Therefore, the question of whether reasonable predictions can be made about stock price trends is one of the most important topics focused on and discussed in financial circles (Cao, 2021). In this regard, Eugene F. Fama stated in his "Efficient Market Hypothesis" study that the stock price reflects all available information, and therefore stock prices are independent of past prices and price prediction is not possible (Fama, 1970). However, many empirical studies have been conducted to investigate the validity of this hypothesis. While the view that markets are efficient was supported in studies conducted in the 1960s and 1970s, the view that market prices are not independent of past information and therefore markets are not efficient has been supported in studies conducted since the 1980s (Nevasalmi, 2020). In addition to

these debates, there are two different analysis methods used for predicting stock prices in stock markets, which are fundamental and technical analysis. In fundamental analysis, stock prices are predicted based on company, sector, and country analyses. In fundamental analysis, the difference between the real value of the stock and the market price is determined, and the aim is to buy the stock at a low price and sell it at a high price. In technical analysis, it is assumed that stock prices are determined by market forces and that history tends to repeat itself, and future prices are predicted using past data (Spahija and Xhaferi, 2018). In recent years, the use of machine learning methods based on artificial intelligence in stock markets has become widespread outside the methods of fundamental and technical analysis (Rothman, 2021). With machine learning methods that can discover complex relationships in data and learn hidden patterns, faster and more accurate predictions can be made than with fundamental and technical analysis (Nõu et al., 2021).

Being able to predict price trends in stock markets can provide various benefits to the stock markets, investors, market regulators, and business executives. Predicting the direction of stock prices will primarily lead to an increase in investment flow into the market. Furthermore, it can enable investors to make reasonable adjustments to their investment portfolios and create buying and selling strategies to maximize returns. Additionally, it can be useful for market regulators in making appropriate decisions and corrective measures. It can also provide business executives with the opportunity to act correctly in maximizing firm values (Mallikarjuna and Rao, 2009). The realization of these benefits depends on determining the most suitable analysis method for the markets and predicting trends with maximum accuracy.

The purpose of this study is to predict the direction of the BIST 100 index using machine learning methods and to compare the performances of different methods to determine the best prediction method for the BIST 100 index. For this purpose, daily data sets and various technical indicators for the period of 01.01.2012-31.12.2021 were used to predict the direction of the BIST 100 index using decision trees, random forests, k-nearest neighbors, naive Bayes, logistic regression, support vector machines, and artificial neural networks. The study consists of six sections in line with the determined objectives. In the second section of the study, the concept of machine learning and types of machine learning are explained. In the third section, similar studies reached through a literature review are summarized. In the fourth section, the data set used in the study is presented, and in the fifth section, machine learning classification methods are explained. In the sixth section, the findings obtained from the research are discussed. The conclusion and recommendations section of the study provides a general evaluation and suggestions for future studies.

2.Machine Learning

There are many different definitions of machine learning in the literature. In general, machine learning can be defined as systems based on algorithms that can learn from data sets and improve their performance over time with more data (Cao et al., 2006). In his pioneering work in machine learning, Mitchell (1997) defined it as “the ability of a machine to improve its performance on future tasks based on past experience.” Mitchell (2006) later defined machine learning as “a computer program that is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E.”

A machine learning approach includes a set of design choices that encompass the type of training experience, the target function to be learned, a representation of that target function, and an algorithm to learn the target function from training examples. A well-defined machine learning problem requires a well-defined task, performance measure, and source of training experience (Mitchell, 2006).

Machine learning is fundamentally a discipline that focuses on two related questions: “How can humans automatically build computer systems that improve through experience?” and “What are the basic theoretical laws that govern any learning system, regardless of whether it is applied in computers,

humans, or organizations?" Machine learning is important as it addresses both these fundamental scientific and engineering questions and has produced highly practical applications in many fields (Mitchell, 2006). As an interdisciplinary field, machine learning shares commonalities with mathematical fields such as probability, statistics, and optimization, as well as with computer science and artificial intelligence. Since the goal is to program machines to learn, machine learning is naturally a subfield of computer science. However, since the ability to turn experience into expertise or to detect meaningful patterns in complex data is a cornerstone of human intelligence, machine learning is also seen as a branch of artificial intelligence in some sense. Unlike traditional artificial intelligence, machine learning does not attempt to create an automatic mimicry of intelligent behavior, but instead seeks to leverage the strengths and special abilities of computers to complement human intelligence and perform tasks that often go beyond human capabilities (Shwartz and David, 2014). Through machine learning algorithms created with statistical methods and computer power, trends can be identified, hidden patterns and behaviors can be detected, and future predictions can be made (Geron, 2019).

Machine learning types have generally been classified into four categories in the literature, based on their usage, application areas, and algorithms:

- Supervised learning is a learning technique that aims to predict the relationship between inputs and outputs and seeks to find patterns in a labeled dataset. Supervised learning is also referred to as a mapping function. The mapping function identifies hidden patterns in the data. In supervised learning, there is a labeled dataset consisting of input data pairs and a target output. The target output is a value associated with the input data. The supervised learning algorithm processes the labeled training dataset to predict similar new datasets or the mapping function. Supervised learning can perform two main tasks: classification and regression.

- Unsupervised learning is a learning technique that focuses on commonalities rather than responding to feedback. The method aims to determine the likelihood of commonalities in a specific dataset and uses these commonalities to develop a model. The algorithm learns how to do something without providing a logical approach to accomplish a task.

- Semi-supervised learning combines both labeled and unlabeled data. In other words, both labeled and unlabeled training data are used together, and predictions are made for unknown points. Semi-supervised learning is often preferred when there is easy access to unlabeled data and obtaining labeled data is expensive.

- Reinforcement learning is a type of learning that provides benefit when exact models are unrealistic. The method focuses on how machines should operate to maximize certain aspects of cumulative rewards and minimize risk. Reinforcement learning combines the fields of supervised learning and dynamic programming.

3. Literature Review

In the scope of the study, the literature focusing on the prediction of main stock indices in Turkey using machine learning methods has been examined. In some studies, different methods were compared for their performance in predicting the direction of the index, while in others, the performance of a single method was examined on the index.

One of the pioneering studies that compared the performance of different methods in predicting the direction of the index was conducted by Kara et al. (2011). In this study, the Istanbul Stock Exchange National 100 Index was predicted using artificial neural networks and support vector machines based on the data set from 02.01.1997 to 31.12.2007. The performance of the methods was compared, and according to the analysis results, the average performance of the artificial neural networks algorithm

was 75.74%, while the average performance of the support vector machines algorithm was 71.52%. It was concluded that the artificial neural networks algorithm had a relatively higher prediction success compared to the support vector machines algorithm.

In the study conducted by Pehlivanlı et al. (2016), which compared the performance of support vector machines, multi-layer perceptron, and random forest methods in predicting the BIST 100 index, a daily data set from 01.04.2007 to 01.31.2013 was used. It was determined that support vector machines were the most accurate method for predicting the direction of the index.

In Alkış's (2017) study, logistic regression and k-nearest neighbor algorithms were used to examine the subject, and the daily data set from 11.01.2010 to 13.10.2016 was used to predict the up/down movement directions of the BIST 100 index. It was concluded that the logistic regression method could make more successful predictions compared to the k-nearest neighbor method.

In Filiz et al. (2017), the direction of the BIST-50 index was predicted using daily data covering 2591 trading days from 2006 to 2016, and the k-nearest neighbor, naive Bayes, and artificial neural network methods were compared. The analysis showed that the naive Bayes algorithm had an accuracy of 92.28%, the artificial neural network algorithm had an accuracy of 91.66%, and the k-nearest neighbor algorithm had an accuracy of 89.58% in predicting the direction of the index.

In Kara's (2019) study, the direction of the BIST 100 index was predicted using artificial neural networks, support vector machines, decision trees, naive Bayes, k-nearest neighbor, logistic regression, and linear discriminant analysis methods, using data from 1995 to 2018. According to the results, the artificial neural network method with an accuracy of 83.83% was found to be the best classification method that could be used to predict the movement direction of the BIST 100 index.

Papuccu (2019) used artificial neural networks, support vector machines, and naive Bayes algorithms to predict the direction of the BIST 100 index using daily closing values covering the period from 2009 to 2018. Ten technical indicator models were used as inputs for predicting the stock index. The analysis results showed that all three models could be used to capture stock index movements, but the artificial neural network algorithm had the most successful performance.

In Filiz et al.'s (2021) study, logistic regression, artificial neural networks, naive Bayes, support vector machines, and decision tree algorithms were used to predict the change direction of the BIST-100 index using macroeconomic indicators such as major world indices, gold, and the dollar as input variables. The dataset used in the analysis covered the period from 01.01.2006 to 01.12.2020. The analysis showed that the support vector machine algorithm had the highest classification success rate of 71.9%, followed by logistic regression with 70.6%, naive Bayes with 70.4%, decision trees with 70.3%, and artificial neural networks with 70.2%. Therefore, it was determined that support vector machines were the most successful method in predicting the BIST-100 index.

In the study by Kemalbay and Alkış (2021), machine learning algorithms were used to predict the daily upward or downward movement direction of the BIST 100 index. Logistic regression and k-nearest neighbor algorithms were used to build models using independent variables whose impact on the BIST 100 index movement direction was statistically significant. An analysis was performed using percentage return data from 1700 trading days between January 11, 2010 and October 13, 2016. According to the results obtained from the analysis, the logistic regression algorithm achieved a higher prediction performance compared to the k-nearest neighbor algorithm, with an accuracy rate of 81% versus 78%.

In a pioneering study examining the performance of a single method on the index, Karagül (2014) used the support vector machines method to predict the stock price direction of 42 companies operating in the food, textile and cement sectors listed in the BIST 100 Index between 2006 and 2011. According to the results of the study, the method accurately predicted the next day's direction of the index with an accuracy rate of 97.6%. In the study by Özer et al. (2018), the direction of the BIST 100 index was predicted using weekly data from the period between 2012 and 2016 with the artificial neural networks

method. The analysis showed that the artificial neural networks method was successful in predicting the index direction.

4. Data Set and Method

The ten-year period between 01.02.2012 and 31.12.2021 was determined as the research period for predicting the direction of the BIST 100 index in this study. The technical indicators used in the study and their calculation methods are presented in Table 1.

Table 1: Technical Indicators and Calculations

Technical Indicators	Calculation Method
Simple Moving Average (MA)	$\frac{C_t + C_{t-1} + \cdots + C_{t-30}}{n}$
Weighted Moving Average (WMA)	$\frac{((n) * C_t + (n-1) * C_{t-1} + \cdots + C_{t-14}}{(n + (n-1) + \cdots + 1)}$
Exponential Moving Average (EMA)	$EMA(k)_t = EMA(k)_{t-1} + a * (C_t - EMA(k)_{t-1}$
Momentum (Mom)	$C_t - C_{t-n}$
Stochastic K% (K%)	$\frac{C_t - LL_{t-n}}{HH_{t-n} - LL_{t-n}} * 100$
Stochastic D% (D%)	$\frac{\sum_{i=0}^{n-1} K_{t-i}\%}{n}$
Relative Strength Index (RSI)	$100 - \frac{100}{1 + (\sum_{i=0}^{n-1} Up_{t-i}/n)/(\sum_{i=0}^{n-1} Dw_{t-i}/n)}$
Moving Average Convergence/ Divergence (MACD)	$MACD(n)_{t-i} + \frac{2}{n+1} * DIFF_t - MACD(n)_{t-1}$
Larry William's R% (LW)	$\frac{H_n - C_t}{H_n - L_n} * 100$
Commodity Channel Index (CCI)	$\frac{M_t - SM_t}{0{,}015 D_t}$

$*C_t$: Closing Price	HH_t: Highest of the highest within the last *t* days
L_t: Lowest Price	$M_t = (H_t + L_t + C_t)/3$
H_t: Highest Price	$SM_t = \sum_{i=0}^{n} M_{t-i+1}/n)$
$DIFF_t = EMA(12)_t - EMA(26)_t$	$D_t = \sum_{i=1}^{n} \lvert M_{t-i+1} - SM_t \rvert/n$
a: Adjustment Factor	UP_t: Upward price at time *t*
LL_t: Lowest of the lowest within the last *t* days	DV_t: Downward price at time *t*

Reference: Kumar ve Thenmozhi (2006).

