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Relationship Between Firm Sustainability Performance and Its Labor Productivity: An Empirical Study on Turkish Firms

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Abstract

This study aims to empirically investigate the relationships of economic, social, and environmental sustainability, calculated based on the scoring system in the United Nations Environment Program Sustainability Criteria report, on labor productivity. For this purpose, the relationships of the economic, social, and environmental sustainability scores of 32 firms in Türkiye in the 2015-2019 period on labor productivity are analyzed econometrically with the Multilevel Mixed Regression Model (MMR). The findings obtained in all models estimated in the study show that the economic, social, and environmental sustainability scores of 32 firms operating in Türkiye have a positive and statistically significant relation with labor productivity during the study period. In this context, the widespread use of sustainability reporting, the economic, social, and environmental reflection of the concept of sustainable development at the firm level, would enable firms to operate as sensitive and solution-producing entities to the problems of society and increase their competitiveness and profitability with the increase in labor productivity.

Keywords: *Labor Productivity, Sustainability, Multilevel Mixed Regression.*

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1. INTRODUCTION

The concept of sustainable development reflects the increasing environmental problems today that threaten human existence in the development literature. In general terms, the concept of sustainable development, introduced at the United Nations Conference on Human Development and Environment held in Stockholm in 1972, can be defined as meeting the needs of today in a way that does not take away the possibilities of meeting the needs of future generations. The introduction of sustainable development, which has economic, social, and environmental dimensions to the business world, became a reality at the end of the 1980s. Within this scope, firms are expected not only to be institutions that make a profit by producing and selling goods and services but also to operate as entities that are sensitive to society's problems and produce solutions. Corporate sustainability is defined as a new approach that reveals the role of firms in sustainable development. The concept above reveals the necessity for firms to undertake social, economic, environmental, and financial responsibilities (Engin and Akgöz, 2013).

This process, which started with Corporate Sustainability Reporting (CSR), continues with the concept of Triple Bottom-Line Reporting (TBL) developed by Elkington (1997). TBL (same as sustainability reporting) has three dimensions: economic, social, and environmental, which are calculated based on the scoring system in the "United Nations Environment Program Sustainability Criteria" (UNEP/SustainAbility, 1996) report. Today, the importance of TBL emerges considering that not only economic but also social and environmental information is requested from firms, and when stakeholders make their decisions on issues such as investment, partnership, and purchasing within the framework of economic data as well as social and environmental information (Şendurur and Karacaer, 2017).

This study attempts to empirically investigate the relationships of economic, social, and environmental sustainability, calculated based on the scoring system in the United Nations Environment Program Sustainability Criteria report, on labor productivity. For this purpose, the relationships of the economic, social, and environmental sustainability scores of 32¹ firms operating in 6 different sectors in Türkiye in the 2015-2019 period² on labor productivity are analyzed econometrically with the Multilevel Mixed Regression Model (MMR). The study contributes to the literature on the relationship between sustainability performance and firms' labor productivity in two ways. First, it applies the Multilevel Mixed Regression Model (MMR). Second, this study uses the TBL scoring system to calculate firms' sustainability performance with their economic, social, environmental and total dimensions by allowing firms to reveal their economic, environmental, social, and overall sustainability performances.

In line with the above objective, the following sections of the first part of the study introduce sustainability reporting in Türkiye, provide a review of the empirical literature, introduce the data set

¹ There are only 32 firms in Türkiye that consistently report on sustainability at the time of the research.

² After 2019, Türkiye entered a period dominated by high inflation. These periods were chosen so that the effects of high inflation would not affect the results of the study.

and methodology to be used in the study, and present the empirical findings. The study concludes with a final section where empirical findings are discussed and policy recommendations are presented.

2. SUSTAINABILITY REPORTING IN TÜRKİYE

The concept of “Sustainability Reporting” has been placed on the agenda of firms in the international context in recent years. As in many countries, the importance of sustainability reporting has increased in Türkiye and started to be implemented over the past decade. Especially to comply with the European Union standards since 2005, firms have begun to prepare a CSR and to voluntarily provide information about the social and environmental activities of the firm in their annual reports.

With the increasing importance of sustainability reporting, sustainability indices have been developed in the world stock markets. In Türkiye, the BIST Sustainability Index has been calculated since 2014. If they meet the criteria, they can be included in the sustainability index from the beginning of the next quarter. 329 of the 395 sustainability reports from 119 organizations in Türkiye until 2022 were prepared following the Global Reporting Initiative (GRI) sustainability standards (Eski, 2023).

Although no direct indicator demonstrates Türkiye’s place in the world in terms of sustainability reporting, we might have an idea about the subject by examining the sustainable development report (SDR), which includes sustainability reporting indicators. According to the data of the SDR, which includes all the sustainability reporting criteria, Türkiye ranks 71st among 163 countries in terms of sustainability. While Türkiye has achieved its goal in 4 of the 17 sustainable development instruments, it has made progress in 7 of them and has remained stagnant in 6 (SDR, 2022).

The fact that the pressure of non-governmental organizations in Türkiye is relatively low, the amount of foreign direct investment is low, the majority of firms belong to families and large groups and the lack of transparency and accountability as a result of the low share of the public in firms cause the concept of sustainability reporting to be adopted by firms late. The main reasons why firms in Türkiye give more importance to sustainability reporting activities are their desire obligation to engage in activities outside of their traditional commercial activities to gain an edge in the face of increasing competition and their obligation to comply with European Union criteria as a result of firms’ desire to be included in the European market and Corporate Governance Principles, which Capital Markets Board updated in 2005 after it was published in 2003 (Van Het Hof, 2009). Although importance has been given to sustainability in Türkiye in recent years, the number of firms that regularly report on sustainability is low.

3. LITERATURE REVIEW

The empirical literature examining the effects of corporate sustainability reporting on firms generally focuses on firm performance and firm value. (Reddy and Gordon, 2010; Bachoo et al., 2012; Loh et al., 2017; Bartlett, 2012; Kasbun et al., 2016; Nnamani et al., 2017; Ching et al., 2017; Horwath, 2017; Laskar, 2018; Swarnapali and Le, 2018; Önder, 2018; Ece and Sarı, 2020). The empirical findings

obtained in these studies generally reveal that corporate sustainability reporting has positive and significant effects on firms' performance and values.

Some of the studies within the scope of this study examine the effects of corporate sustainability reporting on labor productivity. Labor productivity is defined as an important organizational outcome that shows how efficiently a firm's labor force creates output (Delmas and Pekovic, 2013). In this context, while some studies focus on the relationship between labor productivity as a dimension of competitiveness (Wu, 2006; Stuebs and Sun, 2009; Vilanova et al., 2009; Wood, 2010), some other studies have investigated the relationship between corporate social responsibility and labor productivity (Podolny, 1993; Barney and Hansen, 1994; Fombrun, 1996; Greening and Turban, 2000; Heal, 2005; Porter and Kramer, 2002 ; Roberts and Dowling, 2002 ; Schreck, 2011; Stuebs and Sun, 2010). These studies generally reveal that there is a positive relationship between firms' corporate social responsibility performance and labor productivity.

The related literature shows that this result is due to the positive effect of corporate social responsibility performance on the relationship between the firm and its employees. It is stated that firms with better corporate social responsibility performance are more successful in recruiting, maintaining and motivating their employees compared to firms with poor performance, and therefore, the productivity of employees is also high in these firms where employee satisfaction is higher (Heal, 2005; Schreck, 2011). In another group of studies within the scope of the study, the relationship between the firm's environmental, social and governance performance and labor productivity is investigated. In these studies, it is concluded that firms that adopt environmental standards have higher labor productivity. This higher labor productivity is thought to be due to the increased training resulting from the adoption of environmental standards as well as the increased commitment of employees to the firm (Lichtenberg, 1981; Bartel, 1994; Delmas and Pekovic, 2012; Lannelongue et al., 2017).

4. DATA

Labor productivity, the dependent variable, is frequently used in the literature to measure firm performance (Woo et al., 2014). With the increase of globalization and competition between firms today, the effect of labor productivity on the profitability of firms in domestic and foreign markets is becoming increasingly important. The reason of the low unit costs and the increase of competitiveness of firms is high labor productivity. Hence, there is quite an extensive applied literature investigating the determinants of labor productivity (Papadodonas and Voulgaris, 2005).

Within this scope, in the study in which the relationship between sustainability performance and labor productivity at the firm level in Türkiye was investigated; labor productivity (Padagonas and Volugaris, 2005; Falahi et al., 2010; Sánchez and Benito-Hernández, 2015; Kouamé and Tapsoba, 2019; Lannelongue et al., 2017; Ma et al., 2020), capital intensity (Fallahi et al., 2010; Barrymore and Sampson, 2021), firm size (Delmas and Pekovic, 2013; Kouamé and Tapsoba, 2019), firm age

(Padagonas and Volugaris, 2005; Ma et al., 2020; Kouamé and Tapsoba, 2019), vocational education (Medoff, 1982; Lynch and Black, 1998; Sala and Silva, 2013), wage (Fallahi et al., 2010; Delmas and Pekovic, 2013), R&D expenditures (Sánchez and Benito-Hernández, 2015; Barrymore and Sampson, 2021; Ma et al., 2020), business profile (Hackston and Milne, 1996; Choi, 1999; Patten, 1992), export (Fallahi et al., 2010; Kouamé and Tapsoba, 2019), holding (Delmas and Pekovic, 2013) variables and the economic, social, environmental and total sustainability scores of firms, which are frequently used in the literature, are used as dependent and independent variables, respectively.

Among the control variables used in this study, which investigates the relationship between sustainability performance and labor productivity at the firm level in Türkiye, it is seen in the literature that capital intensity, firm size, firm age, vocational training, wages and R&D expenditures are among the important factors affecting labor productivity. In this context, capital intensity (Barrymore and Sampson, 2021), firm size (Pfeffer and Langton, 1993; Zwick, 2004; Ma et al. 2020), firm age (Dunne and Hughes, 1994; Jensen et al, 2001; Ma et al. 2020), the level of vocational training (Medoff, 1982; Lynch and Black, 1998; Sala and Silva, 2013), above-market wage rates (Fallahi et al., 2010), and the level of R&D expenditures that determine the firm's capacity to innovate (Kurt and Kurt , 2015) are expected to have a positive relationship with labor productivity. Other control variables affecting labor productivity are used as dummy variables in the analysis. Among these variables, the business profile variable is used as control variables in the analysis because higher labor productivity is found in firms that are assumed to have more intensive relations with the environment due to their core business (Stray and Ballantine, 2000; Ho and Taylor, 2007), the holding variable due to the positive effect of being part of a holding firm on labor productivity through economies of scale (Zwick, 2004), and the export variable due to the fact that export-oriented firms tend to have higher labor productivity in order to compete internationally (Eriksson and Jacoby, 2003). The definitions of the dependent and independent variables in question are shown in Table 1.

The criteria to be used to calculate the TBL scores in the annual reports of the firms were determined by examining the GRI 4 Sustainability Reporting Guidelines and previous studies in the literature (Suttipun, 2012; Ho and Taylor, 2007; Slaper and Hall, 2011). Looking at the world examples, it is seen that the number of firms reporting according to GRI 4 is not yet at the desired level even in developed countries. When the annual reports of BIST100 firms were examined when the study was considered to be conducted, it was observed that the criteria used in GRI 4 and previous studies in the literature were very detailed and most of the criteria were not included in the annual reports examined firms. The fact that Türkiye is a developing country and the concept of TBL is just beginning to be understood may play an important role in this phenomenon. For this reason, when selecting the criteria used in calculating the TSP scores, items that require a very detailed explanation were eliminated and items that constitute the main headings were included. There are 21 criteria in total, 7 criteria from each category to calculate the economic, social and environmental scores. The total score to be obtained from

these 21 criteria gives us the total TSP score. These 21 criteria used to calculate the TBL scores are consistent with previous studies in the literature (Ho & Taylor, 2007; Suttipun, 2012). A total of 21 economic, environmental and social criteria, 7 criteria in each category, are detailed in Appendix 1. The data collected in the study were collected twice by the same researcher at different times.

Table 1. Variables Used in Analysis and Their Definitions

Variables	Definitions of Variables
FLP (Labor Productivity)	Log (Net Sales / Number of Employees)
FCI (Capital Intensity)	Log (Assets / Number of Employees)
FS (Firm Size)	Log (Number of Employees)
FA (Firm Age)	LogFA (Firm Age)
FE (Vocational Education)	Log (Training Hour / Number of Employees)
FW (Wage)	Log (Total Wage / Number of Employees)
FRD (R&D Expenditures)	Log (R&D Expenditures)
FP (Business Profile)	Dummy Variable – Low (0) / High (1)
FEX (Export)	Dummy Variable – No (0) / Yes (1)
FHL (Holding)	Dummy Variable – No (0) / Yes (1)
ESP (Economic Sustainability Point)	TBL Scoring System
SSP (Social Sustainability Point)	
CSP (Environmental Sustainability Point)	
TSP (Total Sustainability Point)	

The calculation of the economic, environmental, social, and total dimensions of the firms and their sustainability scores are based on the scoring system in the “United Nations Environment Program Sustainability Criteria” report, which Jones and Alabaster (1999) stated as the most reliable scoring system. The above scoring system, a score ranging from 0 to 4, is given by analyzing firms' annual and sustainability reports. Within this scope, 0, the lowest score, is given if the firm does not explain that criterion, and 4, the highest score, is given if the firm makes a detailed explanation about that criterion referring to sustainability. Thus, if the firm makes a minimal explanation about the criterion and has little detail, it is evaluated as 1 point; if the firm makes an honest and detailed explanation, including the deficiencies and commitments of the firm, it is evaluated as 2 points, and if the firm makes an explanation covering the developments about its main field of activity and the responsibilities of the firms for its sustainability, it is evaluated as 3 points and if the firm makes an explanation covering the developments about the main field of activity for the sustainability of the firm and the responsibilities of the business within the scope of TBL and comparing with the best for the competition, it evaluated

as 4 points. The scoring criteria for the TBL scoring system, which is the basis for the calculation of the sustainability scores of the firms in the study, are shown in Table 2.

Table 2. TBL Scoring System

Score	Definitions
0 Point	No explanation was given.
1 Points	Minimal explanation and little detail.
2 Points	Making an honest, detailed explanation, including the firm's deficiencies and commitments.
3 Points	Making an explanation covering the developments about the main field of activity for the firm's sustainability and the business's responsibilities.
4 Point	Making an explanation covering the developments about the main field of activity for the sustainability of the firm and the responsibilities of the business within the scope of TBL and comparing with the best for the competition.

Source: UNEP/SustainAbility (1996), Suttipun (2012).

The dependent variable is labor productivity, and the independent variables are capital density, firm size, firm age, vocational education³, wages, R&D expenditures, business profile, exports, holding. Data on the variables of economic, social, environmental, and total sustainability scores of firms are obtained by compiling from the annual reports, sustainability reports, websites and financial statements of the relevant firms. Data is publicly accessible and covers the period of 2015-2019.

This study uses independent control variables such as business profile, export, and holding as dummy variables. The export variable indicates whether that business exports or not, and the holding variable indicates whether that firm is a holding or not. Business profile, another dummy variable, is divided into low (0) and high (1) (Hackston and Milne, 1996; Choi, 1999; Patten, 1992). Due to the main activity of their businesses, high-profile firms are assumed to have more intense relations with the environment, while low-profile businesses are the opposite⁴ (Stray and Ballantine, 2000; Ho and Taylor, 2007). Except for the said dummy variables, the natural logarithmic values of all other variables during the examination period are used in the models. Descriptive statistics, including the number of observations, mean, standard deviation, and minimum and maximum values of the mentioned variables, are shown in Table 3.

³ According to our observations, the training of most of the firms that provide vocational training consists of compulsory training within the firm such as occupational health and safety rather than training that will improve their profession.

⁴ High-profile firms are mostly from industries such as manufacturing, electricity, gas and water, and mining, while low-profile firms operate in sectors such as finance, technology, wholesale and retail trade, hotels and restaurants, construction and public works and transportation, communications and warehousing.

Table 3. Descriptive Statistics of Variables

Variables	Number of Observations	Mean	Standard Deviations	Min.	Max.
FLP (Labor Productivity)	160	0.01	1.32	-5.47	2.70
FCI (Capital Intensity)	160	1.22	1.31	-1.85	4.31
FS (Firm Size)	160	8.74	1.44	5.32	11.47
FA (Firm Age)	160	3.89	0.45	2.89	4.55
FE (Vocational Education)	160	3.49	0.61	2.23	5.38
FW (Wage)	160	3.13	1.97	-7.81	2.50
FRD (R&D Expenditures)	160	1.64	2.24	-4.61	7.69
FP (Business Profile)	160	0.37	0.48	0	1
FEX (Export)	160	0.03	0.17	0	1
FHL (Holding)	160	0.06	0.24	0	1
ESP (Economic Sustainability Point)	160	2.94	0.09	2.77	3.00
SSP (Social Sustainability Point)	160	2.79	0.07	2.48	2.83
CSP (Environmental Sustainability Point)	160	2.81	0.03	2.64	2.83
TSP (Total Sustainability Point)	160	3.95	0.05	3.76	3.99

Note: All data are obtained by compiling from the annual reports, sustainability reports, websites, and financial statements of the sample firms. Data are public. Data cover the period of 2015-2019. All data are logarithmic to ensure normality. Descriptive statistics are given as 5-year averages. The annual display of descriptive statistics is in Appendix 3.

When Table 3 is analyzed, the variables with the highest and lowest mean values among the variables without dummy variables are FS (8.74) and FLP (0.01), respectively. In this framework, when the data are analyzed in terms of standard deviation, which expresses the difference between minimum and maximum values, the variables with the highest and lowest values are FRD (2.24) and FA (0.61), respectively. In Table 3, regarding sustainability variables, TSP (3.95) and SSP (2.81) variables have the highest and lowest mean values, respectively. In terms of standard deviation within the sustainability variables, ESP (0.09) and TSP (0.05) variables have the highest and lowest values, respectively.

In the study, 32 firms whose data can be accessed during the review period covering 2015-2019 are divided into six subgroups according to the sectors they belong to. Since most of the listed firms did not publish a sustainability report before 2015, the firms in the study are limited to 32, and the starting year is 2015. Relevant firms and their sectors are shown in Table 4.

Table 4. Firms Sectors⁵ and Sector Distributions

Firm Codes	Sectors	Firm Codes	Sectors
AKENR	E	THL	M
AKBNK	M	TIB	M
AKCNS	I	KCHOL	M
AKSA	I	KORDS	I
AKSEN	E	OTKAR	I
AEFES	I	SAHOL	M
ARCLK	I	SISE	M
ASELS	T	THYAO	U
AYGAZ	I	TOASO	I
BRISA	I	TSK	M
CCOLA	I	TCELL	U
CIMSA	I	TUPRS	I
DOAS	TP	ULKER	I
EREGL	I	TVB	M
FROTO	I	YKB	M
TGB	M	ZOREN	E
Sectors		Sector Distributions (%)	
E		9.4	
I		46.8	
T		3.1	
TP		3.1	
M		31.3	
U		6.3	

Note: E, Electricity, Gas, and Water; I, Manufacturing; T, technology, TP, Wholesale and Retail Trade, Restaurants, and Hotels; M, Financial institutions; U, Transportation, Storage, and Communication, which are shown in the sectors columns in the table, represent the sectors.

5. METHODOLOGY

In the present study, which aims to investigate the relationship between sustainability and labor productivity at the firm level, The Multilevel Mixed Regression Model (MMR) is used as the empirical method. In this context, firms operating in the same country share similar contextual characteristics in terms of factors affecting their productivity, such as institutional framework, macroeconomic conditions, sectoral structure, etc. Standard econometric methods in the literature ignore such contextual features that have a direct impact on firm productivity, which may produce downward standard errors (Kouamé and Tapsoba, 2019, pp. 161-162). Therefore, in order to overcome the challenges of incorporating such firm-level contextual characteristics into the data structure, this study employs the Multilevel Mixed Regression Model (MMR).

The Multilevel Mixed Regression Model (MMR), developed to be used in models where units and data are in a contextual structure, as in panel data analysis, allows simultaneous relationships

⁵ The firms whose ticker symbols are given in the table are displayed in the Appendix 2.

between variables by considering the hierarchical units and level of the panel. In the MMR model, the existence of an average correlation between hierarchical panel units and their data is taken into account. In Ordinary Least Squares (OLS) method, low and biased standard error, problems causing spurious regression, R^2 , potential internality, etc. problems can be eliminated (Hox et al., 2018, p. 4). Unlike the standard OLS, the MMR model assumes that the hierarchical panel units and data are not independent from each other by allowing the slope parameter to vary across units, thus accounting for contextual relationships in the data structure and capturing heterogeneity across units (Stevens, 2009, pp. 505-507). Moreover, in the MMR model, the effects of negligible variables in simultaneous relationships can be controlled by fixing the hierarchical units of the panel in the form of country, region, sector, etc. and the data in the form of month, year, etc. In the MMR model, fixing the units and data in the hierarchical structure of the panel not only controls for the effects of omitted variables but also allows the model to examine the effects of changes in demand conditions and supply structure (Kouamé and Tapsoba, 2019 p. 162). In the study, the two-level and most general form of the MMR model is estimated to examine the relationships of firm sustainability on productivity at the highest level and industries at the lowest level based on regression equations 1 and 2:

$$\text{Level 1: } LP_{ist} = \alpha_0 + \beta FS_{ist} + \eta X_{ist} + \varepsilon_{ist} \quad (1)$$

$$\text{Level 2: } \alpha_{0st} = \alpha_{00t} + \vartheta_{st}, \vartheta_{st} \sim N(0, \delta^2), \vartheta_{st} \perp \varepsilon_{ist} \quad (2)$$

Of the terms in the equation, (*i*) and (*s*) indicate the hierarchical units of the panel in the form of firms, sectors and countries, respectively, while (*t*) denotes the values of the data of these units in a given year. The terms (LP_{ist}) and (FS_{ist}) indicate the productivity level and sustainability score, respectively, of the firm (*i*) in the sector (*s*) in the year (*t*), while the term (X_{ist}) indicates the set of control variables consisting of individual and structural characteristics of firms (*i*) in the sector (*s*) in the year (*t*) and α refers to the constant term. Finally, the term (ε_{ist}) in the equation shows the normal distribution ($\varepsilon_{ist} \sim N(0, \sigma^2)$) and the error term belongs to the firms. When equations 1 and 2 above are combined, the basic form of the two-level MMR model can be written as shown in equation 3 (Hox et al. 2018, pp. 71-80):

$$LP_{isct} = \alpha_{00t} + \beta FS_{ist} + \eta X_{ist} \quad (3)$$

Since the equation includes firm, sector, and year relationships, it allows examining the relationships of model firm sustainability on productivity, which vary according to firms and sectors.

6. RESULTS

The study aims to investigate the relation between sustainability scores of selected firms in Türkiye calculated with the TBL scoring system in terms of economic, environmental, social, and total dimensions and labor productivity with the Multilevel Mixed Regression Model (MMR) for the period 2015-2019. Within this scope, the estimation results of the model are shown in Table 5.

Table 5. Multilevel Mixed Regression Model Estimation Results

Dependent Variable: Labor Productivity (FLP)								
Variables	Model-1		Model-2		Model-3		Model-4	
	CE	SE.	CE	SE.	CE	SE.	CE	SE.
FCI	0.7018 ^a	0.0021	0.7182 ^a	0.0021	0.7152 ^a	0.0021	0.7092 ^a	0.0021
FS	0.3123 ^a	0.0041	0.3491 ^a	0.0041	0.3512 ^a	0.0040	0.3459 ^a	0.0040
FA	1.0124 ^a	0.0152	0.8982 ^a	0.0160	0.9196 ^a	0.0151	0.8840 ^a	0.0151
FE	-0.0456 ^a	0.0012	-0.0501 ^a	0.0012	-0.0527 ^a	0.0012	-0.0484 ^a	0.0012
FW	0.2806 ^a	0.0017	0.2771 ^a	0.0017	0.2789 ^a	0.0017	0.2779 ^a	0.0017
FRD	0.0027 ^a	0.0005	0.0054 ^a	0.0005	0.0056 ^a	0.0005	0.0049 ^a	0.0005
FP	-9.1650 ^a	1.7378	-8.2367 ^a	1.5013	-8.8312 ^a	1.6395	-10.3939 ^a	2.0172
FEX	-4.7102	5.4588	-3.8126	4.7424	-4.3846	5.1784	-6.0121	6.3722
FHL	0.5164	4.2281	0.4862	3.6732	0.4800	4.0108	0.4605	4.9354
ESP	0.3741 ^a	0.0109	—	—	—	—	—	—
SSP	—	—	0.0911 ^a	0.0117	—	—	—	—
CSP	—	—	—	—	0.2712 ^a	0.0165	—	—
TSP	—	—	—	—	—	—	0.6403 ^a	0.0193
R ²	0.436		0.436		0.437		0.439	
Observations	322,720		322,720		322,720		322,720	

Note: The terms “CE.” and “SE.” in the table indicate the coefficients and standard errors of the variables; the symbols “a,” “b,” and “c” denote that the t-statistics of the coefficients are significant at the 1%, 5%, and 10% significance level, respectively. All model estimates include firm, industry, and year-fixed relationships; weights are used and standardized to compare across firm sustainability.

Table 5 suggests that the relation between the sustainability performances of firms, calculated with economic (ESP), environmental (CSP), social (SSP), and total (TSP) dimensions, and labor productivity (FLP) is positive and significant at the 1 percent level of significance in all models of the study. These results, in line with the literature (Sánchez and Benito-Hernández, 2015), show that sustainability performance is an important determinant of labor productivity for selected firms in Türkiye during the review period. According to these results, labor productivity increases as firms consider sustainability. However, when the findings in Table 5 are examined, it is seen that sustainability performance variables are ranked as (TSP), (ESP), (CSP) and (SSP) in terms of the magnitude of their effects on labor productivity (FLP), which are significant at 1% significance level. On the one hand, these results show that sustainability performance with its economic, environmental, social and aggregate dimensions increases the labor productivity of selected firms in Türkiye, while on the other hand, it reveals that the effects of sustainability performance on labor productivity of firms are mostly in the aggregate and least in the social dimension.

Besides, the results show that the capital intensity (FCI), firm size (FS), firm age (FA), wage (FW), R&D expenditure (FRD) independent variables, used as control variables in the model, also have a positive and 1 percent significant relation with labor productivity, in line with the literature (Papadogonas and Voulgaris, 2005, Fallahi, 2010, Kouamé and Tapsoba, 2019, Ma and Yin, 2020). Accordingly, labor productivity also increases as capital intensity, firm size, firm age, wages, and R&D investments increase.

Multilevel Mixed Regression Model Estimation results show that coefficient estimates of Vocational Education (FE) and Business Profile (FP) are significantly negative at 1%. Studies that have concluded that education harms labor productivity are found in the relevant literature (Fallahi, 2010; Sánchez and Benito-Hernández, 2015). In the mentioned studies, the relationships between the training given by the firms to their employees can only be seen in the long term, and the training of the employees should be coordinated with the business needs of the individuals. Information obtained from the annual and sustainability reports of the firms included in the study shows that the said firms mainly provided training on occupational health and safety, etc., to their employees during the review period. Within this scope, the study's results on the relationship between education and labor productivity are compatible with the literature. In the study, low-profile firms have higher TBL scores than high-profile firms. This result contradicts previous literature suggesting that high-profile businesses should have higher TBL scores. Yet, when the low-profile firms are examined in detail, they have high market values and are older businesses. Hence, the results of this study in this direction are in line with previous studies (Cowen et al., 1987; Choi, 1999; Suttipun, 2012) that argue that businesses with a higher market value and age and, therefore, a higher reputation has more social and environmental explanations.

According to the final estimation results, the relationship between the variables of export (FEX), holding (FHL) and labor productivity is negative and positive, respectively, but are insignificant. According to these results, there is no relationship between whether capital firms export or not and whether they are holdings and labor productivity.

7. CONCLUSION AND POLICY RECOMMENDATIONS

The concept of sustainable development reflects the increasing environmental problems today that threaten human existence in the development literature. The introduction of sustainable development, which has economic, social, and environmental dimensions to the business world, became a reality at the end of the 1980s. Within this scope, firms are not defined as institutions that only profit by producing and selling goods and services. Nevertheless, they are expected to operate as firms sensitive to society's problems and produce solutions. In line with society's and stakeholders' desires in the mentioned change process, the reporting system has witnessed a process of change and development. The process starts with Corporate Social Responsibility Reporting (CSR) and continues with the concept of Sustainability Reporting.