The Simple Moving Average, Weighted Moving Average, Exponential Moving Average, Momentum, Stochastic K, Stochastic D, Relative Strength Index, Moving Average Convergence Divergence, Larry William's R, and Commodity Channel Index indicators, calculated based on the aforementioned

calculations, were used as input variables to measure the performance of all methods used in the study. The next day's direction of movement of the BIST 100 index, expressed as "decline" or "rise" according to the closing prices, was used as the output data. The dataset was divided into 80% training data and 20% test data. After the training stage, the predictions made by the algorithms were compared with the test dataset and the prediction performance of the methods was measured. Seven different machine learning algorithms, namely decision trees, random forests, k-nearest neighbors, naive Bayes, logistic regression, support vector machines, and artificial neural networks, were used to predict the "rise" and "decline" directions of movement of the BIST 100 index.

In the k-nearest neighbor algorithm, example-based classification is performed based on the distance measure of examples in the known class category training data (North, 2016). In n sample examples represented by p-dimensional vectors $x_1^t = (x_1, \dots, x_{1p}), \dots, x_1^t = (x_1, \dots, x_{np})$ defined by p attributes, each example represents a point in a p-dimensional vector space. The distance between sample points i and j is denoted by $d(x_i, x_j)$, and when all attributes are numerical, the algorithm calculates the distance using the Euclidean distance as shown below (Mitchell, 1997).

$$d(x_i * x_j) = \sqrt{\sum_{k=1}^{p} (x_{ik} - y_{jk})^2} \tag{1}$$

To determine which class a new example belongs to, the distances between the calculated point and all the points in the training data set are calculated, and the calculated distances are sorted from smallest to largest. Taking into account the k-nearest neighbor parameter previously determined, k points with the closest distances are selected. To determine the class of the new observation, usually majority voting or weighted voting methods are used. The votes of the k nearest neighbors $x_m; m = 1, \dots, k$ in the training data set are inversely proportional to the distance to the new example point x_z. The equation for this is expressed below (Cover and Hart, 1967).

$$\text{vote}(x_m) = \begin{cases} \infty, & \text{if } d(x_m, x_z) = 0 \\ \frac{1}{d(x_m, x_z)}, & \text{otherwise} \end{cases} \tag{2}$$

In the decision tree algorithm, the values of decision boundaries in a single-variable decision tree are estimated experimentally from the training data. In the case of continuous data, a logical test is performed in the form of $X_i > C$, where X_i represents a feature of the data in the feature space at each internal node and C is a threshold value in the observed range of X_i. The threshold value C can be determined using certain conditions, such as maximizing differences or minimizing similarities at descent nodes. Assuming a dataset consists of several classes $C_1, C_2 \dots, C_n$ and T represents the class values, the probability of belonging to a class is $P_i = C_i/T$, and the entropy of the classes is calculated. When the T class values are divided into subsets $T_1, T_2 \dots, T_n$ based on the attribute B in the dataset, the gain ratio resulting from the division of the T class values using the B attribute values is determined. The training set T is repeatedly partitioned at each node of the tree such that the gain ratio is maximized. The process is repeated until each leaf node contains observation values belonging to only one class. The following steps are performed to calculate the gain ratio (Quinlan, 1993; Han, Kamber, and Pei, 2012).

$$\text{Entropy}(T) = -\sum_{i=1}^{n} (p_i \log_2(P_i)) \tag{3}$$

$$\text{Gain}(B, T) = \text{Entropy}(T) - \sum_{i=1}^{n} \frac{|T_i|}{|T|} (\text{Entropy}(T_i)) \tag{4}$$

$$\text{Splitting Criterion } (B) = -\sum_{i=1}^{k} \frac{|T_i|}{|T|} \text{Log}_2 \left(\frac{|T_i|}{|T|}\right) \tag{5}$$

$$\text{Gain Ratio} = \frac{\text{Gain (B,T)}}{\text{Splitting Criterion (B)}} \tag{6}$$

In the random forest algorithm, first, the number of decision trees (n) to be created based on the properties of the dataset is determined. Then, at each node of the created decision trees, m number of variables are randomly selected and the best branch is determined by calculating the Gini index. Then, the selected best branch is split into two sub-branches. This process is continued until a single class remains at each node, that is until the Gini index becomes zero. Finally, the predicted class is chosen as the class with the highest number of votes among the predictions made by the n decision trees. If T is the entire dataset, p_j is the square of the ratio of the number of elements smaller and larger than each data point in the dataset, and c is the selected data point, the Gini index is calculated as follows (Breiman et al., 1984; Breiman, 2001).

$$I_G = \sum_{j=1}^{e} p_j^2 \tag{7}$$

In the Naive Bayes algorithm, the class of the data is estimated by calculating the highest probability. The algorithm learns which class the examples belong to from the training data set and makes class predictions for the test data. Bayes theorem is used to estimate the probabilities during this process. Bayes theorem is expressed as follows, where P(C/X) represents the probability of C occurring when X has occurred (Minsky, 1961; Jurafsky and Martin, 2020).

$$P\left(\frac{C}{X}\right) = \frac{P(C) * \left(\frac{C}{X}\right)}{P(X)} \tag{8}$$

The support vector machine algorithm is based on the principle of structural risk minimization and aims to minimize the upper bound of generalization error. In this algorithm, given a dataset of l elements $y_i \in \{-1,1\}$ where $x_i \in \Re^d$ is the feature vector and $\{x_i, y_i\}, i = 1,2,\ldots,l$ is the label value, the constant term is denoted by b, and the weight vector is denoted by w. The training points, called support vectors, are expressed using the following equations (Cortes and Vapnik, 1995; Marsland, 2009):

$$\text{for } y_i = 1,\ w * x_i + b \geq 1 \tag{9}$$

$$\text{for } y_i = -1,\ w * x_i + b \geq -1 \tag{10}$$

$$y_i = w * x_i + b \geq 1 \qquad \forall i \tag{11}$$

In the artificial neural networks algorithm, a fitness function is defined by summing the squares of error signals for each neuron in the output layer of the network. In the kth iteration of training, if the output value of the ith neuron in the output layer of the artificial neural network is denoted by y_i, and the desired value to be output from this neuron is denoted by d_i, then the error signal of the ith neuron is calculated as $e_i = d_i - y_i(k)$. The fitness function, denoted by E, is expressed by the following formula (Rojas, 1996):

$$E = \frac{1}{2} i^{e_i^2}\ k = \frac{1}{2} i^{(d_i - y_i\ k)^2} \tag{12}$$

The backpropagation algorithm aims to minimize the fitness function. Since the fitness function is variable according to the weight values of the artificial neural network, the amount of change in the weights of the artificial neural network in the process of changing them in the most appropriate way is calculated based on the gradient descent method. The gradient descent method equation, where the η term is expressed as the learning rate, is expressed as follows (Haykin, 2009; Li and Huang, 2021):

$$\Delta w_{ij} = -\eta \frac{\partial E(w)}{\partial w_{ij}} \tag{13}$$

The backpropagation algorithm consists of two stages: forward and backward propagation. In the forward pass stage, the desired outputs are calculated and compared with the actual outputs to calculate the error rate. In the backward pass stage, the weights in the network are rearranged by utilizing the errors calculated in the forward pass stage. The forward and backward pass stages are repeated until the error rate reaches a sufficiently low level (Cilimkovic, 2010).

In logistic regression algorithm, assuming Y is a binary dependent variable with two categories, Y is usually encoded as Y=0 and Y=1 and the vector of independent variables $X^T = (X_1, \ldots . X_p)$ is known, the probability of Y taking the value of 1, $\pi(X) = P(Y = 1|X = x)$ is expressed. The multiple logistic regression model is expressed as follows (Hosmer et al., 2013; Hilbe, 2015).

$$\pi(X) = P(Y = 1|X = x) = \frac{1}{1+e^{-(\beta_0+\beta_1 x_1+\ldots.+\beta_p x_p)}} \quad (14)$$

When the logit transformation, $\text{lojit}[\pi(x)] = g(x) = \ln\left(\frac{\pi(x)}{1-\pi(x)}\right.$ is applied to the multiple logistic regression model, the resulting equation becomes a linear model represented by g(x).

$$g(x) = \ln\left(\frac{\pi(x)}{1-\pi(x)} = \beta_0 + \beta_1 x_1 + \ldots . + \beta_p x_p\right. \quad (15)$$

The value range of $g(x)$ can vary between -∞ and +∞ depending on the value set of x. The model's parameters $\beta^T = \beta_0 + \beta_1 + \ldots . + \beta_p)$ and its likelihood function $L(\beta) = \prod_{i=1}^{n}(x_i)^{y_i}\ (1 - \pi(x_i)^{1-y_i}$ are used to make predictions in logistic regression. (Hosmer et al., 2013; Hilbe, 2015).

5. Results

The performance of seven different machine learning algorithms, including Decision Trees (DT), Random Forest (RF), K-Nearest Neighbors (KNN), Naive Bayes (NB), Logistic Regression (LR), Support Vector Machines (SVM), and Artificial Neural Networks (ANN) in predicting the direction of the BIST 100 index was examined in this study. The accuracy rates obtained from the analyses are presented in Table 2.

Table 2: Prediction Accuracy Rates of Machine Learning Algorithms

Decision Trees	0,6414
Random Forest	0,6514
K-Nearest Neighbors	0,5129
Naive Bayes	0,6614
Logistic Regression	0,8207
Support Vector Machines	0,7869
Artificial Neural Networks	*0,8665

*The accuracy rate of the method that predicted the direction of the index with the highest accuracy

When Table 2 is examined based on the prediction accuracy rates, it can be seen that artificial neural networks, with an average prediction accuracy of 86.65%, stand out as the most successful method. This result is consistent with the studies of Kara et al. (2011), Karagül (2014), Özer et al. (2018), Kara (2019), and Papuccu (2019) which compared the performance of different machine learning methods for predicting the movement direction of BIST 100 index in the literature. In these studies, artificial neural networks were identified as the best method for predicting the movement direction of BIST 100 index.

Examining Table 2, the second most successful method is logistic regression, which shows an accuracy performance of 82.07%. It can also be said that the logistic regression algorithm successfully

predicts the movement direction of BIST 100 index. This result is consistent with the studies of Filiz et al. (2021) and Kemalbay and Alkış (2021), which concluded that the logistic regression algorithm achieved successful performance in predicting the movement direction of BIST 100 index.

Examining Table 2, it can be seen that the third most successful method is support vector machines, with a prediction accuracy rate of 78.69%. It can also be said that the support vector machines algorithm successfully predicts the movement direction of BIST 100 index. This result is consistent with the studies of Pehlivanlı et al. (2016) and Filiz et al. (2021), which compared the performance of machine learning methods for predicting the movement direction of BIST 100 index and found that support vector machines performed well.

When Table 2 is examined, it can be seen that artificial neural networks are the most successful method with an average prediction accuracy of 86.65%, based on the accuracy rates. This result is consistent with the studies of Kara et al. (2011), Karagül (2014), Özer et al. (2018), Kara (2019), and Papuccu (2019) in the literature, which compared the performance of different machine learning methods in predicting the direction of BIST 100 movement, where artificial neural networks were identified as the best method for predicting the movement direction of the BIST 100 index.

When Table 2 is examined, it can be said that logistic regression is the second most successful method with a 82.07% accuracy performance. Logistic regression algorithm can also successfully predict the movement direction of the BIST 100 index. This result is consistent with the studies of Filiz et al. (2021) and Kemalbay and Alkış (2021), which concluded that logistic regression algorithm performed well in predicting the BIST 100 index.

When Table 2 is examined, it can be seen that support vector machines are the third most successful method with an accuracy rate of 78.69%. Support vector machines algorithm can also successfully predict the movement direction of the BIST 100 index. This result is consistent with the studies of Pehlivanlı et al. (2016) and Filiz et al. (2021), which compared the performance of machine learning methods in predicting the movement direction of the BIST 100 index and found support vector machines to be successful.

When Table 2 is examined, Naive Bayes is the method with the fourth highest accuracy performance at 66.14%, followed by decision trees at 64.14%, random forest at 65.14%, and k-nearest neighbor at 55.29%. Therefore, the method with the lowest prediction performance is k-nearest neighbor with an accuracy rate of 55.29%. This result is consistent with the studies of Filiz et al. (2017) and Kara (2019), which compared the performance of different machine learning methods in predicting the direction of the BIST 50 and BIST 100 indexes, respectively, and found k-nearest neighbor to be the least successful method.

When all the findings are evaluated together, it is determined that the movement direction of the BIST 100 index can be successfully predicted using machine learning methods, and artificial neural networks are identified as the best method for predicting the direction of the BIST 100 index. However, logistic regression and support vector machines methods have also shown an accuracy performance of over 70%. These results demonstrate that the movement direction of the BIST 100 index can be predicted to a certain level of accuracy using past index data.

6.Conclusion and Recommendations

The aim of this study was to predict the direction of BIST 100 index using machine learning methods, compare the performance of these methods, and determine the best prediction method for BIST 100 index. Daily data set for the period from 01.01.2012 to 31.12.2021 and various technical indicators were used to predict the movement directions of BIST 100 index using decision trees, random forests, k-nearest neighbor, naive bayes, logistic regression, support vector machines, and artificial neural networks methods. According to the results obtained from the analysis, the best method for predicting

the direction of BIST 100 index was determined to be artificial neural networks. Logistic regression and support vector machines methods were also found to be successful in predicting BIST 100 index along with artificial neural networks.

The results show that stock market indices can be predicted with a certain level of accuracy using past index data. In this context, the predictability of stock markets can provide various benefits to stock markets, investors, regulatory authorities, and business managers. Predicting the direction of stock prices will first encourage investment flow into the market. On the other hand, it can provide significant benefits for investors such as protecting their savings, avoiding transaction costs, seizing investment opportunities, and predicting potential risks. In addition, it can be beneficial for market regulators in terms of taking appropriate decisions and corrective measures. Moreover, it can provide an opportunity for business managers to act correctly in maximizing their firm values.

In future studies, using macroeconomic variables such as interest rates, inflation, and exchange rates as input variables along with different technical indicators in the literature may increase the accuracy of the methods. Hybrid prediction methods can also be developed to obtain better trading strategies. In addition, applications can be made not only for certain periods or specific indices but also for different periods and/or different stock market indices.

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Risk Management of Digital Information Security Assets

M. Kenan Terzioğlu

Assoc. Prof. Dr., Trakya University, Faculty of Economics And Administrative Sciences, Econometrics Department, ORCID: 0000-0002-6053-830X,

Aysu Yaşar

PhD Student, Trakya University, Social Sciences Institute, Econometrics Department, ORCID: 0000-0003-2200-2915

Abstract

Using the E-Government application, the reflection of the opportunities offered by the developing information and communication technologies and the changing social needs on the public service; increases the threats and risks it contains while facilitating the use of services within the framework of the public/private sector. As information security is the key factor of the E-Government system, it is important to prepare and implement an efficient and effective security management plan for a sustainable infrastructure. Within the scope of the study, risk factors are determined by establishing a structure in order to effectively model the e-Government information security risk assessment. As a result of the determined structure belonging to the e-Government system, which is still in operation in Turkey, the main criteria with the highest importance in risk assessment are application and data security, portable device and environment security, while the other order of importance is network and system security, physical space security, personnel security and internet of things (IoT) device security.

Keywords: Information Security, Risk Assessment, E-Government, Analytical Hierarchy Process

1. Objectives

In line with the opportunities offered by the developing information and communication technologies and the changing social needs, there is a need for a holistic transformation that brings together human, business processes and technology elements. In this context, the transformation, which includes many technologies such as the internet of things, cloud computing, blockchain, big data and artificial intelligence, brings radical changes in both business processes and social structure. As a result of the transfer of services to Digital Turkey in order to provide user-oriented service and to enable public administration, the importance of usage and cost-effectiveness comes to the fore. By increasing the number of services with high added value and making these services available to the public, both the necessity of preparing user-friendly interfaces and the necessity of providing a sustainable structure for the corporate information systems needed in service delivery emerges. In the digital age, it is important to carry out studies within a governance approach focused not only on data but also on generating value from data. Within the scope of the study, it is aimed to establish an index system with a hierarchical structure and to develop an e-Government information security management model for Türkiye, in order to make risk assessment of e-Government information system security based on operationally critical threats, assets and vulnerabilities (vulnerability) in public institutions.Despite the obligation to implement

information security standards and the encouragement of investments in information technologies as a state policy; there are deficiencies in the information security management model structures that help to ensure the implementation and control of information security in e-Government services offered by public institutions. In this context, because of the fact that the organizational structure with the roles/responsibilities that will guide the information security management is not defined, lack of knowledge about the security level and need of the information held for the transactions/processes carried out according to the relations and stages of the e-Government and the lack of knowledge of security controls and security vulnerabilities in the storage/processing/transfer of information required in the business processes of institutions, makes it necessary to conduct an information security risk assessment in order to present an effective solution. In this context, as a result of the hybrid model structure created by the combination of fuzzy modeling and artificial neural network modeling as well as decision-making techniques to determine the e-Government information security risks in Turkey, the risks and weights that may be encountered in e-Government information security management are determined and their potential effects are revealed.

2. Methodology

Analytical Hierarchy Process (AHP), one of the multi-purpose decision-making methods developed by Saaty, is a mathematical method that considers the priorities of groups or individuals in decision-making, and evaluates qualitative and quantitative variables together. The Analytical Hierarchy Process is used in many areas including social research, R&D, advocacy, selection, prioritization, etc. AHP, which is suitable for complex decisions involving the comparison of decision elements that are difficult to quantify, is based on the approach of clustering the decision elements of subjective judgments according to their common characteristics and revealing their relative importance by evaluating the effects of various elements of the system on the whole system.

Decision making problem in AHP method; The decision maker is defined as the selection of the best alternative according to at least one objective or criterion from the option set, consisting of alternatives, criteria, results, environment and the priorities of the decision maker. Following the definition of the problem, the first step of the method is to create a hierarchical structure by determining the main criteria and sub-criteria belonging to the main criteria in line with the purpose of the decision maker. The structure created is based on the 1-9 importance scale proposed by Saaty, and the criteria and alternatives are evaluated and the importance levels of the criteria are determined among themselves (Satty,1980). There are six stages in the Analytical Hierarchy Process (AHP) method;

Step 1: While defining the problem to be analyzed, it is important to clarify all assumptions (Haller et al.,1996). The decision problem for the AHP process consists of goals, criteria, sub-criteria and alternatives, and a hierarchical structure is created within the scope of the problem. The hierarchical structure shows the relationship between the elements of a level and the elements of the lower levels. This relationship goes down to the lowest levels of the hierarchy and each element is indirectly linked to each other. The decision hierarchy should be large enough to contain the main concerns of the decision makers and small enough to allow for changes. In this step, decision makers must eliminate alternatives that are deemed impracticable or that do not meet the criteria actually considered appropriate.

Step 2: Data are collected from experts or decision makers who will evaluate the pairwise comparison of alternatives and hierarchical structure using a qualitative scale. Experts evaluate the comparison as equally important, somewhat important, very important, very important and extremely important, and pairwise comparison decision matrices are formed according to the 1-9 importance scale.

Step 3: Pairwise comparisons of the criteria created in the second step are arranged in a square matrix. If the value of (i,j) element is greater than 1, i. criteria in row j. better than the criterion in the column; otherwise j. criteria in column, i. It's better than on the line. The (j,i) element of the matrix is the inverse of (i,j). The decision matrix (A)

$$A = (a_{ij})_{nxm} = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nm} \end{pmatrix} \quad (1)$$

is formed where $a_{ij} = 1/a_{ji}$, i,j=1,2,3,…n .

Step 4: The base eigenvalue of the comparison matrix and its corresponding normalized right eigenvector give the relative importance of the various criteria being compared. The elements of the normalized eigenvector are called weights by criteria or sub-criteria, and ratings by alternatives.

Step 5: In this step n. The consistency of the matrix in the order of If the consistency index does not reach a required level, the responses to the comparisons need to be reexamined. Consistency Index (CI), where λ_max is the maximum eigenvalue of the decision matrix;

$$CI = (\lambda_{max} - n)/(n-1) \quad (2)$$

is calculated. If the Consistency Ratio (CR) is,

$$CR = \frac{CI}{RI} \leq 0.10 \quad (3)$$

and the obtained value should be CR≤0.10.

Step 6: The rating of each alternative is multiplied by the weights of the sub-criteria and summed to obtain local ratings according to each criterion. Local ratings are then multiplied by the weights of the criteria and summed to obtain global ratings. The analytical hierarchy process is based on the judging importance of one alternative relative to another according to a common criterion and generates weight values for each alternative (Bhushan et al., 2007)

3. Results

E-Government provides time savings and efficiency for citizens by transferring public services to the digital environment. Therefore, the digitization of public services should be among the priorities of government policies. One aspect of all public services can be digitized. For this reason, the use of e-Government is of vital importance in terms of countries' development policies and human development.

In their quest to modernize their operations and support public-private partnerships, many governments are launching local e-Government programmes. E-Government, which is not a purely technology phenomenon, is about redefining and reorganizing the way service providers (public/private) and citizens (or customers within the context of the new-generation) interact in society.

Regarding the determination of risk factors by examining the security threats in the e-Government information system and reducing the threats; The latest technologies and systems should be used in the inventory management of hardware assets, new developments should be constantly followed and exemplary practices should be taken and adapted around the world. Within the scope of the study, the development and stages of a decision support system with AHP are explained in order to choose the best alternative. By determining the priority weights of the evaluation criteria and ordering the alternatives, the AHP model setup allows decision makers to apply different scenarios by changing the input parameters, and provides a simple and easy way to observe the results up to a point that meets the information security objectives. Modeling can be developed by using extensions to the AHP method to meet the risk assessment problem, qualitative and uncertain parameters. In this framework, by integrating AHP and other models for e-Government information security risk assessment, a significant contribution will be made compared to other methods used in the literature.

4. Conclusion

In future studies, countries with similar environmental levels should be compared using the mentioned AHP method in order to increase ICT-oriented innovation competence. Relative comparison of countries with similar environmental level is an important factor for increasing national competitiveness. Therefore, countries should verify national ICT efficiency by comparing results with input sources. Governments must accurately assess whether their organizations are operating efficiently and recognize the problems of inefficiency. Governments should compare other countries that are efficient at generating profits. Countries with similar gains should manage their ICT operations with reference to each other's ICT environment and accessibility.