In this sense, labor productivity is defined as an important organizational result that shows how efficiently a firm's workforce creates output; the relationship between the sustainability performance of firms and labor productivity has been investigated in the applied literature. It is stated that firms with better sustainability performances are more successful in hiring, retaining, and motivating employees compared to firms with poor performance. Therefore, the employees' productivity is higher in these firms where the employees' satisfaction is higher. In the mentioned studies, it is argued that there is a

positive relationship between the sustainability performances of firms and labor productivity. Within this scope, the study aims to investigate the relation between sustainability scores of selected firms in Türkiye calculated with the TBL scoring system in terms of economic, environmental, social, and total dimensions and labor productivity with the Multilevel Mixed Regression Model for the period 2015-2019. Multilevel Mixed Regression Model Estimation Results show that the relationship between sustainability performances calculated with economic, environmental, social, and total dimensions and labor productivity is positive and significant at the 1 percent significance level.

The findings of this study reveal a positive and significant relationship between sustainability performance and labor productivity. In particular, economic (ESP), environmental (CSP), social (SSP) and total (TSP) sustainability dimensions all have a significant impact on labor productivity (FLP) at 1% significance level (Sánchez and Benito-Hernández, 2015). These results suggest that as the importance given to sustainability increases, labor productivity will also increase. However, the higher impact of TSP than the other dimensions (ESP, CSP and SSP) emphasizes that firms' collective assessment of their sustainability performance has a stronger impact on productivity. Moreover, control variables such as capital intensity (FCI), firm size (FS), firm age (FA), wages (FW) and R&D expenditures (FRD) also have positive and significant effects on labor productivity, which is in line with the findings in the literature (Papadogonas and Voulgaris, 2005; Fallahi, 2010; Kouamé and Tapsoba, 2019; Ma and Yin, 2020). Moreover, the significant negative association of vocational training (VT) and job profile (JP) variables with labor productivity suggests that the effects of training programs should be observed in the long run and that training should be aligned with employees' business needs (Fallahi, 2010; Sánchez and Benito-Hernández, 2015). Moreover, low-profile firms have higher TBL scores, which can be explained by the fact that they are older firms with higher market capitalization, which is in line with previous studies (Cowen et al., 1987; Choi, 1999; Suttipun, 2012). The results reveal that independent variables such as exports (FEX) and holding (FHL) show negative and positive relationships with labor productivity, but these relationships are not significant. In light of these findings, it is recommended that firms consider their sustainability strategies more integrated, taking into account all sustainability dimensions rather than only environmental or social performance. Moreover, aligning employee training programs with workforce productivity and firm needs can maximize the impact of training processes on long-term productivity. In future studies, it would be useful to examine the relationship between training and sustainability performance in more depth and to increase the generalizability of these findings by researching on different sectors and firm scales. Moreover, examining the effects of sustainability performance on labor productivity over a wider time period may help us better understand the long-term effects of education and R&D investments.

The results of the study reveal important evidence that sustainability performance is an important determinant of labor productivity as an indicator of firm performance during the review period for selected firms in Türkiye. In this context, the widespread use of sustainability reporting, which is the

economic, social, and environmental reflection of the concept of sustainable development at the firm level, will enable firms to operate as sensitive and solution-producing entities to the problems of the society, as well as to increase their competitiveness and profitability with the increase in labor productivity. In this context, the positive impact of sustainability performance on labor productivity allows firms fulfill their environmental and social responsibilities and make their business processes more efficient. Therefore, making sustainability reporting more transparent and focusing more on sustainability criteria may contribute to firms' efforts to increase labor productivity. In addition, firms need to promote long-term sustainable growth rather than focusing only on short-term profitability targets. This will be a critical strategy to both meet society's expectations and gain competitive advantage (Papadogonas and Voulgaris, 2005; Sánchez and Benito-Hernández, 2015; Kouamé and Tapsoba, 2019).

While this study has made important contributions to understanding the relationship between sustainability and labor productivity, research in this area needs further sectoral deepening. Future studies should examine in more detail the impacts of sustainability strategies on labor productivity across different industries. In particular, the potential impacts of technological developments such as digitalization and artificial intelligence on the workforce should also be explored. Furthermore, future research could include variables such as organizational culture, leadership styles and internal communication in addition to the variables used in this study (Norris and O'Leary, 2020; Jordan et al., 2021). Such research will help us to understand the interaction between sustainability and labor productivity more comprehensively. Based on the study findings, these results and findings can provide guidance for policy makers and firm managers, particularly those seeking to improve and understand the relationship between sustainability performance and labor productivity.

Ethics Committee approval was not required for this study.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors declare that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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Appendix 1. TBL Scoring Criteria

TBL Scoring Criteria	
Economic Statements	
<ul style="list-style-type: none"> Size and profitability Product and service analysis Dividend distribution Taxes 	<ul style="list-style-type: none"> Employee benefits Size of major investments R&D investments
Social Explanations	
<ul style="list-style-type: none"> Corporate participation in philanthropic activities Employee training Anti-bribery policies Awards related to social performance 	<ul style="list-style-type: none"> Employee benefits Customer privacy policies Human rights policies
Environmental Disclosures	
<ul style="list-style-type: none"> Incorporating environmental concerns into business decisions Supporting renewable energy consumption Information on reused or recycled materials Water usage information 	<ul style="list-style-type: none"> Waste management Environmental rewards Environmental impact of the lead product and service

Appendix 2. List of Firms Used in the Study

No.	Firm Code	Firm Name
1.	AKENR	Akenerji Elektrik Üretim A.Ş.
2.	AKBNK	Akbank
3.	AKCNS	Akçansa Çimento Sanayi ve Çimento A.Ş.
4.	AKSA	Aksa Akrilik Kimya Sanayi A.Ş.
5.	AKSEN	Aksa Enerji Üretim A.Ş.
6.	AEFES	Anadolu Efes Biracılık ve Malt Sanayi A.Ş.
7.	ARCLK	Arçelik A.Ş.
8.	ASELS	Aselsan Elektronik Sanayi ve Ticaret A.Ş.
9.	AYGAZ	Aygaz A.Ş.
10.	BRISA	Brisa Bridgestone Sabancı Lastik ve Ticaret A.Ş.
11.	CCOLA	Coca-Cola İçecek A.Ş.
12.	CIMSA	Çimsa Çimento Sanayi ve Ticaret A.Ş.
13.	DOAS	Doğuş Otomotiv Servis ve Ticaret A.Ş.
14.	EREGL	Ereğli Demir ve Çelik Fabrikaları T.A.Ş.
15.	FROTO	Ford Otomotiv Sanayi A.Ş.
16.	TGB - GARAN	Türkiye Garanti Bankası A.Ş.
17.	THL - HALKB	Türkiye Halk Bankası A.Ş.
18.	TIB	Türkiye İş Bankası A.Ş.
19.	KCHOL	Koç Holding A.Ş.
20.	KORDS	Kordsa Teknik Tekstil A.Ş.
21.	OTKAR	Otokar Otomotiv ve Savunma Sanayi A.Ş.
22.	SAHOL	Hacı Ömer Sabancı Holding A.Ş.
23.	SISE	Türkiye Şişe Cam Fabrikaları A.Ş.
24.	THYAO	Türk Hava Yolları A.O.
25.	TOASO	Tofaş Türk Otomobil Fabrikası A.Ş.
26.	TSK-TSKB	Türkiye Sınai Kalkınma Bankası A.Ş.
27.	TCELL	Turkcell İletişim Hizmetleri A.Ş.
28.	TUPRS	Tüpraş-Türkiye Petrol Rafinerileri A.Ş.
29.	ULKER	Ülker Bisküvi Sanayi A.Ş.
30.	TVB-VAKBN	Türkiye Vakıflar Bankası T.A.O.
31.	YKB-YKBNK	Yapı ve Kredi Bankası A.Ş.
32.	ZOREN	Zorlu Enerji Üretim A.Ş.

Appendix 3. Descriptive Statistics of Variables (Annually)

Variables (2015)	Mean	Standard Deviations	Min.	Max.
FLP	-0.38	1.31	-5.45	1.97
FCI	0.91	1.36	-1.84	4.16
FS	8.70	1.49	5.57	1.14
FA	3.84	0.47	2.89	4.51
FE	3.47	0.57	2.45	5.12
FW	-3.41	2.00	-7.75	1.81
FRD	1.29	2.27	-4.60	6.81
FP	0.37	0.49	0.00	1.00
FEX	0.03	0.17	0.00	1.00
FHL	0.06	0.24	0.00	1.00
ESP	2.93	0.09	2.77	2.99
SSP	2.77	0.07	2.56	2.83
CSP	2.81	0.04	2.63	2.83
TSP	3.94	0.05	3.76	3.98
Variables (2016)	Mean	Standard Deviations	Min.	Max.
FLP	-0.21	1.32	-5.46	1.88
FCI	1.05	1.30	-1.69	3.78
FS	8.73	1.46	5.47	1.14
FA	3.86	0.46	2.94	4.52
FE	3.50	0.66	2.23	5.37
FW	-3.35	2.03	-7.80	1.89
FRD	1.63	2.16	0.00	7.44
FP	0.37	0.49	0.00	1.00
FEX	0.03	0.17	0.00	1.00
FHL	0.06	0.24	0.00	1.00
ESP	2.94	0.08	2.77	2.99
SSP	2.78	0.07	2.48	2.83
CSP	2.81	0.03	2.70	2.83
TSP	3.95	0.04	3.80	3.98
Variables (2017)	Mean	Standard Deviations	Min.	Max.
FLP	-0.01	1.29	-5.15	2.28
FCI	1.22	1.31	-1.61	3.95
FS	8.74	1.44	5.32	1.14
FA	3.48	0.69	2.35	5.06
FE	-3.11	1.97	-7.75	2.00
FW	1.63	2.20	0.00	7.46
FRD	0.37	0.49	0.00	1.00
FP	0.03	0.17	0.00	1.00
FEX	0.06	0.24	0.00	1.00
FHL	2.94	0.08	2.77	2.99
ESP	3.88	0.45	2.99	4.53
SSP	2.79	0.07	2.56	2.83
CSP	2.81	0.03	2.70	2.83
TSP	3.95	0.04	3.80	3.98
Variables (2018)	Mean	Standard Deviations	Min.	Max.
FLP	0.21	1.31	-4.99	2.69
FCI	1.38	1.26	-1.32	4.19
FS	8.75	1.45	5.31	1.14
FA	3.91	0.44	3.04	4.54
FE	3.48	0.61	2.32	4.66
FW	-2.96	1.92	-6.796	2.10

Appendix 3 (cont.)

Variables (2018)	Mean	Standard Deviations	Min.	Max.
FRD	1.76	2.28	0.00	7.59
FP	0.37	0.49	0.00	1.00
FEX	0.03	0.17	0.00	1.00
FHL	0.06	0.24	0.00	1.00
ESP	2.95	0.08	2.77	2.99
SSP	2.80	0.06	2.63	2.83
CSP	2.81	0.02	2.77	2.83
TSP	3.95	0.04	3.82	3.98
Variables (2019)	Mean	Standard Deviations	Min.	Max.
FLP	0.34	1.28	-4.87	2.68
FCI	1.50	1.27	-1.13	4.31
FS	8.75	1.45	5.45	1.14
FA	3.93	0.43	3.09	4.55
FE	3.50	0.50	2.63	4.78
FW	-2.78	1.96	-7.02	2.49
FRD	1.87	2.36	0.00	7.69
FP	0.37	0.49	0.00	1.00
FEX	0.03	0.17	0.00	1.00
FHL	0.06	0.24	0.00	1.00
ESP	2.94	0.08	2.77	2.99
SSP	2.80	0.04	2.70	2.83
CSP	2.81	0.02	2.77	2.83
TSP	3.95	0.04	3.85	3.98

Note: The number of observations in all years in the table is 32.

Evaluation of Hospital Vision and Mission Statements in terms of Customer Orientation: A Content Analysis for Private Hospitals in Türkiye

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Abstract

This study aims to examine the vision and purpose statements of private hospitals in Türkiye with regard to their level of customer orientation. In order to achieve this objective, an examination was conducted on the purpose and vision statements of 494 privately owned hospitals in Türkiye. The vision and purpose statements of hospitals were subjected to content analysis using Nwankwo's (1995) customer orientation criteria. The evaluation of the vision and purpose statements was based on the following criteria: "Defining" refers to the emphasis placed on customer-centricity, "Sensitivity" pertains to the proactive approach adopted, "Measuring" signifies the adoption of a formalized approach, and "Implementation" denotes the commitment to taking decisive actions. Ultimately, it was determined that 82% of hospitals possessed purpose and vision statements. The findings of the study indicate that hospitals prioritize the requirements of patients and their families as the focal point of their service provision. The vision statement, accounting for 19.4% of the total content, and the mission statement, comprising 18.5% of the overall content, both emphasize the development of innovative strategies aimed at enhancing the provision of distinct service delivery to patients and their families. Nevertheless, the rate of utilization is relatively inadequate in the context of health services that heavily rely on technological advancements.

Keywords: *Mission, Vision, Private Hospital, Customer Orientation.*



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1. INTRODUCTION

According to Özer (2006), intensified competition, driven by the pursuit of customers and market share, coupled with economic downturns during periods of crisis, reduced consumer demand, and heightened focus on customer orientation in contexts where customers have increased options, can confer a competitive advantage to businesses. The concept of customer orientation entails prioritizing the satisfaction and value derived by customers from engaging with a business. It confers a competitive advantage to businesses. According to Baş et al. (2016), a crucial objective is to establish customer orientation as a means of gaining a competitive advantage. In order to ensure the continued operation and expansion of a hospital, it is imperative to maintain and enhance the quality of its service-oriented processes and performance, adhering to rigorous standards of customer service that effectively address the needs of patients (Marina & Wahjono, 2013, p. 400). There exists a clear correlation between patients' perception of service quality and the extent to which the business prioritizes customer satisfaction. Healthcare organizations should prioritize patients through a systematic approach. Patients who express their dissatisfaction and negative experiences with their environment may experience a decrease in patient retention. In the event of negative experiences, individuals may opt to seek medical care at alternative healthcare facilities. It is imperative for hospitals to ensure that all of their services are centered around the patient. It is imperative to employ a comprehensive array of motivational tools to foster the widespread adoption of a patient-centered culture among all staff members within the educational institution. In the context of social responsibility and societal service, it is imperative to consider the implementation of a patient-centered approach (Soysal & Koçoğlu, 2018, p. 42).