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Scale Development on Digital Citizenship

M. Kenan Terzioğlu

Assoc. Prof. Dr., Trakya University, Faculty of Economics And Administrative Sciences, Econometrics Department, ORCID: 0000-0002-6053-830X

Mehmet Ali Yücel

Ph.D. Student, Trakya University, Social Sciences Institute, Econometrics Department, ORCID: 0000-0002-5474-3307

Abstract

With the increasing use of digital tools in daily life, individuals are using the developing information and communication technologies effectively for information, communication, law, health, education, security, entertainment and public service procurement. Digital citizenship is defined as the effective and efficient use of digital technologies for the purpose of accessing digital public services and communicating with public institutions, creating and disseminating digital content. The development of public policies by governments with a focus on digitalization have increased the importance of the concept of digital citizenship, especially with the effect of the pandemic period. With the expansion of the field of digital citizenship, new and different needs have emerged. The transformation through rapid technological innovations, which includes various technologies such as internet of things, cloud computing, blockchain, big data and artificial intelligence, causes profound changes in both business processes and social structure in the digitalizing era. Within this framework, in the study, it is planned to use explanatory and/or confirmatory factor analysis to test the dimensionality of the digital citizenship scale. Within the scope of the study, it is aimed to increase digital awareness by determining digital citizenship attitudes towards students in Turkey, to create a digital citizenship scale and to update the definition of digital citizenship.

Keywords: Digital Citizenship, e-Government, Scale Development

1. Objectives

The fact that both companies and governments are investing heavily in collecting, aggregating and storing data for profit or security about what we say and do via the Internet is the strongest practical evidence of the importance placed on our connected digital lives. Information and communication technology (ICT) completely changes people, life and the age we live in. With these changes, digital technologies are used effectively for information seeking, sharing, communication, access, law, consumption and entertainment. The changing age with information and communication technologies leads to the exchange of the characteristics of individuals and, accordingly, the characteristics of society. The concept of citizenship is expanding with digital technologies. Different conceptualizations of digital citizenship highlight certain aspects such as the necessary competences for digital citizenship or opportunities to participate in digital spaces (Chen et al., 2021).The digital age, in which digital tools are widely used, strives to create digital citizens from the digital society. Digital citizens are generally

defined as “those who use the internet regularly and effectively” (Mossberger et al., 2008). The concept of digital citizen is of increasing importance as it includes government policies. Digital citizenship consists of responsible codes of conduct in technology use, digital participation, digital commerce, digital communication, digital literacy, digital ethics, digital law, digital rights, digital health and digital security(Ribble, 2012). Within the scope of the study, as expressed in the definition of the concept of digital citizenship, it has been stated that there are some deficiencies in the definition in the literature regarding the concept, and the process steps are explained in order to redefine the concepts in a way that will eliminate these deficiencies.

2. Methodology

The measurement is explained as whether a certain object has a certain feature or not, and if it does, the degree of ownership is observed and the observation results are expressed with symbols and numbers with certain characteristics. he feature that is the subject of measurement can be observed directly in some cases where the feature can be directly observed and counted and listed, and indirectly in cases where the feature cannot be observed directly but is measured with another object of known size, which is known to be related to the feature. As a result of each measurement process, a scale (measurement tool) is used to measure the feature to be measured and this feature. Scale types are divided into two groups: the classification (naming) scale, which is in the group that reflects the measurement results only with qualitative distinctions, and the ranking scale, which is in the group that includes quantities such as degree/quantity of the measurement results, equally spaced scale and ratio scale (Tavşancıl,2010). A classification scale is a type of scale that shows the presence or absence of a feature in an object or individual only in a certain way. Ranking scale is obtained by placing objects in order in terms of the amount of having a certain property. Equally spaced scales are defined as scales that are ranked according to a certain starting point and in terms of the degree of ownership of a particular feature, or the differences between the ranks are equal. If the arbitrary starting point (zero) in the equally spaced scale is taken as absolute zero or is chosen as a fixed point, the transition to the ratio scale is achieved. Since all arithmetic operations can be applied to the data obtained with the ratio scale, it is considered as a more powerful scale compared to the other three scales (Kurtuluş,1981). Reliability, validity, usefulness, sensitivity, unidimensionality and continuity are among the features that the scales used as a measurement tool should have. Reliability; It is an indicator of the degree of determination that the measurement tool measures the feature or features it measures. Reliability (Özdamar,1999), a concept that reveals homogeneity in measurement, indicates the degree of freedom from random errors (Turgut, 1997) of measurement results. It is necessary to reveal the existence of a certain relationship between the answers given to each item in the scale. It is necessary to reveal the existence of a certain relationship between the answers given to each item in the scale.

Correlations between items can be used as evidence that the scale measures a single construct for the scale under development with factor analysis, Factor analysis aims to find fewer unrelated variables by bringing together related structures in a structure with p variables. In other words, with factor analysis, common dimensions are created, dimension reduction and dependency structure are eliminated. There are two approaches: exploratory (explanatory) factor analysis, which tries to find factors based on the relationship between the variables, and confirmatory factor analysis, which provides the analysis of the accuracy of the previously determined hypothesis of the relationship between the variables. Sample size, normal distribution and linearity are among the issues to be considered in the application of factor analysis. With the factor analysis method, the items that measure the same structure are gathered under the same factor and the items that do not measure this structure are removed. When considered within this framework, it is expected that the factor loadings of the items will be high. Items that are highly correlated with each other measure a construct or a factor. Therefore, while the items are expected to have a high loading value for only one factor, they are expected to have a low loading value for the other factors. Common factor loads are expected to be high (Bardakçı,2013). In the last stage of

factor analysis, the factor numbers measured by the scale items are determined by using eigenvalues, explained variance ratio and line graphs (Arslan,2015). Eight basic steps are considered in multivariate measurements (Churchill,1979). The starting point in scale development is to clearly identify the structure of interest and the dimensions that make up this structure. At this point, it is necessary to determine what is included and excluded from the definition of the structure of interest, as it will be conceptualized and dimensioned. The second step of the scale development process is the creation of variables (expressions) that can reveal the clearly defined dimensions of the structure of interest. This step requires mostly exploratory research. In the creation of variables, literature review, experimental questionnaires, focus group interview, etc. methods are possible. The important thing at this stage is to take care that all the variables obtained are expressed as clearly and comprehensibly as possible. In this respect, the superficial and content validity of the obtained statements should also be evaluated. The third step of the scale development process is the collection of data for the implementation of the tests to be carried out in the next stage. At this stage, which is the fourth step of the scale development process, while evaluating the reliability of the data obtained, the dimensions of the scale are tried to be revealed by using exploratory factor analysis. According to the analyzes used, the variables that do not meet the necessary criteria are removed from the scale and thus the scale is simplified. The fifth stage includes re-collection of data on the remaining variables in the scale over a different and new sample for the analyzes to be carried out in the sixth and seventh stages. In the sixth step of the scale development process, the reliability of the scale is evaluated over the new data collected. In the seventh stage, the construct validity of the scale is evaluated over the data obtained in the fifth stage. In the eighth and final stage, norms are developed. It is mentioned that the rules for the use of the obtained scale should be developed and put forward. In particular, since the proposed scale is a new scale, it is important to establish clear norms for the interpretation of the scores obtained from the scale.

3. Results

Well-constructed non-random sampling method should be used, which is suitable for the purpose of the research if the purpose of scale development is carried. Non-random sampling methods are widely used, especially in studies where time and budget constraints are in question, the population is limited, or in pilot studies. Care is taken to include as many participants as possible from different demographics in the samples. In the case of using non-random sampling methods, the sample size is determined by considering the objectives, scope and limitations of the research, the number of variables included in the research, and the assumptions of the statistical analyzes used. In this framework, the sample size of the research is determined by considering the nature of the research, the time and cost constraints it has, and the assumptions of the statistical analyzes to be used in the research. The main population of the research should be selected from individuals aged 18 years and over. In the scale development study, care should be taken to ensure that the sample size is sufficient during the simplification phase of the scale. On the other hand, statistical analyzes used in the research such as exploratory and confirmatory factor analyzes affect the sample size depending on the number of variables in the variable pool. While suggesting to work with a sample size of at least five, ideally ten times the number of variables included in the analysis, for exploratory factor analysis; If the measurement model contains six or more factors, it defines such models as complex models and recommends performing confirmatory factor analysis with a sample size of over 500 people.

It is recommended to use quota sampling, which is among the non-random sampling methods. Among non-random sampling methods, especially quota sampling, when applied effectively, allows more detailed and accurate data collection compared to other non-random sampling methods. Based on the quota sampling method; Quotas of various qualities and quantities are determined by the researcher in order to ensure that some specific features in the main mass are also included in the sample mass. In this framework, an equal number of participants from each department is included in each sample by creating a departmental quota.

The validity of a measurement primarily depends on the good definition (conceptualization) of the structure to be measured and the determination of the different aspects or dimensions of this structure in the best way. Validity is defined as the ability of an instrument to accurately measure the property it aims to measure without confusing it with any other properties. Factors that reduce the validity of the scale are related to the scale development process and application process. In order to develop a high validity scale; The definition of the feature that is the subject of measurement should be logical and not inconsistent with previous known facts, there should be harmony between the work required by the measurement tool and the definition made, and the test should be reliable.Demonstrating the dimensionality of the structure of interest is an important part of the scale development process, since it is impossible to develop a good scale that can measure the structure in question without knowing the dimensionality of the structure.The concept of dimensionality is expressed as the number of common factors or latent variables needed to calculate the correlation between variables in a scale. While a narrow definition may leave out the important aspects (dimensions) of the structure to be measured, a broad definition may cause the inclusion of some unnecessary dimensions that are not really related to the structure to be measured. In addition to contributing to the determination of the boundaries, dimensions and contents of the structure to be measured, it is also possible to obtain information about which other theoretical structures are related to the structure to be measured, in the form of dependent and independent variables, and to test the validity of the scale to be created in the nomological context. . In the creation of the scale, as the first basic step, it is recommended to perform three sub-stages: defining (conceptualizing) the structure to be measured and determining its dimensions, creating the variable pool and making the first simplification. All these basic and sub-stages are preliminary studies that provide the necessary infrastructure to be able to carry out field studies. Each sub-stage includes qualitative and quantitative qualitative research methods.Accordingly, in defining (conceptualizing) the structure to be measured, determining its dimensions and creating the variable pool, open-ended evaluations and focus group interviews are carried out, primarily literature review.

4. Conclusion

In order not to damage the construct validity of the scale, it is necessary to eliminate overlapping dimensions to prevent repetition and to consider dimensions that differ from each other. The construct validity of a scale allows the results to explain the feature that is the subject of measurement with the help of the data obtained. In other words, it shows the degree of accurate measurement of an abstract phenomenon or attitude of the measurement tool. Conditions affecting the development of the concept or dimension to be measured, the discovery of the dimension, its definition, its function, etc. All kinds of data are collected and evaluated within the scope of construct validity. The theoretical framework on which the scale was developed shows the similarities and differences of this structure with other structures. By examining the contents of the focus group interviews to be held, the dimensions that are different from the literature are added to the dimensions obtained from the literature, and the possible dimensions that are desired to be measured are determined. After defining the structure to be measured and the dimensions of this structure, it is necessary to create variables that will reflect these defined dimensions. Obtaining the expressions that best reveal the dimensions of the structure to be measured and thus creating the variable pool in which the expressions will take place is done by domain sampling. The variables in a scale are a sample obtained from the universe of variables, in which all the variables representing the dimensions of the scale in question are included. Therefore, the validity of the scale, in a sense, depends on the representative ability of the sample to be made from this theoretical variables universe. It is not possible to reach all the variables that reflect the dimensions of the scale and exist at the theoretical level. In this context, in order to have a good representative sampling, the number of variables in the variable pool that we can sample should be kept as much as possible. While creating a variable, or in other words, an expression, there are some points that need to be carefully considered. One of the most important points to be considered while creating the variables likely to be included in

the scale is to ensure that the expressions are as clear and understandable as possible, thus contributing to the content validity. Content validity, which is possible with a good sampling of the feature that is the subject of the measurement, can be defined as the degree to which the items or questions in the measurement tool represent the feature that is the subject of measurement in a balanced way. One way of determining content validity is to pre-determine the feature that is the subject of measurement with the measurement tool and to prepare the questions or items according to this scope.Another way to determine content validity is to examine the correlation between another measurement tool that is known to measure the same scope, and its validity and reliability have been determined. The important point is, if the existence of a scale measuring the same scope is known, it is not appropriate to develop a new scale.The newly developed scale must have different or superior features. The main problem in content validity is whether the items or questions in the scale represent all observable signs of the feature to be measured. In this framework, it is necessary to determine the performance area of the feature that is the subject of measurement, to create a structured framework for the matching of the performance area and the scale items, and to summarize the data obtained during the matching process.