It is widely acknowledged that prioritizing the customer can enhance operational efficiency, prolong business longevity, differentiate a company within the market, and confer a distinct competitive advantage. The literature review revealed that existing studies have examined hospital mission and vision statements, but none have specifically investigated the extent to which these statements are customer focused. Given this, it is widely believed to be of utmost significance to examine the purpose and vision statements of private hospitals regarding their customer-centric orientation. According to Soysal and Koçoğlu (2018, p. 43), it is posited that hospitals will increasingly face competition from patients and their families, thereby becoming a significant competitive force in the present and future. This study examined the websites of 494 private hospitals in Türkiye, as documented in the Directory of Public and Private Health Institutions. The study utilized the customer orientation criteria established by Nwankwo in 1995, which were subsequently employed by Oruç and Zengin (2015) in a Turkish context. The present study employed content analysis to examine the vision and purpose statements of private hospitals in Türkiye, focusing on the criteria pertaining to customer orientation. The examination focused on distinct factors related to customer orientation, namely "Defining," "Sensitivity," "Measuring," and "Implementation." In this study, firstly, the concept of customer orientation is examined, the importance of customer-oriented approach for hospitals is mentioned and previous

researches in this field are included. In the second part of the study, the concepts of mission and vision in hospitals, their formation and content are given and the researches conducted in this field are mentioned. In the last part of the study, mission and vision statements obtained from the websites of private hospitals were evaluated with the customer orientation scale, content analysis was performed, and findings and results were given.

2. CONCEPTUAL FRAMEWORK

2.1. The Concept of Customer Orientation

Customer orientation refers to a collection of principles that prioritize the satisfaction of customers, while also considering the interests of other stakeholders, including entrepreneurs, managers, and employees, with the ultimate goal of enhancing long-term profitability (Nwokah & Maclayton, 2006, p. 67). This approach enhances the advantages for purchasers or customers while simultaneously mitigating costs. Acquiring such a depth of comprehension necessitates the acquisition of knowledge pertaining to clients and a comprehensive grasp of the economic and political frameworks that they encounter (Nwokah, 2009, p. 22). Numerous firms encounter difficulties as a result of an inadequate perception of customers and their needs. The adoption of a customer-centric approach plays a crucial role in enhancing corporate profitability when solving this particular difficulty. According to Nwokah and Maclayton (2006), the attainment of competitive advantage is of utmost importance and serves as a distinguishing characteristic of prosperous enterprises.

According to Mann et al. (2007), the establishment of an enduring and sustainable customer-centric performance system is contingent upon the presence of a widespread customer-centric culture within the business. A culture that prioritizes client orientation motivates and directs people to align their behaviors with the principles and values of this culture. The development of customer orientation cannot be achieved solely by highlighting peripheral service features. On the contrary, the literature suggests that firms can embrace customer orientation if they develop it as an organizational culture throughout the organization (Kennedy et al., 2002, p. 163). Mann et al. (2007) identified six distinct qualities that define a customer-oriented service.

1. Leadership: The influence of customers on organizational direction and activities has a key importance.
2. Listening: The organization actively seeks the perspectives of customers and provides them with opportunities to share their opinions.
3. Analysis and understanding: The analysis and comprehension of customer expectations and essential requirements have been achieved.
4. Integration and delivery: Customers' expectations are met.
5. People: The firm possesses a comprehensive comprehension of and has successfully integrated a customer-centric culture.

6. Review and improvement: It is imperative to consistently assess and enhance customer-centric strategies, procedures, and processes.

Hennig-Thurau (2004) demonstrated in his research that the degree of customer orientation exhibited by service sector employees significantly influences the development of customer satisfaction. Furthermore, within the confines of the aforementioned study, it was determined that the technical aptitude, social competencies, degree of motivation, and decision-making abilities exhibited by employees are significant aspects that impact customer-centric service behaviors, ultimately leading to customer satisfaction and loyalty. Kealesitse et al. (2013) posit that customer orientation is regarded as a strategic approach in the private sector aimed at enhancing customer happiness and loyalty, ultimately leading to improved profitability and competitiveness. Nevertheless, empirical evidence suggests that customer orientation exerts a significant and favorable influence on staff performance and motivation within the public sector (Paarlberg, 2007, p. 201).

In the light of all this information, as a synthesis of the definitions found in the literature, customer orientation can be defined as the orientation of an organization's activities and strategies by focusing on customer satisfaction and customer needs. As stated by Soysal and Koçoğlu (2018), customer orientation is based on the principles of understanding customer expectations and needs, providing value to them and offering a satisfying customer experience. A customer-centric approach also increases the success of an organization. Organizations that adopt this approach increase customer loyalty and brand reputation, expand their customer base and gain competitive advantage. It also creates an image of an organization that values customers and strengthens long-term customer relationships (Nwukah, 2009; Nwukah & Maclayton, 2006). As a result, it is clearly seen that adopting a customer-oriented approach is very important for businesses for sustainable success.

2.2. Customer Orientation and Hospitals

Consumer orientation refers to the recognition that consumer expectations play a crucial role in shaping the marketing endeavors of an organization. Customer satisfaction and expectations are on the rise across all sectors, including healthcare. To effectively meet these demands, it is crucial to adopt a customer-oriented approach that prioritizes the satisfaction of patients and their relatives (Soysal & Koçoğlu, 2018, p. 41). Customer orientation in hospitals pertains to a method that endeavors to enhance service provision to patients and fulfill their requirements. The active participation of patients in the treatment and care processes within the hospital setting is of paramount significance. The happiness of patients and the fulfillment of their demands are critical determinants that significantly impact the overall quality of healthcare services. Patient satisfaction encompasses various components, including but not limited to, efficient communication, tailored service, feedback mechanisms, complaint resolution strategies, provision of education and information, and safeguarding patient rights. Given that the patient is the central Orientation, it is appropriate to employ the phrase "patient orientation" rather than

"customer orientation" when discussing the concept of consumer orientation inside healthcare establishments. It is recommended that hospital management, healthcare providers, and all other staff members embrace a patient-oriented approach (Soysal & Koçoğlu, 2018, p. 43). The use of this strategy holds significance in enhancing patient happiness, improving treatment outcomes, and fostering a positive patient experience. (Kumbasar, 2016, p. 85)

When discussing customer orientation within the context of health institutions, it is possible to identify two paradigms that are relevant to the delivery of health services: the old paradigm, which centers around payers and healthcare personnel, and the new paradigm, which prioritizes the customer, specifically patients and their relatives. The augmentation of the 10 components of the novel paradigm can lead to an enhancement in customer happiness, cost efficiency, and therapeutic efficacy. According to a study conducted by Ford and Fottler (2000), a total of 177 hospitals were analyzed, and these 10 principles were determined to be consistent with cost-effectiveness.

The fundamental principles underlying the new paradigm are as follows:

- Principle 1: The assessment of service quality and value is contingent upon the perspectives and evaluations of patients and their families.
- Principle 2: The inclusion of patients and their families contributes to the enhancement of service experiences by improving their quality and value.
- Principle 3: Everyone should recognize the importance of patients and their relatives and subsequently adopt appropriate actions in response.
- Principle 4: Identify, recruit, and train competent and appropriate individuals.
- Principle 5: Patients and family members desire employees who are not only well-trained but also possess strong interpersonal skills.
- Principle 6: Patients and family members anticipate a seamless service experience.
- Principle 7: Waiting times for patients and their families seeking healthcare services should be avoided.
- Principle 8: Provide services in accordance with patients' and families' expectations.
- Principle 9: What is measured will be managed.
- Principle 10: The attainment of success should not be regarded as a final destination.

In a study by Marina and Wahjono (2013), a new paradigm in healthcare organizations was mentioned. According to the research; "Patients are the partners of the hospital" and the understanding of service needs to be developed. With this paradigm, hospitals will abandon the old paradigm of "Doctor is king". The paradigm shift in the hospital has guided the gradual transformation of the hospital

into a profit-oriented commercial enterprise. At this point, a satisfactory hospital service for patients and their relatives is possible with hospital employees and management who have a culture and value system of service and do their best (Marina & Wahjono, 2013, p. 404). According to Kumbasar's quote from Apker J., some features should be taken into consideration for patient-centeredness in health services (Kumbasar, 2016, p. 87):

Access to healthcare: The provision of patient appointment services includes offering patients the ability to select their preferred appointment time, assuring timely adherence to scheduled appointments, minimizing waiting times, and promptly responding to telephone and electronic correspondence.

Participation in the treatment process: The patient is involved in their own treatment process by allowing them to participate in treatment and care decisions, presenting different options, and clearly outlining roles and duties.

Information systems: Systems that enable access to laboratory tests and imaging services done during the diagnosis and treatment process, as well as reporting on the services obtained, are developed.

Coordination: A comprehensive system is established to enable seamless access to patient information for all healthcare personnel involved in providing care. This system facilitates the sharing of patient information among employees whenever it is required.

Possibility of feedback: A low-cost, patient/caregiver-oriented online survey is used to create a system that allows patients to evaluate the health care they have received.

In a study done in 2018, Soysal and Koçoğlu discovered a favorable correlation between the perception of customer orientation among institutional staff and patients' evaluations of service quality, reliability, enthusiasm, and assurance. A positive correlation exists between customer orientation and patients' opinion of service quality. A further noteworthy finding of the study pertains to the divergence observed in the levels of customer orientation perception between patients and healthcare personnel. The study assessed the level of consumer orientation perception among healthcare professionals and patients, finding that healthcare professionals had a higher view of customer orientation compared to patients. In their study, Bozkurt and Çolakoğlu (2020) examined the evaluation of various characteristics, including customer orientation, brand prestige, brand trust, and brand advocacy, by participants in the context of hospitals. The findings indicated a positive assessment of these variables inside the organizations. Furthermore, the findings of this study indicate that customer orientation has a statistically significant impact on brand prestige, brand trust, and brand advocacy (Bozkurt & Çolakoğlu, 2020, p. 4009). The prioritization of customer orientation within health management is crucial for enhancing the overall quality of health services and optimizing patient happiness. Furthermore, from a financial perspective, health institutions place significant weight on factors such as cultivating a loyal

patient base, establishing a favorable reputation, fostering a positive image and referral network, gaining a competitive edge in the market, and assuring cost-effectiveness.

2.3. Concepts of Mission and Vision

In the realm of business, the notion of a mission serves as a guiding framework that delineates the tasks, principles, convictions, purpose, and strategies that an organization must adhere to in order to distinguish itself from other enterprises. According to Muslu (2014), a meticulously crafted mission statement can yield several advantages for a firm, including enhanced economic performance, fostering collaboration and cohesion among employees, and facilitating the establishment and reinforcement of the corporate culture. According to Kantabutra and Avery (2010), mission statements serve as a valuable management tool that contributes to the enhancement of organizational performance. The mission statement is regarded as the fundamental basis for an organization's planning procedures and articulates the role and objective of the organization (Cronin & Bolon, 2018, p. 30).

In contrast, vision offers a strategic outlook on the future trajectory of an organization. By establishing a desired future state, a firm can enhance the coherence of its decision-making process in the present. In essence, the objective is to formulate the future based on the current timeframe (Dalay, et al., 2002, p. 20). According to Muslu (2014), businesses strive to gain insight into future prospects through the formulation of vision statements, thereby fostering a sense of connection between the organization and its personnel.

As stated by Rego et al. (2016), the future outlook of an organization encompasses several key elements. These include the organization's sector of operation, the markets it intends to compete in, the goods and services it plans to offer, the value it aims to deliver to its customers, the long-term advantages it anticipates having, and its projected performance and profitability (Akgemici & Güleş, 2009, p. 14).

As can be seen in Figure 1, mission and vision both have different characteristics and differ from each other. The distinctions between mission and vision can be characterized as follows: the mission pertains to the present condition and fundamental undertakings of the organization, whilst the vision pertains to the future objectives and aspired condition of the organization. The mission statement serves to elucidate the purpose and operations of the organization, whereas the vision statement delineates the future direction and aspirations of the organization. Both the mission and vision statements are key components of an organization's strategic planning process, serving as effective means to communicate a coherent message to the stakeholders on the organization's aims and objectives. In essence, a mission statement delineates the fundamental objectives of an organization, encompassing its activities and target beneficiaries. The document articulates the aims, intended recipients, principles, spheres of operation, and enduring aspirations of the organization. A vision statement serves as a strategic tool that articulates the enduring objectives of an organization, delineating its desired future role and intended trajectory. The statement articulates the prospective trajectory of the organization, its

strategies for fostering innovation, implementing change and fostering growth, as well as its capacity to adjust to a dynamic and evolving global landscape.

Table 1. Characteristics of Mission and Vision

Mission	Vision
Idealistic. It is original. It is distinctive. It has attractive qualities. It is short and memorable. Inspiring and ambitious. Describes what is expected in the future.	It is short, clear and striking. The purpose of the service is defined. The production/service area of the business is specified. The goods/services produced by the business are defined. A meaningful discourse is created that will motivate the staff, that they will keep in mind while working and that they will be proud of.

Source: (Akgemici & Güleş, 2009, p. 14)

The significance of vision and mission statements in strategic management is widely recognized across all types of companies, including public, private, big, small, and international entities. Furthermore, it has been observed that the performance of organizations is significantly influenced by their purpose and vision statements (Darbi, 2012, p. 95). Mission and vision statements are key components of a company's strategic planning process, serving as a fundamental framework that guides and aligns all stakeholders involved in the organization. These statements serve the purpose of fostering confidence by effectively expressing the objectives and obligations of the organization to external stakeholders, while simultaneously establishing the company's distinct character and trajectory.

2.4. Concepts of Mission and Vision in Healthcare Organizations

The mission and vision of a hospital encompass its purpose, delineate its societal position, and outline its inherent obligations, specifically referring to the services it offers to the community. In this context, the individuals in question guide and steer the workforce towards a shared target, and facilitate its implementation by assisting in the formulation of organizational goals. The aforementioned study by Rego et al. (2016) examines the impact of certain factors on the interaction between health professionals and patients. Specifically, the study investigates how these factors condition the aforementioned relationship. According to Cronin and Bolon (2018), the mission and vision statement of a hospital should enable stakeholders to differentiate amongst organizations based on their articulated priorities and objectives. Mission statements serve the objective of elucidating the hospital staff's understanding of their *raison d'être*, identity, and existence, thereby offering a clear and targeted direction, as well as instilling inspiration and motivation among personnel (Bart, 2007, p. 684).

Rego et al. (2016, p. 64) emphasize the importance of hospitals making their mission, philosophy, values, principles, and rules known to the public. This is crucial because hospitals have moral, legal, and social responsibilities that they need to fulfill. In recent years, hospitals have been utilizing mission and vision statements more frequently to clearly define and effectively communicate

the desired relationships they aim to establish with their key stakeholders, including investors, customers, and employees. According to Leggat and Holmes (2015), hospitals are advised to make their mission and vision statements available online in order to effectively communicate with stakeholders and other interested parties, while keeping costs to a minimum. Many managers mistakenly believe that simply creating mission and vision statements is sufficient for effectively communicating them. Managers invest a significant amount of time and resources in order to develop mission and vision statements. However, it is often overlooked by managers that in order for a statement to have a meaningful impact, it must be effectively communicated and understood by both patients and their relatives. Managers should take advantage of every opportunity to effectively communicate the hospital's organizational mission and vision statement, ensuring that it is clearly understood by all. According to Desmidt and Heene (2006), the most crucial aspect of the statement process is not just coming up with the statement itself, but effectively managing its meaning. The study conducted by Kartal and Uğurluoğlu in 2020 evaluated the vision statements of hospitals based on their achievement of four primary objectives. The purposes were identified to guide the organization in terms of innovation, motivation, and basic ideology. According to the findings of the content analysis conducted by Kartal and Uğurluoğlu (2020), there was no significant difference observed between the ownership status of hospitals and their ability to meet the stated objectives. Demir and Öztürk (2019) conducted research that revealed private hospitals prioritize the development of vision and mission statements by carefully analyzing the external environment. Marina and Wahjono (2013) found that in order for vision and mission to effectively influence employee and management behaviors, it is crucial to first identify the core business ethics values that exist within an organization. This step is essential prior to designing and establishing the vision and mission of the organization. The definition becomes even more crucial when an organization is involved in both accommodation and hospitality businesses, as it is essential for meeting customer satisfaction. According to a study conducted by Şahin and Ocak in 2020, it was found that only 8% of hospitals have a comprehensive and well-defined vision statement. This indicates that there is a lack of understanding regarding the importance of developing a vision statement for effective strategic management. In a research conducted by Biçer in 2018, findings revealed that over 50% of health managers had not undergone any form of strategic management training. Furthermore, it was shown that a significant proportion, specifically over 33%, of these managers exhibited a lack of awareness regarding seven out of the total sixteen strategic management tools (Biçer, 2018, p. 425).

As a result of all this literature, it is clear that vision and mission statements play an important role in shaping the organizational culture of hospitals. These statements provide a road map for hospital employees and stakeholders, guide decision-making processes and orientation on a common goal. At the same time, they also clearly express what role a hospital aims to play in society and the health sector.

3. METHOD

3.1. Purpose and Importance of the Research

Within the realm of healthcare services, it is widely recognized that patients, as well as their family members or relatives, are considered clients. In highly competitive private healthcare facilities, it is crucial for healthcare professionals to prioritize customer-oriented (or patient-oriented) service delivery. This approach should be widely embraced to ensure the best possible care for patients. Mission and vision statements are of great importance as they act as guiding principles that demonstrate the hospital's dedication to client orientation and its core values. These phrases act as a reminder to hospital administrators and staff about the significance of prioritizing customer satisfaction, improving patient experience, and upholding healthcare quality. Customer orientation is a comprehensive concept that includes several important elements. These elements involve being attentive to the needs and preferences of patients, providing services that are not only safe but also of excellent quality, and fostering effective communication and teamwork among healthcare professionals. Effectively articulating mission and vision statements is crucial for hospitals to convey their approach towards these domains.

This study aims to assess the extent to which private hospitals incorporate the customer (patient) in their mission and vision statements, which articulate their purpose and future objectives. This study examines the degree to which private hospitals incorporate consumer orientation into their mission and vision statements as displayed on their websites. Incorporating consumer orientation criteria into mission and vision statements is believed to enhance customer satisfaction and yield positive outcomes for the company. Examining the customer orientation evident in the mission and vision statements of private hospitals offers substantial benefits for both organizations and patients. Furthermore, scholarly research has thoroughly investigated the connection between customer orientation and mission and vision statements. Nonetheless, research specifically investigating this connection within the context of hospitals is insufficient. The findings of this research hold significant implications for the health sector.

3.2. Type of the Research

Content analysis was used in the study. Content analysis is defined as a methodological tool and technique applied to various statements (Bilgin, 2014). The study favored content analysis as a research method because to its potential to examine a text-based large amount of data systematically, impartially, and scientifically in detail and, at the same time, provide answers to various research problems (Koçak & Arun, 2013; Ültay et al., 2021, p. 191).

Therefore, the content analysis method, which integrates both qualitative and quantitative data methodologies, was used to evaluate, code, analyze, and express the vision and mission statements of private hospitals in numerical form. So that, the underlying messages embedded in the vision and mission statements of the private hospitals can be uncovered.

3.3. Research Ethics

Ethics committee approval for this research was obtained from Istanbul Aydın University Social and Human Sciences Ethics Commission Board.

3.4. Population of the Research

This study focuses on private hospitals that are currently in operation within the geographical boundaries of Türkiye. The current study conducted an analysis of the websites belonging to a total of 494 privately owned hospitals that were listed in the Directory of Public and Private Health Institutions in Türkiye. This study does not include public hospitals and private medical centers that have fewer than 50 beds. One limitation of this study pertains to its scope, as it exclusively focuses on hospitals in Türkiye that own 50 or more beds and hold private hospital licenses.

3.5. Data Collection Tools

The present study employed the customer orientation criteria originally created by Nwankwo in 1995, which were subsequently adapted for usage in the Turkish context by Oruç and Zengin (2015). This study employed text analysis to examine the vision and mission statements of private hospitals in Türkiye, focusing on their alignment with customer orientation criteria. The evaluation of customer orientation criteria was conducted as distinct components, namely definition, sensitivity, measurement, and implementation. The "Defining" component of the criterion focuses on analyzing vision and mission statements in relation to the degree of customer-centricity exhibited by the product or market, the articulation of customer-oriented goals, the acquisition of customer feedback, and the implementation of employee training initiatives. These items pertain to the concept of "being customer-oriented". The "Sensitivity" component of the criterion assesses the efficacy of vision and mission statements in terms of their ability to anticipate consumer needs, provide clear direction, and facilitate the exploration of novel techniques. The elements inside the criterion pertain to the concept of "being proactive". The "Measurement" component of the criterion focuses on the evaluation of vision and mission statements with regard to customer research and customer-centric performance. These narratives also express "being formal". The final component of the criterion, known as "Implementation," assesses the vision and mission statements based on two key factors: the level of support provided by top management and the extent to which they are action oriented. These comments also analyze the concept of "being action-oriented". Firms that adhere to these characteristics can be classified as "Customer-focused" firms, which implies that they prioritize customer benefits and do not neglect the interests of other stakeholders (Nwokah et al., 2006, p. 70).

3.6. Analysis of the Data

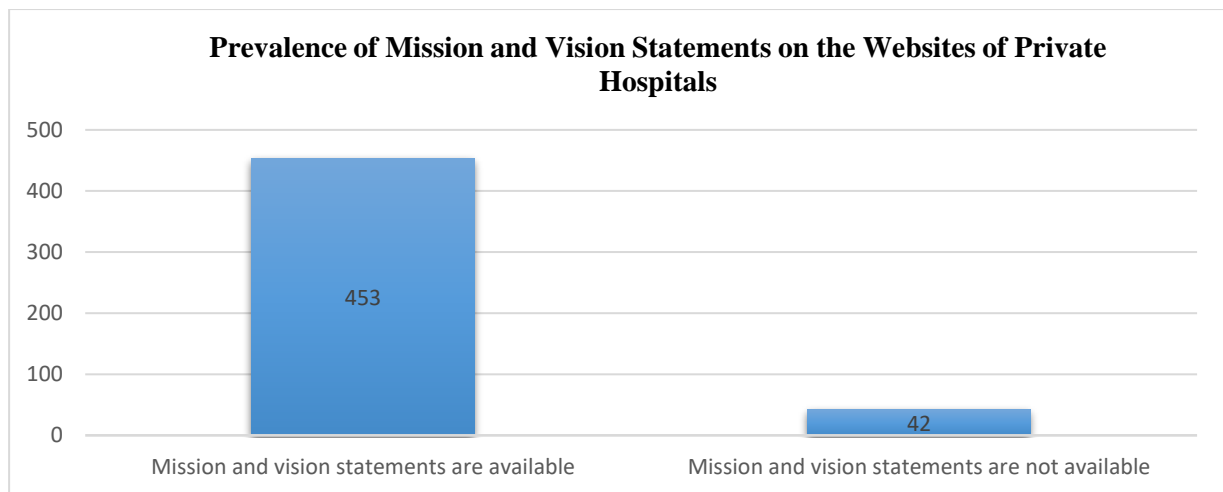
The present study involved a comprehensive analysis of the mission-vision statements found on the websites of private hospitals. Each statement was evaluated individually based on the criteria outlined in the Customer Orientation scale, which was recorded in an Excel table specifically designed

for this purpose. The examination of hospitals' vision and mission statements was conducted using the Customer Orientation Criteria developed by Nwankwo and adapted for usage in Türkiye by Oruç and Zengin (2015). Each statement was analyzed individually, and the occurrence of the criteria within the statements was systematically coded. The coded statements were analyzed in terms of percentages, and the distribution of these percentages was generated using the Excel software. The validity of this study was ensured by the fact that the coding scheme and analysis methods used were compatible with similar studies in the literature. Coding was done by considering the keywords and expressions commonly used in the literature to measure the concept of customer orientation. In addition, the coding scheme was reviewed by experts in the field and found appropriate. In order to assess the reliability of this study, the coding done by a single coder was measured by the retest method. The same data set was recoded after a certain period of time and the consistency between the two coding sets was calculated by Pearson correlation coefficient. The correlation coefficient was found to be 0.82, which indicates a very good level of reliability.

4. FINDINGS

The present study involved an examination of the websites belonging to 494 private hospitals listed in the Directory of Public and Private Health Institutions in Türkiye. A total of 41 hospitals were omitted from the study due to the absence of purpose and vision statements. The research was carried out on a sample of 453 private hospitals, as depicted in Figure 1.

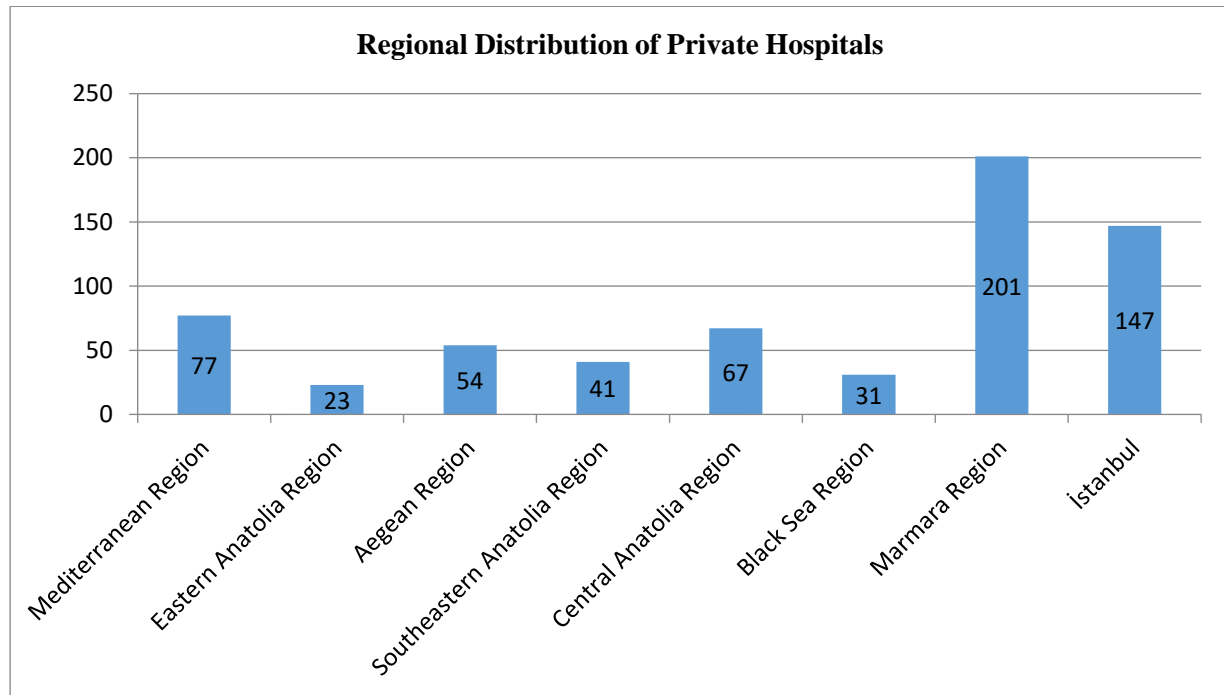
Figure 1. Prevalence of Mission and Vision Statements on the Websites of Private Hospitals



Based on the categorization of geographical regions, it can be asserted that the Marmara Region, particularly the province of Istanbul, has the greatest concentration of private hospitals. According to the data presented in Figure 2, the Marmara Region is succeeded by the Mediterranean Region and Central Anatolia Region. The Eastern Anatolia Region exhibits the lowest number of private hospitals. In terms of provincial distribution, Istanbul has the highest concentration of private hospitals, with Ankara and Antalya following suit in descending order. Certain provinces, like Artvin, Kilis, Bartın,

and Batman, lack private healthcare facilities. Based on the findings, it can be inferred that private hospitals operating in Istanbul, Ankara, and Antalya provinces, as well as in the Marmara and Mediterranean areas, demonstrate a commitment to vision and mission statements, thereby establishing long-term objectives they want to accomplish.

Figure 2. Regional Distribution of Private Hospitals Participating in the Study



The "Definition" component of the study examined the concept of customer orientation and conducted evaluations based on four distinct criteria items. Table 2 reveals that the criterion "Customer-centeredness of the product or market" was the predominant criterion employed in the vision (49.4%) and mission (57.6%) statements of the hospitals. It can be asserted that this criterion is more prominently featured in the mission statements of hospitals. When examining the relationship between mission and vision, it can be argued that the mission embodies principles and values, while the vision encompasses strategic aims and objectives. In this context, the emphasis on customer-centeredness within a product or market is primarily associated with principles and values. Within this particular section, it was seen that the criterion pertaining to the articulation of customer-oriented objectives ranked second in both the mission statement, accounting for 32% of the content, and the vision statement, accounting for 15.9% of the content. It is evident that approximately one-third of hospitals include the goals they have set for patients and their families as guiding principles and core values. Inside the part dedicated to defining key elements, it was observed that the inclusion of staff training programs as a criterion inside mission and vision statements was quite infrequent.

Table 2. Status of Mission and Vision Content According to the Definition Criterion

Identification Criteria	Mission	%	Vision	%
Customer-centricity of the product or market	261/453	57.6	224/453	49.4
Articulation of customer-oriented objectives	145/453	32	72/453	15.9
Collecting information from customers	21/453	4.6	45/453	9.9
Employee training programs	4/453	0.9	2/453	0.4

The "Sensitivity" segment examines the concept of proactivity and involves the assessment of three distinct criteria items. According to the data presented in Table 3, the criterion pertaining to "Being able to make predictions about customers" was found to be the most commonly utilized criterion in both the vision (40.8%) and purpose (49.2%) statements of the hospitals. These qualities are frequently observed in the mission statements of hospitals. Among the criteria discussed in the section on being proactive, the criterion of being directed emerged as the least prevalent among mission and vision statements. Hospitals demonstrate a tendency to prioritize the proactive provision of various services to patients and their relatives through the development of novel solutions.