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Do Exchange Traded Funds (ETFs) Using Artificial Intelligence (AI) Methodologies Make a Difference in Times of Crisis?

Çağrı HAMURCU

(Corresponding Author),

Assoc. Prof., Aksaray University, Ortakoy Vocational School of Higher Education, Department of Finance, Banking&Insurance, Aksaray, Turkey

ORCID: 0000-0002-3248-6733

Abstract

In this study, it is aimed to reveal whether exchange traded funds (ETFs) using artificial intelligence methodologies make a difference in times of crisis. For this purpose, ETFs using artificial intelligence methodologies and other artificial intelligence ETFs were examined. The Russia-Ukraine war was examined as a crisis within the context of the research. The ETFs within the scope of the study were analyzed with the event study method before and after the start of the war. The paired-samples T-Test and the Wilcoxon Signed Ranks Tests were used to determine whether there was a statistically significant difference in the cumulative abnormal returns (CARs). The analysis results reveal that the mean CAR values of all considered AI ETFs increased negatively in the period after the start of the war compared to the previous period. ETFs using artificial intelligence methodologies have higher average CARs for the periods after the start of the war than other ETFs. It is thought that the findings of the study may be important in terms of revealing evidence of the positive contribution of the use of artificial intelligence methodologies in crisis periods. This result comes to mind that the use of artificial intelligence methodologies may have contributed to rational decision making, and on the other hand, there may be reflections of human decisions that may move away from rationality with the effect of behavioral finance biases.

Keywords: Exchange-traded fund (ETF), Artificial intelligence (AI), Event Study, cumulative abnormal return (CAR), behavioral finance

1. Introduction

One of the biggest challenges faced by many investors, managers and researchers in the field of finance is uncertainty and the risk that both complicates financial decision making and creates profitable opportunities for investors who can manage and analyze them efficiently and effectively (Gadre-Patwardhan, Katdare, & Joshi, 2016). Investors who encounter these difficulties make their choices by showing different types of behavior patterns called rational, irrational and new investors.

A rational investor is an investor who creates her portfolio by making choices by combining information from a number of information sources in proportion to the relative precision of the weights

given to different information and aims to maximize her utility while doing all these (Daniel, & Titman, 1999).

Irrational investors, unlike rational ones, cannot grasp and synthesize information perfectly, they often make decisions based on emotions, biases and irrelevant stimuli and cognitive limitations, which deviate from rationality, and involve misleading results with cognitive and emotional errors on the way to their rational desires (Statman, 2019).

The "new investor", which is expressed as the third investor type, has some characteristics such as having better access to more knowledgeable or at least better information than the irrational investor, being faster than before, continuing to accelerate with technological progress, making better diversified investments, being less emotional and knowledgeable than the irrational investor, being more modest in their knowledge (Lin, 2012).

The diversification of investment instruments and the increase in access to information may confront investors with complex decision-making situations. It is thought that the use of technology may have some positive contributions to protect investors from irrationality and information complexity, as well as from some behavioral finance biases, emotions, psychology and negative effects of their personalities. From this point of view, technological developments offer various conveniences to investors. Among these, artificial intelligence draws special attention.

The consequences of artificial intelligence entering the world of finance and its possible future effects are becoming a matter of curiosity. From a behavioral finance perspective, it is considered important to examine how the results of decision-making processes, which are expected to move away from irrationality with the help of artificial intelligence, differ.

In this study, it is aimed to reveal whether exchange traded funds (ETFs) using artificial intelligence methodologies make a difference in times of crisis. The hypothesis of this research is that "Exchange-traded funds (ETFs) using artificial intelligence methodologies differ more positively than other ETFs in times of crisis."

AI

AI is defined as the science of giving programs the ability to change themselves for the better as a result of their own experience, with the primary goal of creating an intelligent machine and the second goal of learning about the nature of intelligence (Schank, 1987). AI-related processes involve the collection and representation of real information through computers, the contextual indexing of that information, and the adaptation and modification of that information through its application (Schank, 1991).

AI in Finance

In recent years, it is begun to leverage artificial intelligence technologies to assist the financial industry through trend forecasting, investor behavior detection, portfolio management, fraud detection, risk management, bankruptcy, stock forecasting, financial target assessment, finding specific dynamics in securities price action (Gadre-Patwardhan, Katdare, & Joshi, 2016). Artificial intelligence, which is defined as an existential component of modern finance, affects the financial world in many ways thanks to its remarkable progress and promises, making finance cheaper, faster, larger, more accessible, more profitable and more efficient, and at the same time serious risks and risks. contains limitations (Lin, 2019).

As artificial intelligence techniques in finance; Expert systems, Machine learning, Algorithms, Neural networks and Fuzzy logic are used (Milana, & Ashta, 2021).

- Expert systems, which uses an interface that can be more or less detailed and interrogates the system to provide recommendations based on the experience gained from the expert's knowledge base.

- Machine learning, which is based on mathematics, probability theory, and statistics, and includes supervised learning, unsupervised learning, and reinforcement learning, can solve a problem.
- Algorithms, which is defined as a set of rules and steps used in mathematics or computers to classify or solve.
- Neural networks, which connect inputs to outputs with neurons with hidden layers between them and allow intuitive learning.
- Fuzzy logic which is based on the observation that people make decisions based on imprecise and non-numerical information.

AI ETFs

A fund is considered an artificial intelligence ETF if it meets at least one of the following three requirements (VettaFi, 2023) :

Type 1. Funds that invest especially in businesses that produce new products or services using technology or that do artificial intelligence research.

Type 2. At least 25% of its portfolio is made up of open funds for businesses that invest a lot of money in R&D for artificial intelligence.

Type 3. Funds of investments that choose certain securities to include in the fund using AI methodologies.

2. Literature Review

In his study, Bahrammirzaee (2010) provides an overview of artificial intelligence and machine learning research in finance, using co-citation and bibliometric matching analyses, and examined the thematic structure of artificial intelligence and machine learning research in finance for 1986-April 2021. In the study, portfolio creation, valuation and investor behavior of the studies in the literature; financial fraud and distress; and emotion extraction, prediction and planning, under three main categories. It is shared that the results of the study provide guidance for researchers to evaluate the increasing emphasis on artificial intelligence and machine learning in finance research.

Eliasy and Przychodzen (2020) carried out a study to determine whether Artificial Intelligence (AI) could be incorporated into the Capital Asset Pricing Model (CAPM) and whether doing so may result in a more precise prediction of expected returns. The results indicate that using AI improves cost of equity estimates' accuracy by over 60%, and that the robust capacity of the chosen deep learning neural network to predict stock prices enhances the accuracy of predicting returns by at least 18%. In light of all of this, it is stated that AI reveals significant potential to replace conventional asset pricing models in the near future.

In order to compare the abnormal returns on founder stocks at the start dates of ETFs, Wu and Chen (2022) classified US AI ETFs into those with AI names and those without AI names. They reached the conclusion that equities in AI ETFs with AI names had cumulative abnormal returns (CAR) during the event period that were around 0.4% greater than those in AI ETFs without AI names.

Chen & Ren (2022) conducted a study analyzing the performance of mutual funds contributed by artificial intelligence (AI). The study's findings showed that while these funds did not outperform the overall market, they significantly outperformed similar funds managed by humans as opposed to those driven by AI. It is claimed that decreased transaction costs, better stock-collecting abilities and reduced behavioral biases play a role for the success of AI funds.

Grobys, Kolari, and Niang (2022) analyzed the performance of hedge funds in four categories depending on their level of automation. The results indicate that hedge funds with the highest levels of automation outperform those with human participation and that automation plays a key role in the profitability of the hedge fund industry.

A study by Guo, Tong, Chen, and Kumar (2022) examined the activities of individual investors and artificial intelligence analysts with a focus on mutual fund investments. According to the results of the study, individual investors who use the artificial intelligence tool perform more manual investment sessions, invest more, have both positive and negative effects across investor groups, can provide more investment activity for individual investors who do not have sufficient financial knowledge, It is understood that less familiar investors reduce their investment activities, their practices indicate a negative resistance effect, investors increase their investments in products that increase volatility by changing their risk tolerance, and information overload causes a moderate negative effect for investors with less financial information.

Guo, Hu, and Tam (2023) conduct a study in a book chapter that aims to gain more in-depth information on the use of machine learning in estimating and evaluating fund performance. This paper addresses the benefits of machine learning techniques over conventional techniques for assessing fund performance.

3. Methods

ETFs using artificial intelligence methodologies and other artificial intelligence ETFs were examined.

Among the 36 ETFs listed in the AI ETF main category, 6 ETFs in the Type 1 or 2 category with the highest value in terms of Total Assets, and 6 ETFs in the Type 3 feature were selected and discussed in the study. When the table is analyzed, it is seen that all of the ETFs in Type 3 have the abbreviation AI in their names. When evaluated in terms of this distinction, it shows that Type 3 ETFs differ from the others.

Table 1. Types of ETFs

Type	Symbol	ETF Name	Asset Class
Type 1 or 2	IYW[1]	iShares U.S. Technology ETF	Equity
Type 1 or 2	FTEC[2]	Fidelity MSCI Information Technology Index ETF	Equity
Type 1 or 2	FDN[3]	First Trust Dow Jones Internet Index Fund	Equity
Type 1 or 2	IXN[4]	iShares Global Tech ETF	Equity
Type 1 or 2	XT[5]	iShares Exponential Technologies ETF	Equity
Type 1 or 2	IGM[6]	iShares Expanded Tech Sector ETF	Equity
Type 3	AIVL[7]	WisdomTree U.S. AI Enhanced Value Fund	Equity
Type 3	AIEQ[8]	AI Powered Equity ETF	Equity
Type 3	AIVI[9]	WisdomTree International AI Enhanced Value Fund	Equity
Type 3	AMOM[10]	QRAFT AI-Enhanced U.S. Large Cap Momentum ETF	Equity
Type 3	NVQ[11]	QRAFT AI-Enhanced US Next Value ETF	Equity
Type 3	QRFT[12]	QRAFT AI Enhanced U.S. Large Cap ETF	Equity

Note: The table was created using VettaFi (2023a).

The access date to the links of the EFTs numbered below is 18.05.2023.