Table 3. Status of Mission and Vision Content According to the Sensitivity Criterion

Sensitivity Criteria	Mission	%	Vision	%
Make predictions about customers	223/453	49.2	185/453	40.8
Being directive	28/453	6.2	37/453	8.2
Research new strategies	84/453	18.5	88/453	19.4

In the "Measurement" section, evaluations were conducted for two different criterion items to assess the level of formality. According to Table 4, the criterion of "Customer-oriented performance" was found to be the most used criterion in both the vision (93.6%) and mission (93.8%) statements of the hospitals. The high percentages suggest that hospitals prioritize patients when strategizing their operations and initiatives, as evidenced by their mission and vision statements. The mission and vision statements of hospitals often incorporate these criteria at a similar frequency. The criterion of customer research was given the least priority in the mission and vision statements, as stated in the measurement section.

Table 4. Status of Mission and Vision Content According to Measurement Criteria

Measurement Criteria	Mission	%	Vision	%
Customer research	57/453	12.6	28/453	6.2
Customer-oriented performance	425/453	93.8	424/453	93.6

The "Implementation" section encompassed evaluations that were carried out for two distinct criterion items, both of which were indicative of a strong emphasis on proactive measures. Based on the

data provided in Table 5, it can be observed that the criterion of "being activity-oriented" was the most employed criterion in the vision (93.6%) and mission (93.8%) statements of the hospitals. Private hospitals place a high emphasis on prioritizing the provision of services and endeavor to attain their objectives by assuring patient satisfaction through the delivery of these services. The findings from the implementation section indicate that the criterion of top management support was the least employed in the formulation of the mission and vision statements. Upon analysis of the mission and vision characteristics, it becomes evident that the criterion of top management support is the least frequently cited among all the criteria.

Table 5. Status of Mission and Vision Content According to Implementation Criteria

Application Criteria	Mission	%	Vision	%
Top management support	4/453	0.9	6/453	1.3
Being activity-oriented	425/453	93.8	424/453	93.6

5. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This study analyzed the vision and mission statements of private hospitals in Türkiye through text analysis, with an emphasis on customer orientation. Consequently, several findings were derived. Forty-one private hospitals, representing 8.2% of the sample, did not provide vision and purpose statements on their websites. The lack of these remarks, which suggest continuity, indicates insufficient adoption of strategic management within these hospitals. Mission and vision statements are crucial for hospitals as they influence patient and family satisfaction, guide future objectives, and enhance competitive advantage.

The research identified that the most frequently cited criteria were "activity-oriented" for implementation and "customer-oriented performance" for measurement. Kartal and Uğurluoğlu (2020) performed an analysis of the vision statements of hospitals. The study indicated that private hospitals prioritized the "human" aspect, corroborating our research findings. Yavuz and Döven (2018) conducted an analysis of the purpose and vision statements of public hospitals, revealing that "patient satisfaction" was the most referenced element. This finding is consistent with our research and underscores the necessity for hospitals to prioritize service delivery centered on patients and their relatives. Eren (2010) argues that vision and mission statements must encompass and clearly articulate the primary activities of organizations. Our study indicates that the most cited criterion in the purpose and vision statements of the private hospitals examined is an orientation towards activity.

The "Sensitivity" area, indicative of proactivity, demonstrates that hospitals emphasize the proactive delivery of diverse services to patients and their families through the adoption of innovative strategies. Kartal and Uğurluoğlu (2020) examined the efficacy of vision statements in fulfilling four distinct objectives. The findings indicated that two-thirds of the hospital vision statements focused on

the objectives of "guiding the organization" and "motivating." Nonetheless, the goals of "innovation" and "basic ideology" received comparatively less emphasis. This result is consistent with the findings of our study. However, the results obtained in our research are deemed insufficient for hospitals. Hospitals are essential institutions that depend significantly on advanced technology for effective operation. Hospitals ought to integrate these elements more prominently into their vision and purpose statements, aligning change and innovation with service delivery.

Analysis of the mission and vision characteristics reveals that top management support is the least frequently cited criterion among all evaluated criteria. Mission and vision statements represent the fundamental decisions made by senior management and are executed with the participation of the entire organization. The support of senior management is essential for achieving the objectives and aspirations outlined in the vision and mission. The data indicates that the hospitals in the study possess mission and vision statements, reflecting robust support from upper management. It is important to recognize that these statements lack significant substance.

The criterion related to staff training programs was the least frequently observed in the mission and vision statements within the definition section. Soylu and İleri (2010) found that 33% of hospital staff lacked awareness of their organization's vision, goals, and policies. This result supports our findings. Hospitals' reliance on labor makes a low percentage in this category unfavorable for their operations. Integrating employee training and development into customer-focused strategy planning is both suitable and recommended.

The measuring component identified the purpose and vision statements of consumer research with minimal space allocation. This situation illustrates an absence of customer behavior research undertaken by hospitals in the development of their purpose and vision statements. Decisions are primarily informed by input from patients and their relatives. Among the mission and vision statements, the criterion of being directive was the least frequently observed in the section concerning proactivity. Hospitals typically emphasize the anticipation of patient needs and appropriate responses, rather than implementing a prescriptive strategy.

Health services exhibit a notable information asymmetry between service recipients and providers. The patient's perspective may provide distinct insights into customer orientation. The essential factor is not only having a customer-centric understanding reflected in the mission and vision statements but also ensuring that this understanding is effectively conveyed to patients and their families through the content. Hospitals must develop their vision and purpose statements clearly and precisely. Hospitals should regularly evaluate and update their purpose and vision statements to align with consumer orientation. In light of client expectations and changes within the healthcare sector, it is essential to evaluate and adjust mission and vision statements accordingly. Hospitals can consistently improve customer orientation and effectively achieve their objectives.

Consequently, mission and vision statements must indicate that hospitals prioritize enhancing the customer experience in healthcare services and value customer satisfaction. These statements offer a framework for hospitals to attain their objectives and fulfill customer expectations. The vision and mission statements of hospitals are considered distinct from those of other service businesses because of unique characteristics inherent to health services, including continuous 24-hour availability, non-deferrable service requirements, and the lack of substitute options. This difference should be elucidated in future research. Future research should assess the mission and vision statements of public hospitals affiliated with the Ministry of Health regarding customer orientation and compare these with those of private hospitals.

Ethics committee approval for the study was obtained from the Istanbul Aydın University Ethics Committee on March 2, 2023, with meeting number 2023/2.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors declare that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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A Research on the Mediating Role of Foreign Direct Investments of Logistics Sector on the Relationship between Global Competitiveness Index with Gross Domestic Product and Exports

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Abstract

Exports, Gross Domestic Product (GDP) and Foreign Direct Investment (FDI) are very important concepts for countries to achieve their strategic, political and economic goals and to have stable growth. The Global Competitiveness Index publishes by the World Economic Forum also has a great impact on the decisions of foreign investors and provides comparative information to investors on different issues about the country where investment is desired. At this study, the relationship between Türkiye's global competitiveness index ranking with exports and GDP data and whether foreign direct investments in the logistics sector have a mediating role at this relationship is investigated. SAS software package is used to analyse the data and Structural Equation Model is established. In this framework, it is determined that Türkiye's global competitiveness index ranking affects the logistics sector foreign direct investments and GDP. It is also concluded that there is a significant relationship between export values and GDP data. It has been determined that foreign investments in the logistics sector have no effect on exports and GDP data, and the ranking of the index has no effect on export values. In addition, FDI in the logistics sector have a mediating role in the relationship between the global competitiveness index and GDP but doesn't have a mediating role relationship between exports and GDP and between the global competitiveness index and exports. Within the framework of the results obtained, it is important to increase the gross domestic product by achieving a good ranking in the global competition index in terms of Türkiye's goals of becoming one of the top ten economies and becoming a logistics hub, and for this purpose, it is important to focus on foreign direct investments in the logistics sector.

Keywords: *Global Competitiveness Index, Logistics Sector, Foreign Direct Investment, Export Data, Gross Domestic Product.*



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1. INTRODUCTION

Foreign direct investment (FDI), which is defined as "a form of long-term investment in which the investor controls or be closely involved with decisions of an enterprise in an economy other than the economy in which the investor is resident", provides great advantages especially for developing countries such as Türkiye (Central Bank of the Republic of Türkiye, 2017). Foreign investments, which make significant contributions to the economic growth of countries such as China, India and South Korea, also enable countries to develop in terms of capital and technology. Since foreign investments, which countries try to increase by encouraging them in various ways, are important for Türkiye's economic development, amendments have been made to the law on this subject at different times. The amendments made did not reach the desired level and did not meet expectations. Despite this, they have led to an increase in the number of foreign investments.

The Global Competitiveness Index (GCI) guides the decisions by providing information on different issues. Therefore, Türkiye's ranking and score in the index can also be effective on the decisions of the foreign investments in the country. Since Türkiye has the advantage of geographical location and the potential to become a logistics hub, the Transportation and Communication sector has had the large share in public investments for years (International Transport and Logistics Service Producers Association, 2022). It can explain as an indicator of the importance of the sector. FDIs contribute to the growth of the sector to achieve the country's export and growth targets.

At this research, the relationship between Türkiye's GCI ranking, logistics sector FDIs, exports and GDP data and whether mediating role of logistics sector FDIs at this relationship are investigated. With this research, firstly FDIs and their strategic importance are explained, and then Türkiye's FDI, GDP, exports and GCI data are evaluated. The study also includes research methodology.

2. LITERATURE REVIEW

2.1. Foreign Direct Investment (FDI)

According to the Central Bank of the Republic of Türkiye (CBRT), foreign direct investment (FDI) is "a form of long-term investment in which the investor controls or be closely involved with decisions of an enterprise in an economy other than the economy in which the investor is resident". At FDI, the investor must have a share of 10% or more of the working capital (Central Bank of the Republic of Türkiye, 2017). Factories, houses, lands or partnership shares established by businesses, individuals or the state within the borders of another country, provided that they are not less than 10%, are considered direct foreign investment. If the share of working capital is below 10%, it is considered a portfolio investment (Organisation for Economic Co-Operation and Development, 2008). If the profits obtained from direct investments in the country are used in reinvestment in the same country, these investments are also considered as FDIs (Republic of Türkiye Prime Ministry Undersecretariat of Treasury, 2005). The reason of these investments varies depending on whether the countries are

developed or underdeveloped. According to the Dunning Eclectic Paradigm, this situation can also be expressed as the search for resources, the search for markets, the search for efficiency and strategic assets. Economic, social and political factors such as market size, growth rate, infrastructure, workforce, inflation, innovation and macrostability are effective in countries attracting these direct foreign investments (Çubukçu, 2021).

Foreign investments, which are classified in different ways in the literature, are generally classified into three groups according to the method of investment abroad (United Nations Conference on Trade and Development, 2005). The first is greenfield investment, a form of investment in which the main company starts a new venture in the foreign company by building new operational facilities. Greenfield investment is also the most common type of FDI and is used in greenfield projects (Aalioua, 2019). It is the most preferred type of investment by countries as it creates new facilities in the host country, increases employment and involves capital and technology transfer. The second type of FDI is mergers, which is “a type of investment in which two or more businesses transfer all their assets to form a new company” (Aalioua, 2019). Investors who do not want to make an investment from scratch can focus on a specific market by merging with an existing business (Abuu, 2020). By merging, the company's products and services may reach new markets and investors can gain the opportunity to capture new and profitable markets (Hitt & Pisano, 2003). The third type of investment, acquisitions, involves the purchase of all or part of the capital and can take the form of vertical, horizontal and holding company acquisitions (Aalioua, 2019). Buyout investments have been criticized in some countries for being less conducive to economic development, employment and production capacity compared to investments in the creation of new enterprises (United Nations Conference on Trade and Development, 2000).

2.2. Strategic Importance of Foreign Direct Investment

Since the 1980s, with the removal of barriers to international capital flows, FDIs have increased, national firms have internationalised, and host countries have begun to put various strategies in place to attract investment by not emphasising their superiority (Aalioua, 2019). Especially developing countries, where raw materials and labour are cheap, have started to provide facilities to investors to attract foreign investments (Alparslan, 2019). Thus, by transferring capital and technology through FDI, an increase in production was realized and contribution was made to the current account balance (Akman, 2019).

Thanks to the production made in the country with FDIs, employment is provided, export data increase and economic growth can be achieved and stabilized (Akman, 2019). Domestic businesses in the host country may also benefit from new technology, marketing know-how, and skilled labour (Javorcik, 2004) brought into the country by capital flows (Jayaraman, 1998). Investing enterprises can more easily find markets for their products and, thanks to their foreign connections, they can produce

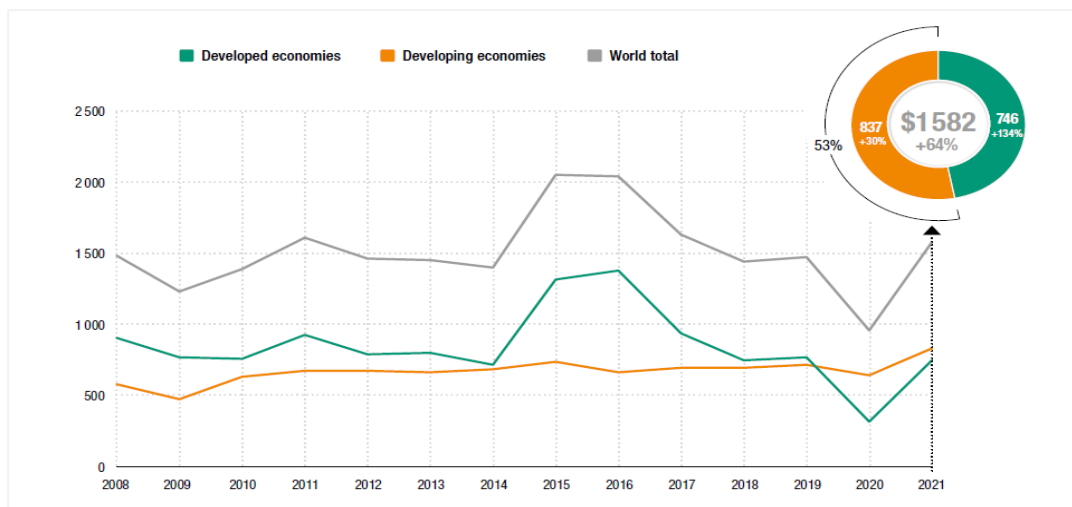
and export their products in that country. Thus, the host country can reach new markets and gain a larger share of the global economy (Kurtaran, 2007) and domestic firms can increase their exports (Harding & Javorcik, 2012). However, in order to compete with firms in the host country, the FDI enterprise may need to produce higher quality products and sell them at more economic prices. While this is highly advantageous for the welfare of host country citizens, it can put domestic businesses in a difficult competitive position. Moreover, the host country can sometimes be criticized for being technologically dependent on FDI (Alparslan, 2019).