1 https://www.ishares.com/us/products/239522/ishares-us-technology-etf

2https://institutional.fidelity.com/app/funds-and-products/etf/snapshot/FIIS_ETF_FTEC/fidelity-msci-information-technology-index-etf.html

3 https://www.ftportfolios.com/Retail/Etf/EtfSummary.aspx?Ticker=FDN

4 https://www.ishares.com/us/products/239750/ishares-global-tech-etf

5 https://www.ishares.com/us/products/272532/ishares-exponential-technologies-etf

6 https://www.ishares.com/us/products/239769/ishares-north-american-tech-etf

7 https://www.wisdomtree.com/investments/etfs/equity/aivl

8 https://etfmg.com/funds/aieq/

9 https://www.wisdomtree.com/investments/etfs/equity/aivi

10 https://www.qraftaietf.com/amom

11 https://www.qraftaietf.com/nvq

12 https://www.qraftaietf.com/qrft

The Russia-Ukraine war was examined as a crisis within the context of the research. The ETFs within the scope of the study were analyzed with the event study method developed by Fama et al. (1969) before and after the start of the war.

The equations used in this method, which is based on the efficient market hypothesis (Fama, 1970; MacKinlay, 1997), where the prices of assets always contain and reflect all relevant information, including the effects of unexpected events, and which is used to measure the price response of securities to certain new information, given below.

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

$$\varepsilon_{it} = R_{it} - \alpha_i - \beta_i R_{mt} \quad (2)$$

$$AR_{it} = R_{it} - \alpha_i - \beta_i R_{mt} \quad (3)$$

$$CAR_{it} = \sum_{t1}^{t2} AR_{it} \quad (4)$$

R_{it}: is the daily return of an ETF (P_{it}) ($R_{it} = \ln\left(\frac{P_{it}}{P_{(i,t-1)}}\right)$)

R_{mt}: is the daily return of the reference stock market price index (P_{mt}) (The NYSE Composite index was taken as the reference index in this study. ($R_{mt} = \ln\left(\frac{P_{mt}}{P_{(m,t-1)}}\right)$)

α_i: is regression coefficient of the daily return of the stock market price index for sector i

β_i: is regression coefficient of the daily return of the stock market price index

ε_{it}: error term, AR_{it}: is abnormal return of the daily return of an ETF, CAR_{it}: is cumulative abnormal return

For the pre-event and post-event, analyzes were made over the time windows, which were handled in 30-day periods starting from 30 days and up to 270 days. The paired-samples T-Test and the Wilcoxon Signed Ranks Tests were used to determine whether there was a statistically significant difference in the cumulative abnormal returns (CARs).

4. Results

Table 2 shows the mean, standard deviation, standard error, mean lower and upper Bound 95% Confidence Interval, minimum and maximum values of CAR calculations for Type 3 AI ETFs for all considered time periods.

Table 2. Type 3 AI ETFs CARt Mean Values

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
CARt30	(-)	30	-0.015	0.006	0.001	-0.018	-0.013	-0.025	0.000
	(+)	30	-0.021	0.003	0.001	-0.022	-0.020	-0.028	-0.014
CARt60	(-)	60	-0.037	0.025	0.003	-0.044	-0.031	-0.069	0.003
	(+)	60	-0.062	0.006	0.001	-0.064	-0.061	-0.072	-0.050
CARt90	(-)	90	-0.011	0.024	0.003	-0.016	-0.006	-0.052	0.020
	(+)	90	-0.045	0.007	0.001	-0.046	-0.043	-0.062	-0.032
CARt120	(-)	120	-0.026	0.024	0.002	-0.031	-0.022	-0.073	0.005
	(+)	120	-0.066	0.006	0.001	-0.067	-0.065	-0.083	-0.053
CARt150	(-)	150	-0.017	0.023	0.002	-0.020	-0.013	-0.068	0.010
	(+)	150	-0.061	0.006	0.001	-0.062	-0.060	-0.078	-0.048
CARt180	(-)	180	-0.009	0.022	0.002	-0.012	-0.005	-0.063	0.016
	(+)	180	-0.057	0.006	0.000	-0.058	-0.056	-0.073	-0.043
CArt210	(-)	210	-0.021	0.021	0.001	-0.024	-0.018	-0.075	0.003
	(+)	210	-0.072	0.010	0.001	-0.073	-0.071	-0.107	-0.055
CARt240	(-)	240	-0.010	0.020	0.001	-0.012	-0.007	-0.066	0.014
	(+)	240	-0.066	0.012	0.001	-0.067	-0.064	-0.100	-0.046
CARt270	(-)	270	-0.039	0.022	0.001	-0.041	-0.036	-0.098	0.011
	(+)	270	-0.098	0.012	0.001	-0.100	-0.097	-0.132	-0.078

Note: (-) = before the start of the war. (+) = after the start of the war.

As shown in Table 2, the mean CAR values of all Type 3 ETFs decreased when compared to the period prior to the commencement of the war.

The mean, standard deviation, standard error, mean lower and upper bound 95% confidence interval, minimum and maximum values of CAR calculations for Type 1 or 2 AI ETFs are available in Table 3 for all time periods that were taken into consideration.

Table 3. Type 1 or 2 AI ETFs CARt Mean Values

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
CARt30	(-)	30	-0.036	0.020	0.004	-0.044	-0.029	-0.077	0.005
	(+)	30	-0.059	0.018	0.003	-0.066	-0.052	-0.105	-0.029
CARt60	(-)	60	-0.058	0.051	0.007	-0.071	-0.045	-0.145	0.021
	(+)	60	-0.159	0.039	0.005	-0.169	-0.149	-0.230	-0.096
CARt90	(-)	90	-0.005	0.046	0.005	-0.014	0.005	-0.104	0.062
	(+)	90	-0.141	0.047	0.005	-0.151	-0.132	-0.215	-0.056
CARt120	(-)	120	-0.024	0.041	0.004	-0.032	-0.017	-0.128	0.037
	(+)	120	-0.165	0.042	0.004	-0.173	-0.158	-0.240	-0.080
CARt150	(-)	150	0.002	0.037	0.003	-0.004	0.008	-0.103	0.062
	(+)	150	-0.146	0.039	0.003	-0.152	-0.140	-0.215	-0.055
CARt180	(-)	180	0.070	0.036	0.003	0.065	0.075	-0.031	0.134
	(+)	180	-0.086	0.046	0.003	-0.093	-0.079	-0.207	0.017
CArt210	(-)	210	0.016	0.044	0.003	0.010	0.022	-0.078	0.091
	(+)	210	-0.141	0.052	0.004	-0.148	-0.133	-0.263	-0.026
CARt240	(-)	240	0.056	0.043	0.003	0.051	0.062	-0.033	0.136
	(+)	240	-0.105	0.056	0.004	-0.112	-0.098	-0.222	0.019
CARt270	(-)	270	-0.017	0.042	0.003	-0.022	-0.012	-0.106	0.063
	(+)	270	-0.177	0.054	0.003	-0.183	-0.170	-0.295	-0.054

Note: (-) = before the start of the war. (+) = after the start of the war.

According to Table 3, the mean CAR values of all Type 1 or 2 AI ETFs increased negatively in the period after the start of the war compared to the previous period.

To assess if the cumulative abnormal returns differed statistically significantly from each other, Paired Sample T-Tests are applied, and the results are given in Table 4.

Table 4. AI ETFs CARt Paired Sample T-Test

	Type 3 ETFs			Type 1 or 2 ETFs		
	t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)
CARt30	6.211	29	0.000	4.748	29	0.000
CARt60	6.793	59	0.000	27.995	59	0.000
CARt90	12.341	89	0.000	33.475	89	0.000
CARt120	17.806	119	0.000	23.736	119	0.000
CARt150	22.226	149	0.000	36.884	149	0.000
CARt180	32.963	179	0.000	40.592	179	0.000
CARt210	46.687	209	0.000	29.966	209	0.000
CARt240	54.387	239	0.000	31.727	239	0.000
CARt270	42.887	269	0.000	32.355	269	0.000

The obtained paired sample T-Test (see Table 4) test results indicate that there are statistically significant differences between pre- and post-event Cumulative abnormal returns (CARs) for all time windows.

Wilcoxon Signed Ranks Tests were conducted for cumulative abnormal return values in order to assess the findings produced using non-parametric methods. The results are shown in Table 5.

Table 5. AI ETFs CARt Wilcoxon Signed Ranks Test

	Type 3 ETFs		Type 1 or 2 ETFs	
	Z	Asymp. Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)
CARt30	-4.227	0.000	-3.651	0.000
CARt60	-4.719	0.000	-6.736	0.000
CARt90	-7.510	0.000	-8.239	0.000
CARt120	-8.985	0.000	-9.506	0.000
CARt150	-10.525	0.000	-10.624	0.000
CARt180	-11.626	0.000	-11.635	0.000
CARt210	-12.565	0.000	-12.381	0.000
CARt240	-13.430	0.000	-13.429	0.000
CARt270	-14.243	0.000	-14.226	0.000

note: Z values are based on positive ranks.

According to the findings of the Wilcoxon Signed Ranks test (see Table 5), there are significant differences between the cumulative abnormal returns (CARs) before and after the event for all time frames.

In order to make a proportional comparison of the difference between the CAR mean values between AI types, the ratios called $Ratio_{CAR}$, which is calculated as Type 1or2/Type 3, were calculated for each time window. The results of how the average CAR values of all ETFs for both pre-event and post-event periods and for all time intervals are relative to each other (Type 1or2/Type 3) are given in Table 6.

Table 6. Ratio of CARt Mean Values

Event Window	Type 3 ETFs Mean Value	Type 1or2 ETFs Mean Value	$Ratio_{CAR}$
CARt30(-)	-0.015	-0.036	2.400
CARt30(+)	-0.021	-0.059	2.810
CARt60(-)	-0.037	-0.058	1.568
CARt60(+)	-0.062	-0.159	2.565
CARt90(-)	-0.011	-0.005	0.455
CARt90(+)	-0.045	-0.141	3.133
CARt120(-)	-0.026	-0.024	0.923
CARt120(+)	-0.066	-0.165	2.500
CARt150(-)	-0.017	0.002	-0.118
CARt150(+)	-0.061	-0.146	2.393
CARt180(-)	-0.009	0.07	-7.778
CARt180(+)	-0.057	-0.086	1.509
CArt210(-)	-0.021	0.016	-0.762
CArt210(+)	-0.072	-0.141	1.958
CARt240(-)	-0.01	0.056	-5.600
CARt240(+)	-0.066	-0.105	1.591
CARt270(-)	-0.039	-0.017	0.436
CARt270(+)	-0.098	-0.177	1.806

The graphs in Figure 1 have been created in order to more clearly reveal the differentiation between AI ETF types in terms of average CAR values in Table 6.

Figure 1. CARt of ETFs

Another important finding is that in the post-start of the war period, the average CAR values of Type 1 or 2 AI ETFs were negatively higher compared to ETFs using AI methodologies (Type 3) (see Figure 1). This result shows that ETFs using artificial intelligence methodologies have higher average CARs for the periods after the start of the war than other AI ETFs.

When the post-event CAR values of the ETF types in Table 4 are compared to each other (Type 1or2/ Type 3), it is understood that it has different structures for the pre-event and post-event periods. For this, pre-event and post-event CAR rates were prepared as separate graphs.

Figure 2 shows the graph of the CAR Ratio values for the post-event time intervals.