2.3. Global Foreign Direct Investment

Global foreign direct investments (GFDI), which were 24 billion dollars in the 1970s, increased to 93 billion dollars with the liberalization movements that emerged with neoliberal policies in the 1980s (United Nations Conference on Trade and Development, 2002). In 2007, FDIs reached a peak of 1.83 trillion dollars (United Nations Conference on Trade and Development, 2008), and in 2018, they decreased by 13 percent compared to the previous year to 1.3 trillion dollars (United Nations Conference on Trade and Development, 2019). Foreign investments, which sometimes experience such fluctuations depending on economic developments, were also adversely affected by the Covid 19 pandemic worldwide and fell below 1 trillion dollars with a contraction of 42%. This rate was below 30 percent even during the 2008-2009 crisis

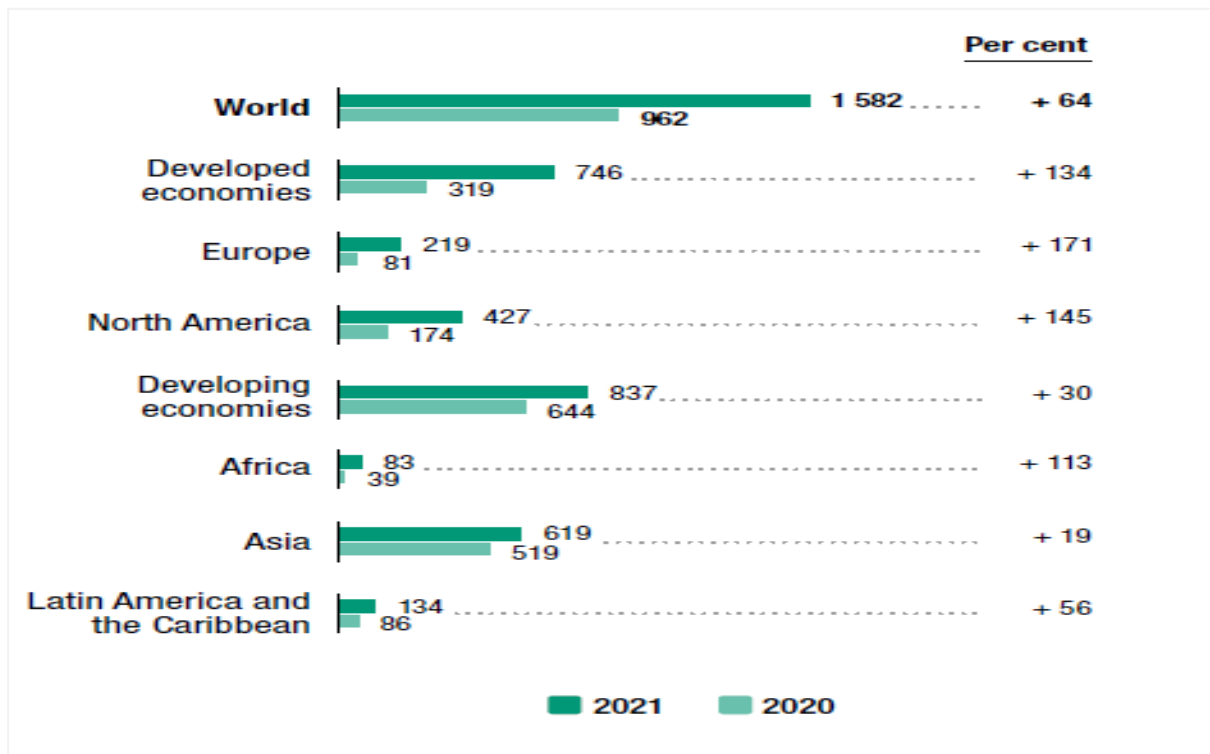
As seen in Figure 1 and 2, foreign investments surpassed the contraction caused by the pandemic in 2021, increasing by 64% to \$1.58 trillion. Since developed countries are generally successful in attracting foreign investments and receive a large share of global foreign investments, the figure of foreign investments worldwide and the graph of developed countries are very similar. Since the shares of developing countries in total foreign investments are at lower levels, there is no significant fluctuation in the Figure 1.

Figure 1. According to Global and Economic Grouping, 2008–2021 FDI Inflows (Billion Dollars / %)



Source: United Nations Conference on Trade and Development, 2022

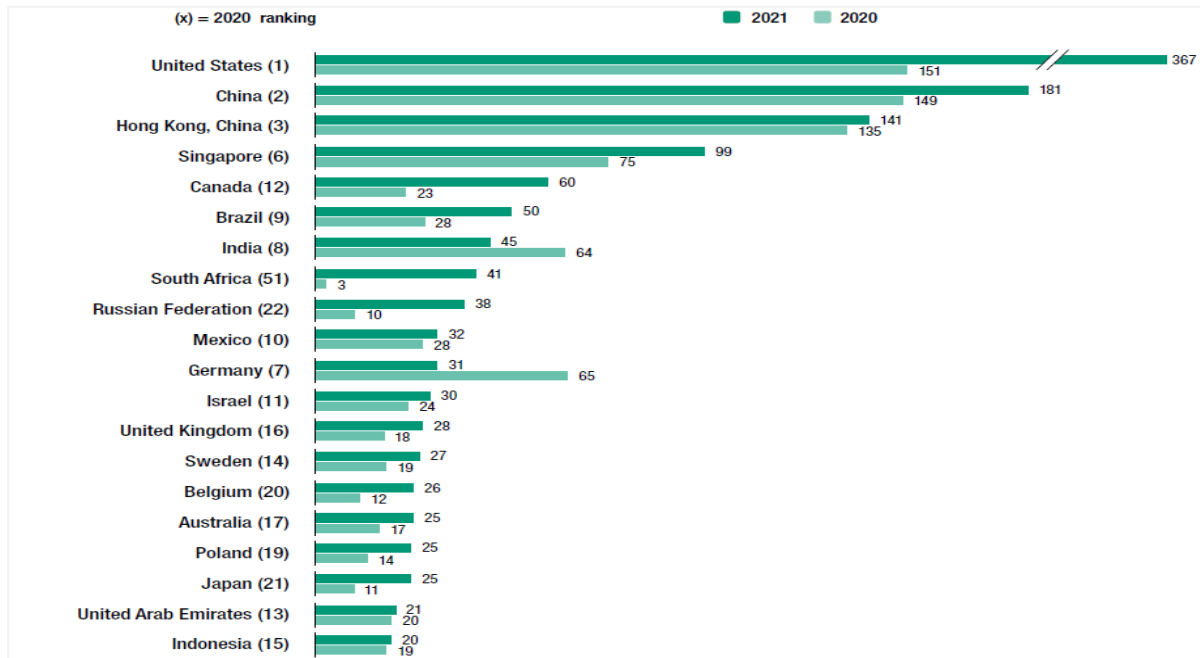
Figure 2. FDI Inflows by Region, 2020–2021 (Billion Dollars / %)



Source: United Nations Conference on Trade and Development, 2022

Figure 3 shows the rankings and shares of the top twenty countries in attracting foreign investment in the world. While there is no change in the ranking of the top three successful countries in attracting FDI in 2020-2021, the rankings of other countries may change from time to time. It is also seen in the data that FDIs, which are among the development strategies of countries, are not evenly distributed among countries. The USA is the country that attracts the most FDI, especially since the bonds and bills issued by the USA attract many investors. At the same time, the USA is the country that makes the most FDI. China, another successful country in attracting foreign investment, has started to attract more foreign investment since the 2000s by providing incentives to foreign investors with its huge population, cheap labour and natural resources after becoming a member of the WTO in 1991 and has achieved rapid growth. In addition, countries such as India, South Korea and Singapore are also successful in attracting foreign investment and are among the leading countries that have shown great development (Uslu, 2018).

Figure 3. Top 20 Countries with the Highest FDI Inflow (Billion Dollars)



Source: United Nations Conference on Trade and Development, 2022

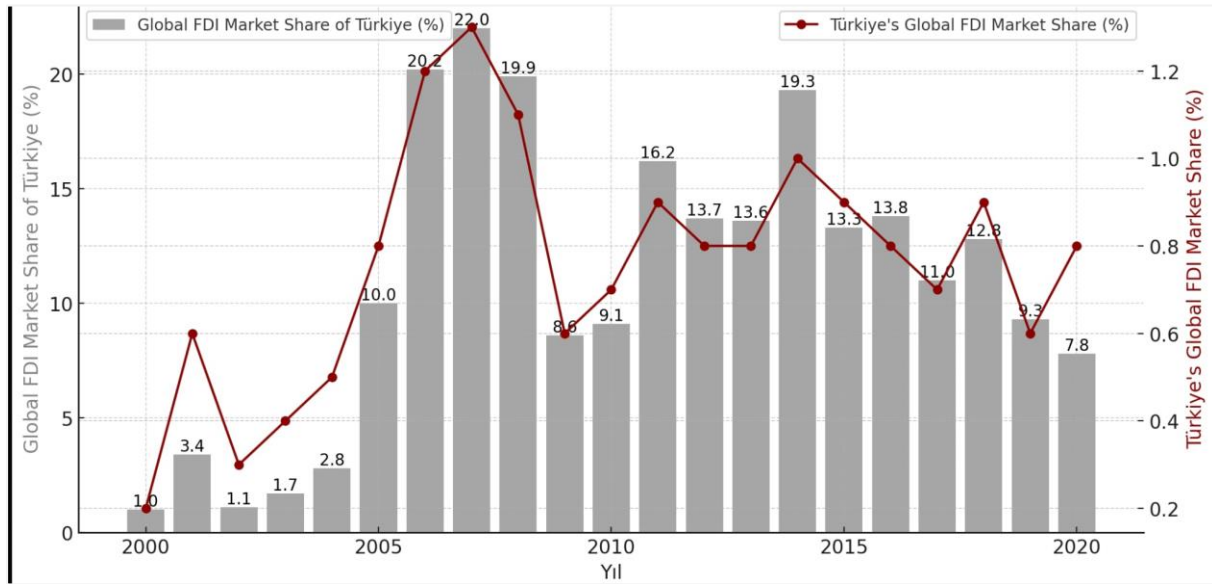
2.4. Developments in Türkiye's Foreign Direct Investments

During the Ottoman Empire, FDI first started with the construction of railways by British, German and French enterprises, and they were encouraged in the years when the Republic was established. Mustafa Kemal Atatürk also stated at the 1st Turkish Economic Congress that he was not against foreign capital and supported foreign investments made jointly with Turkish Citizens. In this regard, 66 of 201 companies were established between 1923 and 1930 as joint ventures of domestic and foreign businesses (Kepenek, 2003). Türkiye is among the major markets due to its geographical location and market size. In this respect, it is an advantageous country in terms of FDI. In terms of labour force, which is one of the most important criteria for attracting FDI, Türkiye attracts the attention of investors with its cost advantage compared to other countries, as well as with its young and educated population of more than 30 million (Akman, 2019).

In Türkiye, which has made significant progress in attracting FDI in recent years, the first regulation on foreign investments was enacted in 1954 as the "Foreign Capital Encouragement Law" (State Planning Organization, 2000). This law provided foreigners various legal guarantees regarding their investments and allowed them to make all kinds of investments independently of domestic investors (State Planning Organization, 2000). However, despite this change, FDI inflow did not reach the expected level until the 1980s. However, after the 1980s, with the regulations in the foreign capital law and international liberalization movements, there has been a partial increase in FDI inflows. Türkiye's share in global FDI inflows, which started to increase especially after the 2000s, is presented in Figure 4. The amount of FDI, which was below 1 billion dollars before the 2000s, was realized at the levels of 1-3 billion dollars in the early 2000s and reached the highest level in the country's history with

22 billion dollars in 2007 (Alparslan, 2019). The new regulation made in 2003 in the FDI Law No. 4875 has a great share in achieving these data. With this regulation, investments made by Turkish citizens residing abroad started to be considered as foreign investments (Özen & Kıdemli, 2020). Large privatization transactions such as Aliğa Petkim and Türk Telekom had an impact on the increase in the amount of FDI in the 2005-2008 period (Uslu, 2018). The sharp decline in 2009 was caused by the worldwide economic crisis, while the decline in 2019-2020 was caused by the global pandemic.

Figure 4. Türkiye's Share in the Global FDI Market (2000-2020, Trillion USD, %)



Source: Investment Office of the Presidency of the Republic of Türkiye, 2022

The share received from global foreign investments varies throughout the world from year to year. Türkiye's foreign investment share has generally remained below 1%, except for certain periods (Investment Office of the Presidency of the Republic of Türkiye, 2022). Türkiye's target of had a 1.5% share of global FDI and was among the top 10 countries attracting the most foreign capital (International Investors Association, 2022) had expected to increase the transaction volume of foreign investments in mergers and acquisitions between 2014 and 2019. and their numbers are given in Table 1. According to the report published by Deloitte, 108 transactions with a transaction volume of 5.7 billion dollars were carried out in 2022 with the initiative of FDI in the form of mergers and acquisitions.

Table 1. Mergers and Acquisitions by Foreign Investors in Türkiye between 2014-2022 (Billion Dollars)

	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of Transactions	113	125	93	70	74	71	82	86	108
Transaction Volume	8.0	11.5	3.8	5.5	7.6	3.4	4.6	5.9	5.7

Source: Deloitte, 2023

Table 2 contains information on the distribution of foreign investments in Türkiye according to other countries. The largest investment in Türkiye was made by the Netherlands, followed by Ireland, Germany and China, respectively.