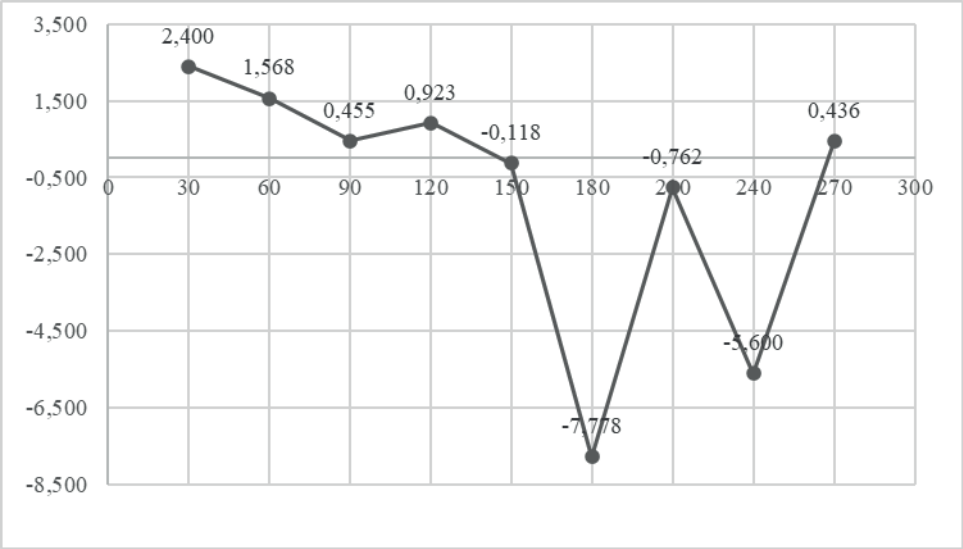

Figure 2. Pre-event CARt Ratio

When the ratios of pre-event CAR values (Type 1or2/Type 3) are compared, it is seen that they vary between -7.778 and 2.400 (see Figure 2). It is understood that the ratios are not in a single structure in terms of negativity or positivity.

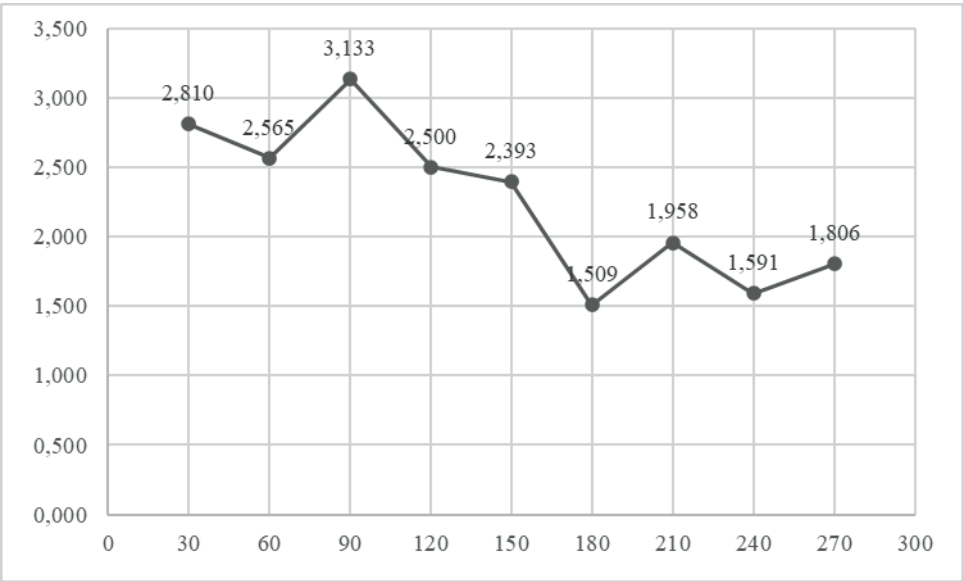

Figure 3. Pre-event CARt Ratio

When the ratios of past-event CAR values to each other (Type 1or2/Type 3) are compared, it is seen that they vary between 1.509 and 3.133 (see Figure 2). All of the ETFs being compared have negative mean CAR values. The estimated ratio values are all more than 1,000 for all time windows. This result suggests that Type 1 or 2 ETFs have lower CAR values.

5. Discussions and Conclusion

The analysis results reveal that the mean CAR values of all considered AI ETFs increased negatively in the period after the start of the war compared to the previous period. Another important finding is that ETFs using artificial intelligence methodologies have higher average CARs for the periods after the start of the war than other AI ETFs.

The findings of the post-crisis study are consistent with the findings of studies by Wu and Chen (2022), Chen & Ren (2022), and Grobys, Kolari, and Niang (2022).

It is thought that the findings of the study may be important in terms of revealing evidence of the positive contribution of the use of artificial intelligence methodologies in crisis periods.

This result comes to mind that the use of artificial intelligence methodologies may have contributed to rational decision making. and on the other hand. there may be reflections of human decisions that may move away from rationality with the effect of behavioral finance biases.

The fact that not all ETFs were included in the scope of the study and that other crisis-status events were excluded from the scope are considered as limitations of the study. It is recommended that future studies be carried out by taking into account the issues stated in the limitations section.

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The Moderating Role of Firm Size to Capital Structure: A Case study of Turkish banking Industry.

Dr. Fikri KAPLAN

Faculty of Business Administration University of Turkish Aeronautical Association Ankara / Türkiye

orcid.org/0000-0002-4284-3466

Dr. Waqar Badshah

Department of Management Information System, Faculty of Economics, Istanbul University

orcid.org/0000-0001-5009-8745

Abstract:

This research investigates the role of firm size in the capital structure decision. This study is aimed at Turkish banking sector. A panel data approach has been used. 10 Year annual data have been collected of the banks' profitability, debt position, size, and macro-economic indicators. Fixed effects panel regression has been employed. The results suggests that in the case context of Turkish banks, the size of the banks (measured by the log total assets reported) matter. In explaining the volatility surrounding the capital structure choices, banks size and inflation are found to be significant. The profitability and debt sensitivity ratios were found to be not a contributing factor in explaining the variance in capital structure decision of Turkish Banks.

Keywords: Financial Institutions, Banking Industry, Capital structure,

Introduction

Capital structure decisions are essential for the financial sustainability and growth of firms. Capital structure refers to the mix of debt and equity financing used by a firm to finance its operations and investments. The optimal capital structure for a firm is determined by various factors such as the firm's size, industry, growth prospects, profitability, risk, and availability of capital. Among these factors, firm size is considered a critical determinant of a firm's capital structure. In this literature review, we will examine the moderating role of firm size on capital structure decisions in the Turkish banking industry.

Several theoretical frameworks such as trade-off theory, pecking order theory, and agency theory have been used to explain the relationship between firm size and capital structure. According to the trade-off theory, the optimal capital structure is achieved by balancing the benefits of debt financing, such as tax shields and financial leverage, with the costs of financial distress and bankruptcy. Larger firms may have a greater capacity to handle the risks associated with debt financing, which may lead to higher levels of debt financing in their capital structure.

The moderating role of firm size on capital structure decisions has been investigated in several studies. Some studies suggest that larger firms have greater access to capital markets and can take on more debt without significantly increasing their risk of financial distress (Chang et al., 2018; Hasan et al., 2018). However, other studies have found that larger firms face greater agency costs and may prefer equity financing to align the interests of managers and shareholders (Jensen and Meckling, 1976; Jensen, 1986).

Market value of a public company is represented by the number of shares outstanding into market value of these shares. This market value of firm is subject to volatility. This volatility in share prices can be induced by number of factors broadly classified as firm level factors and institutional settings. These factors can also be referred as endogenous and exogeneous variables. One of the major contributing factors that affects the share prices is capital structure.

Capital structure refers to the balance or choice between debt and equity. There are several ways in which firm size can moderate the relationship between capital structure and firm performance. One important factor is the availability of financing options. Larger companies tend to have more access to debt and equity markets, and therefore may be able to secure more favourable terms and lower costs of capital. Smaller companies, on the other hand, may face higher borrowing costs and limited access to capital, which can affect their ability to invest and grow.

Another factor is the level of risk associated with a company's capital structure. Larger companies may have more diversified revenue streams and assets, which can reduce their overall risk level and make them more attractive to lenders and investors. Smaller companies, however, may have a higher risk profile and be more dependent on a single product or market, which can make them more vulnerable to financial shocks.

The cost of raising the funds has a direct impact on the profitability of a firm and subsequently on its market value. Hence choice of capital structure is not only important for the firm itself but also for the investors and other stakeholders. Firms often try to achieve the optimal capital structure. Optimal capital structure tends to have the lower cost of raising funds causing the earnings to grow and positively influence the market value of firm. This relationship holds in a perfect market. However, in the imperfect markets due to the restrictions, the relationship between the capital structure and share prices can deviate.

Faulkender and Petersen (2006) in their study also pondered the impact of size on the capital structure choices of large vs small firms. Larger firms owing to the economies of scale are less susceptible to financial distress. Their less likelihood of bankruptcy also allows them to raise equity or debt at a lower cost. In short, for larger firms the debt comes at a lower cost than the smaller firms due to their greater probability of bankruptcy and suffering from the financial distress.

This research is aimed at understanding the role of bank size in the capital structure decisions of Turkish Banking industry. This study contributes by developing the understanding of the role of total assets and the leverage positions of the banks in Turkey. The regression analysis provides the evidence that size of the bank not only matters but also the financing decisions of the Turkish banks are highly sensitive to the total assets and inflation.

Literature review

Empirical studies in the banking industry have shown mixed results regarding the relationship between firm size and capital structure. Some studies have found a positive relationship between firm size and the use of debt financing in the capital structure, while others have found a negative relationship. For instance, a study by Aktas and Yurtoglu (2018) found a positive relationship between firm size and debt financing in the Turkish banking industry. In contrast, other studies found a negative relationship between firm size and debt financing in the same industry.

The Turkish banking industry has undergone significant changes in recent years, with increased competition and regulatory reforms. Several studies have investigated the capital structure decisions of Turkish banks, with mixed results. Some studies suggest that Turkish banks prefer equity financing due to the high cost of debt financing and regulatory constraints (Yurtoglu and Kuzucu, 2008; Uyar and Kilincarslan, 2011).

However, other studies have found that Turkish banks rely heavily on debt financing due to the availability of government subsidies and tax benefits (Demirguc-Kunt et al., 2002; Kayhan and Bayrakdaroglu, 2009). Demirguc-Kunt et al. (2002) also found that Turkish banks have higher levels of leverage compared to other countries in the region, due in part to the availability of government subsidies and tax benefits. Kayhan and Bayrakdaroglu (2009) also found that Turkish banks rely heavily on debt financing to take advantage of tax benefits.

The Turkish banking industry has undergone significant changes in recent years, including increased competition and regulatory reforms. The capital structure decisions of Turkish banks have been influenced by a range of factors, including regulatory constraints, tax benefits, and government subsidies.

Literature on the capital structure is rich in terms of its empirical investigation. Miller and Modigliani (1958) studied the relationship between capital structure and market value of firm. The market value of firm can be maximized by lowering the cost of raising capital. The capital can be raised either by debt or by equity. They came up with two propositions.

1- In a perfect world, with no taxes, no transaction, bankruptcy and agency cost, capital structure choices have no impact on the market value of firm.

2- However, in the presence of greater risk associated with raising an equity rather than raising a debt then there is a positive association between the capital structure choices and cost of equity which can be determined by the weighted average cost of capital (WACC).

However, they considered the role of capital structure in effecting the share prices in an imperfect world in their subsequent paper. They found that in a market with no transaction cost and no tax, there is a positive association between debt and firm value which means that under these settings the optimal capital structure is the maximum debt option. Though, the findings of Miller and Modigliani (1958) were critical in the development of capital structure theory the results were widely criticized by many authors on the basis of their unrealistic assumptions. Durand (1959: 639-655) pointed out the obvious setbacks like the nonexistent perfect market and non-possibility of zero transaction cost, agency cost or bankruptcy cost in a real world making the MM propositions null and void. He also stated that in a setting where MM assumptions would hold, there will be no incentive for the investors to invest in stocks or capital markets.

Baxter (1967) added the provision of bankruptcy cost in the imperfect market settings and found that debt is the optimal choice of raising funds in a capital structure decision. Jensen and Meckling (1976:305-360) contributed to the capital structure literature by incorporating the impact of the agency cost on the capital structure decision. They categorized the agency problem into stockholders versus managers and stockholders versus debt holders. Their primary hypothesis supported the findings of Miller and Modigliani. According to their assertion, the market value of firm will be maximum when the debt equity proportion will be dominated by the debt keeping the marginal cost of debt equivalent to marginal benefit of tax shield. In the literature this is commonly referred as trade off theory of capital structure.

Pecking order theory was put forward by Donaldson in 1961. This theory lays out the preferences of the big corporations regarding the capital structure decisions. According to Donaldson, big corporations where dividends are regularly paid internal financing is mostly preferred because of the least tangible cost associated with the retained earnings. However, in case of an external financing, firms primarily prefer to raise capital via bank loans or government bonds. Equity financing is the last resort for such

companies due to the higher transaction and administrative cost as compared to the raising debt. Thus, according to pecking order theory, the order in which firms prefer to raise the financing would be

- 1-Internal Financing,
- 2- Debt Financing and lastly
- 3-Equity Financing.

Myers in 1984 combined the logics of both pecking order and trade-off theory of capital structure to explain the actual underlying reasoning behind the financing behavior of a firm. He stated that pecking order theory made it abundantly clear for investors and firms that in order to maximize the market value of a company, raising debt is the more preferred solution due to the less associated transaction, bankruptcy, agency and administrative cost. Equity capital is not only the more expensive way of raising capital but also it is the more costly way of arranging the finances. Moreover, equity capital is also the riskier and more volatile source of financing as compared to the other sources. Hence preferring to raise the equity over debt would not maximize the wealth of shareholders or market value of firm.

Trade-off theory on the other hand suggest the positive influence of debt on the profitability of the firm. According to the trade-off theory, debt maximizes the firm value virtue of the debt-interest tax-shield. Many researchers empirically tested both these theories and found evidence in support of these findings. Berger et al (1995: 351-381) argued that in calculating the optimal capital mix, taxes and bankruptcy cost are the two main frictions. These two factors are accounted for ascertaining the target capital mix. Since debt payments are tax deductibles and dividend payout are taxable income which makes the debt cheaper source of financing than the equity returns. This creates a positive slope between the firm leverage and effective tax rate. This tax shield becomes more effective when the government raises the taxes.

Frank and Goyal (2009: 1-37) find that firms raise more debt when the tax rates are higher making the tax shield more advantageous for the company. Hovakimian et al. (2004:517-540) determined number of factors that influence the positive co-relation between higher debt ratio and higher profitability. Other things constant, higher debt implies higher tax savings contributing to lesser cost and more earnings which means firm has more taxable income to shield without increasing the risk parameters. Rasiah and Kim (2011) found tax shield on the interest payments of the loans as the most significant reason which encourages the firms to engage in debt financing.

Titman and Wessels (1988) found evidence supporting the inverse correlation between leverage and firm size. According to them, cost of issuing debt and equity is more expensive for smaller firms then the larger sized firms making these smaller firms more leveraged in shorter term. Rajan and Zingales (1996) also investigated the impact of firm size on the capital structure mix. They took the log of sales as the proxy for firm size and concluded that larger firms are generally more diversified and are less likely to fail or bankrupt. Banks and other lending institutions also feel more confident in dealing with larger firms than the smaller firms having more volatility in their earnings and greater default risk.

Pecking order theory suggests that for the optimal capital structure the most appropriate option is to utilize internal funds as there is little to no cost attached in reinvesting the revenues generated internally. Raising debt or equity always come at a greater cost. Baker and Wurgler (2002: 1-32) linked the profitability of the firm with the availability of Internal resources. The results found profitability negatively associated with the leverage undertaken (due to the higher cost of leverage) and positively associated with the extent of internal resources generated. Bartoloni (2013:111-151) found evidence in support of the Baker and Wurgler using firm's debt ratio and return on sales. Lemma and Negash (2013) also lent empirical support to this hypothesis by confirming the lower sensitivity of leveraged position to profit volatility in large scale firms.

Based on the above arguments and evidence, our hypothesis is stated as follows,

Firm size defined by the total assets is significant in effecting the financing decision of the Turkish Banks.

Research Methodology:

For the purpose of this study, banking sector of Turkey has been chosen. All the banks that have been incorporated in Turkey are included in the analysis. Data has been gathered from Thompsons and Reuters Eikon database. Data is of annual frequency. The missing data of any observation has been excluded completely. The total cross section observations for the banking industry are 286. The annual period comprises of 10 years from 2011 to 2020. Latest annual data set has been used to understand and analyse the recent development in the field of the capital structure. The list of the firms that constitute the financial industry of the turkey and list of Banks included in the study are presented in the appendix.

The list of variables and their respective definitions are presented in Table 1.

Table 1: List of Variables.

Dependent Variable		
	Debt to Equity Ratio	
Independent Variables		
	Profitability	Return on Assets (ROA)
		Operating profit Margin
	Debt Sensitivity	Interest Coverage Ratio (ICR)
		Leverage (TA/TL)
	Size of the Firm	Log of total Assets
	Macros	GDP Growth Annual
		Inflation Rate

In the financial sector, how the ratios are calculated and defined make a lot of difference in terms of interpretation and analysis. For the purpose of this study, above listed variables are defined as below.

Debt to Equity Ratio:

It is calculated as the total debt percentage divided by the total shareholder's equity including the minority interest and hybrid debt.

Profitability Ratios:

Following two ratios were taken as proxy for the Banks profitability ratios.

- Return on Asset (ROA) percentage: This value is calculated as the income after taxes for the fiscal period divided by the average total assets and is expressed as percentage. Average total assets are the average of total assets at the beginning and at the end of the year.
- Operating Profit (OP) Margin, Percentage: This value measures the percentage of revenues remaining after paying all operating expenses. it is calculated as operating income divided by total revenue for the fiscal Multiplied by 100.

Debt Sensitivity:

The debt sensitivity of the Turkish banks is measured by the following two variables

– Interest Coverage ratio: It measures the number of times bank's operating income is able to cover the interest expenses within a fiscal year. It is calculated by dividing the EBIT divided by the interest expenses for the given time period.

– Leverage: It is measured by dividing the total assets reported by the total liabilities reported in the bank's balance sheet.

Size of the firm:

– It is proxied by taking the log of total assets reported in the bank's balance sheet.

The capital structure decisions of firms are influenced by a range of factors, including market conditions, firm-specific characteristics, and regulatory environments. Firm size may play a moderating role in determining the optimal capital structure, with larger firms having greater access to capital markets but also facing greater agency costs. In the case of Turkish banks, the capital structure decisions may be influenced by regulatory constraints, tax benefits, and government subsidies.

Macro-economic indicators:

Turkish banks are sensitive to the macro-economic environment and the government policies. Keeping this in mind, following two indicators were taken to reflect the Turkish macro-economic environment.

– GDP Growth Annual (Percentage): It is the annual GDP growth reported in percentage.

– Inflation: It is the percentage change in the prices of the basket of goods associated with the cost of living.

Results and Conclusion:

The panel data approach used in this study to run the fixed effect panel regression yielded results presented in table three. Table two list the descriptive statistics of the individual samples.

Table 2: Descriptive Statistics

Variables	Mean	Median	Max	Min	S.D	Skewness	Kurtosis	Obs.
Debt to Equity	215.445	162.040	982.461	0.000	191.531	1.526	5.016	286
ROA	1.428	1.233	20.904	-11.905	2.244	3.226	38.169	286
OP MARGIN	22.512	24.905	79.360	-819.594	54.369	-13.136	202.973	286
ICR	4.154	0.618	338.959	-1.046	23.990	11.282	145.315	286
LEVERAGE	1.195	1.121	5.486	1.030	0.389	8.140	78.091	286
Size	10.364	10.402	12.008	8.045	0.837	-0.163	2.307	286
GDP	5.442	6.084	11.200	0.917	3.112	0.168	2.133	286
INFLATION	10.912	8.892	17.140	6.472	3.975	0.483	1.511	286

Table 2 reports the descriptive statistics for all the ratios and variables, respectively. Since all the variables and indicators are of the banking sector, debt to equity ratio has the highest mean. Also, the maximum variance can be found in the debt to equity ratio and in operating profit margin. Moreover, except macros and size of the firm all the indicators have wider fatter tails i.e., their kurtosis is greater than three which means they have Leptokurtic distributions.

Table 3: Correlation Matrix.

	D/E	ROA	OP Margin	Size	ICR	Leverage	GDP	INF
D/E	1.000	-0.083	0.072	0.025	-0.058	-0.156	0.025	-0.024
ROA	-0.083	1.000	0.573	-0.149	0.127	0.551	-0.064	0.088
OP MARGIN	0.072	0.573	1.000	0.086	0.059	0.104	0.082	-0.062
Size	0.025	-0.149	0.086	1.000	0.021	-0.431	-0.179	0.205
ICR	-0.058	0.127	0.059	0.021	1.000	0.047	-0.095	0.096
Leverage	-0.156	0.551	0.104	-0.431	0.047	1.000	-0.030	-0.005
GDP	0.025	-0.064	0.082	-0.179	-0.095	-0.030	1.000	-0.836
INF	-0.024	0.088	-0.062	0.205	0.096	-0.005	-0.836	1.000

Table 3 forms a correlation matrix for all the variables. From the table we can see the negative and positive associations of the respective variables. Profitability ratios are positively associated with the leverage ratios suggesting that greater the leverage, greater would be the return on asset and operating margin in Turkish banking industry. Size of the banking institute is also positively correlated with the interest coverage ratio and operating profit margin of the bank. This suggests the bigger banks as measured by the total assets have larger proportions of operating profit and also higher interest coverage ratios. Interestingly GDP growth shows negative effect on the leverage position of the banks.

Table 4: Fixed Effect Panel Regression.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3092.277	494.307	-6.256	0.000
ROA	-1.750	5.598	-0.313	0.755
OP_MARGIN	-0.081	0.175	-0.467	0.641
ICR	-0.714	0.821	-0.871	0.385
LEVERAGE	-17.878	30.144	-0.593	0.554
Size	337.000	48.105	7.006	0.000
GDP	1.208	3.904	0.309	0.757
INF	-14.932	3.576	-4.176	0.000
Adjusted R-squared	0.669			

Fixed effect panel data regression was run. The results show that only size of the bank and inflation index is significant in explaining the capital structure choice of the Turkish banking industry. Leverage ratios and profitability ratios apparently do not have any say in defining the target or optimal capital structure. The coefficients of these indicators (ratios) are also negative. The results show that size of the bank does matter in making important decisions like capital structure and overall economic structure of the country.

Overall, the moderating role of firm size on capital structure highlights the importance of considering the unique characteristics of each company when evaluating their financing decisions. A company's size, industry, growth prospects, and risk profile are all important factors to consider when determining the optimal mix of debt and equity financing for their specific situation.

This result is in align with the current situation of the Turkey where financial institutions specially banks are extremely sensitive with the inflation primarily due to the currency devaluation. This devaluation in Turk lira has changed the approach of banking institutions in Turkey to look towards the target capital structure. Similarly total assets of the banks including the fixed assets are one of the most secure investments of the banks. these two factors combined shape the vision with which banking institutions in Turkey approach the capital structure. This adjusted R squares also show that majority of the variance in the capital structure is explained by these factors out of which only Total assets and Inflation are significant.

In short, the capital structure decisions of Turkish banks are influenced by a complex set of factors, including regulatory constraints, tax benefits, and government subsidies. Turkish banks are highly sensitive to the firm size and inflation while making decisions concerning the capital structure. This finding has a huge implication for not only the investors but also for other stakeholders who make financing decisions as all these events directly impact the financial performance and market value of banks.

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