Table 2. Distribution of Foreign Direct Investments to Türkiye by Country

Rank	Countries	2022 FDI	2023 FDI January
		(Million Dollars)	(Million Dollars)
1	Netherland	863	76
2	Ireland	371	44
3	Germany	697	23
4	China	83	15
5	Spain	1.592	14
6	Russia	22	11
7	Taivan	112	10
8	Hong Kong	50	8
9	Switzerland	738	7
10	United States of America	257	7
11	Italy	230	6
12	Luxembourg	295	6
13	England	401	5
14	Sweedden	20	5
15	United Arab Emirates	20	4
16	Belgium	82	3
17	Jersey	0	3
18	Uzbekistan	0	2
19	Austria	193	1
20	Libya	0	1
	LIST TOTAL	6026	251
	TOTAL	6506	253

Source: Central Bank of The Republic of Türkiye, 2023b

Table 3 shows the sectoral distribution of FDI flows to Türkiye. While the investments made until the 2000s were dominated by industry, the services sector, including transportation and storage, has come to the forefront since these years. While 73% of the investments made in 2021 belonged to the service sector, this rate decreased to 70% in 2022. Therefore, the service sector is one of the critical sectors for FDI inflows to the country.

Table 3. Distribution of Direct Investments of Non-Residents in Türkiye by Sectors

	TOTAL (Million USD)	AGRICULTURE SECTOR (Million USD)	INDUSTRIAL SECTORS (Million USD)	SERVICES SECTOR (Million USD)	A. Transport and Storage (Million USD)
2022	6,506.00	107.00	1,851.00	4,548.00	80.0
2021	7,098.00	148.00	1,850.00	5,100.00	216.0
2020	5,791.00	17.00	1,188.00	4,586.00	576.0
2019	5,881.00	23.00	2,106.00	3,752.00	274.0
2018	6,699.00	34.00	2,706.00	3,959.00	629.0
2017	7,401.00	29.00	2,022.00	5,350.00	1,333.0
2016	7,579.00	38.00	3,120.00	4,421.00	635.0
2015	12,181.00	31.00	5,785.00	6,365.00	1,524.0
2014	8,632.00	61.00	4,258.00	4,313.00	594.0
2013	10,523.00	47.00	5,390.00	5,086.00	364.0
2012	10,761.00	43.00	5,480.00	5,238.00	130.0
2011	16,136.00	32.00	8,040.00	8,064.00	221.0
2010	6,256.00	81.00	2,887.00	3,288.00	183.0
2009	6,266.00	48.00	3,887.00	2,331.00	230.0
2008	14,748.00	41.00	5,187.00	9,520.00	96.00
2007	19,137.00	9.00	5,037.00	14,091.00	679.0
2006	17,639.00	6.00	2,988.00	14,645.00	453.0
2005	8,535.00	5.00	908.00	7,622.00	21.00

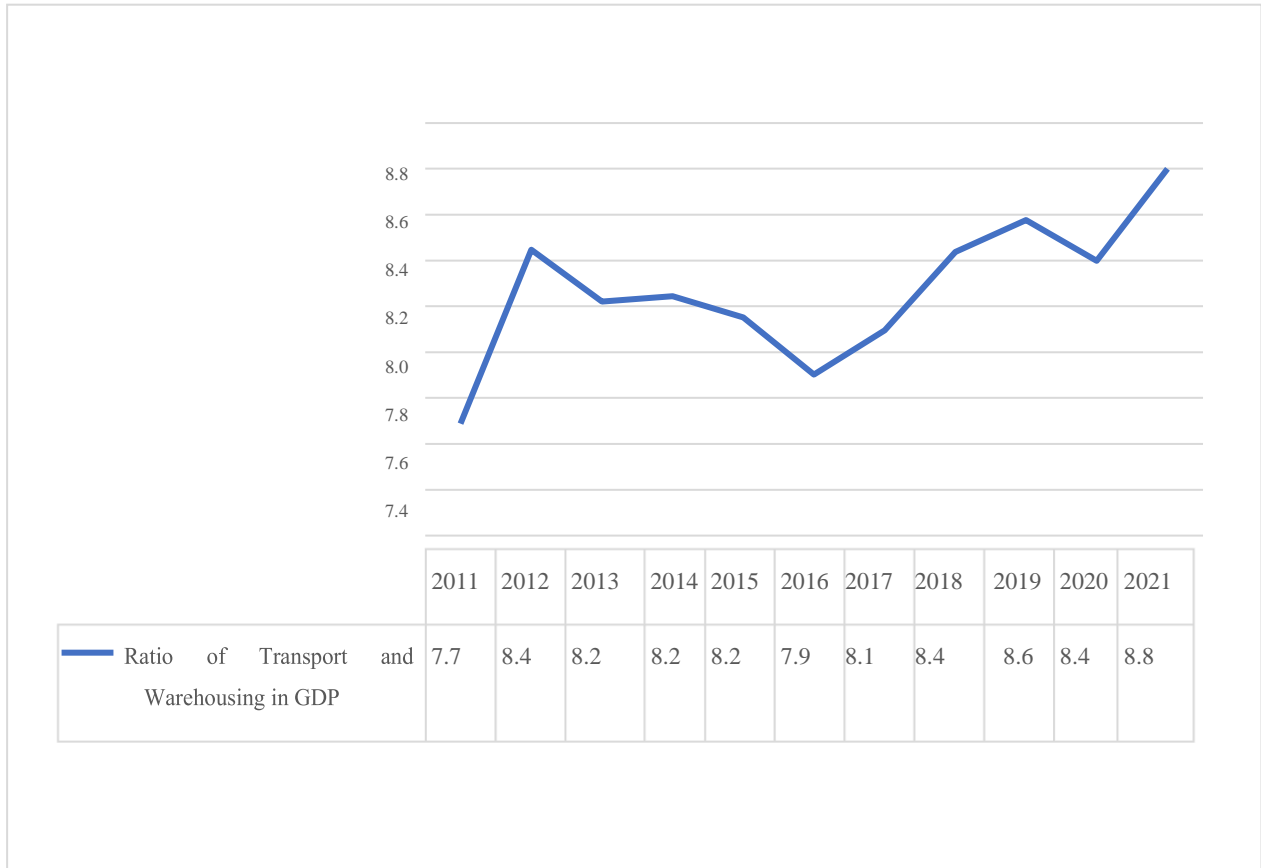
Source: Central Bank of The Republic of Türkiye, 2023a

3. EVALUATION OF TÜRKİYE'S LOGISTICS SECTOR, GDP, EXPORTS AND GLOBAL COMPETITION INDEX DATA

After tourism, one of the sectors with the greatest expectations for Türkiye to achieve its export targets is the logistics sector. Therefore, transportation and communication investments have the largest share among public investments in the logistics sector. In 2022, the largest investment was made in the transportation and communication sectors with 49,746,105 (thousand TL) and 27% share (Republic of Turkish Strategy and Budget Presidency, 2022). The logistics sector, which has a global market of 10.68 trillion dollars as of 2022, is one of the promising and fast-growing sectors in Türkiye and the world. The share of the logistics sector (International Transportation and Logistics Service Producers Association, 2022), which is expected to reach 18.23 trillion dollars in 2032, in Türkiye's GDP is shown in Figure 5. Since 2017, the logistics sector has continuously contributed more than 8% to GDP and made the largest contribution with 8.8% in 2021. On the way to becoming a leading country and logistics hub in the region on a global base in the field of transportation and logistics, Türkiye's 2053 target of 1 trillion dollars in exports needs to be achieved by improving logistics infrastructure, increasing efficiency and productivity, and reducing costs. In this direction, it is aimed that the investments to be made until 2053 will contribute to the national income at the level of 1 trillion dollars, that is,

investments can contribute more than 5 times more than now (Turkish Exporters Assembly, 2022). Therefore, with the investments in the sector at future, this ratio is expected to increase further and contribute more to GDP.

Figure 5. Share of Transportation and Storage in GDP

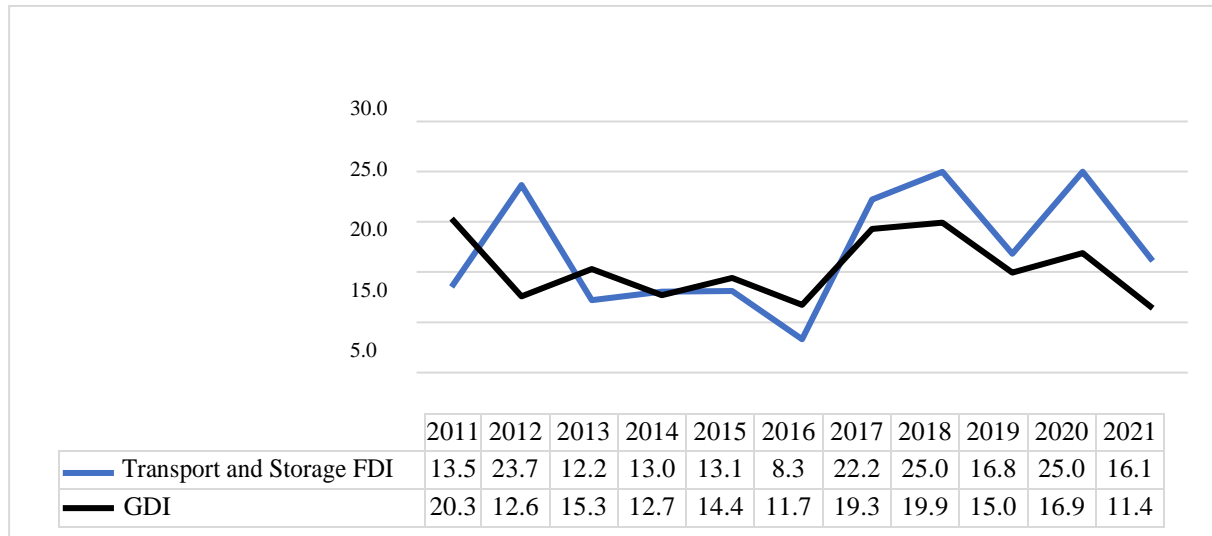


Source: Turkish Statistical Institute, 2022

Figure 6 shows a comparison of the transportation and storage sectors and GDP growth rates. These mentioned sectors include not only freight-related activities but also passenger transportation activities.

Especially since 2017, the sector has grown above the GDP growth rate. This reveals the importance of investments in the sector for the country's growth rates. In addition, it is one of the leading sectors in terms of providing foreign currency inflow to the country within service exports. As of 2021, while GDP had a growth rate of 11.4%, growth rate of the sector reached 16.1%, which rate is less than the transportation and storage sector.

Figure 6. Comparison of Transportation and Storage (H) Sector and GDP Growth Rates



Source: Turkish Statistical Institute 2022 (GDP at Current Prices).

Table 4 shows Türkiye's export data. Service exports make a significant contribution to Türkiye's exports which have reached over 254 billion dollars in 2022, in 2022 service export increased by 47%, reached 90.3 billion dollars. The major contribution to service exports was made by the transportation sector, with a data exceeding 21 billion dollars and a rate of 70.2% as of 2021. The transportation sector which is significant for service exports, contributes more than each day to Türkiye's export targets. The sector is one of the important sectors, that can be effective in increasing Türkiye's 1.27% share in global service exports.

Table 4. Türkiye 2005-2022 Export Data (Value: Thousand US\$)

Year	Export Value	Change (%)
2005	73,476,408	16.3
2006	85,534,676	16.4
2007	107,271,750	25.4
2008	132,027,196	23.1
2009	102,142,613	-22.6
2010	113,883,219	11.5
2011	134,906,869	18.5
2012	152,461,737	13.0
2013	161,480,915	5.5
2014	166,504,862	3.1
2015	150,982,114	-9.3
2016	149,246,999	-1.1
2017	164,494,619	10.2
2018	177,168,756	7.7
2019	180,832,722	2.1
2020	169,637,755	-6.2
2021	225,214,458	32.8
2022	254,191,555	12.9

Source: Turkish Statistical Institute, 2022

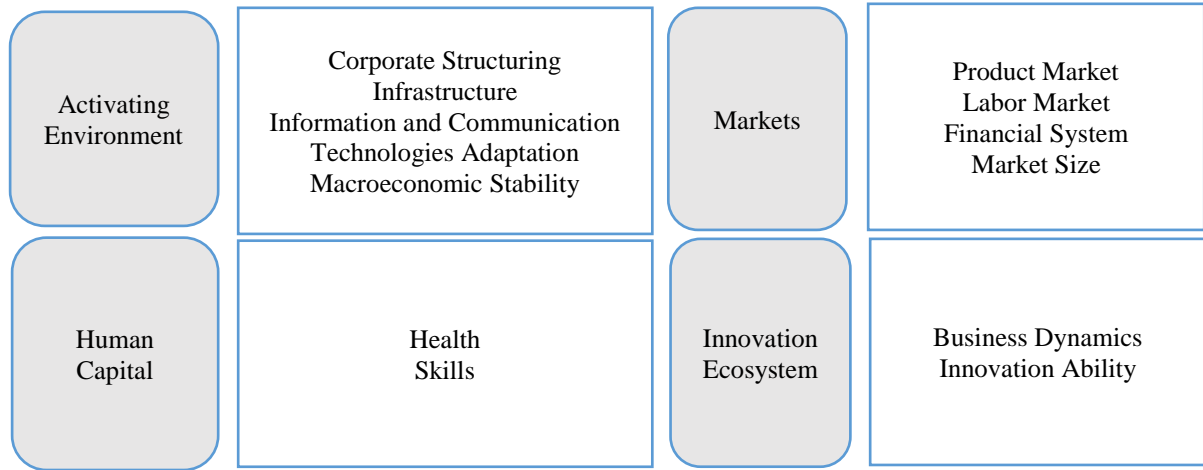
The Global Competitiveness Report, which has been published by the World Economic Forum under the name "Global Competitiveness Report" since 1979, was renamed the "GCI 4.0" in 2018 to ensure compliance with the current economic structure. In this framework, to determine the global competitiveness of countries, twelve criteria related to Industry 4.0, which is very important for the economy, were added under four headings for the creation of the report. In the prepared reports, the strengths and weaknesses of the countries are evaluated to scoring on the basis of criteria and countries are ranked with a comprehensive and regular analysis according to the average of 12 criteria. Approximately 15 thousand enterprises were subjected to the questionnaire for the preparation of the report. In addition, data published by relevant countries and international organizations were also used to evaluate and calculate scores of the countries. In the recently published 2019 report, 141 countries, which account for 99% of the total global GDP, were evaluated and included in the report (World Economic Forum, 2019). The criteria by which countries are evaluated are shown in Figure 7 and Türkiye's index scores and ranking are shown in Table 5.

Table 5. Global Competitiveness Index Türkiye Score and Ranking

Year	Score	Ranking
2019	62.1	61
2018	61.6	61
2017	4.42	53
2016	4.39	55
2015	4.37	51
2014	4.46	45
2013	4.45	44
2012	4.45	43
2011	4.28	59
2010	4.25	61
2009	4.16	61
2008	4.15	63
2007	4.25	53
2006	4.14	59
2005	4.1	71

Source: World Economic Forum, 2019

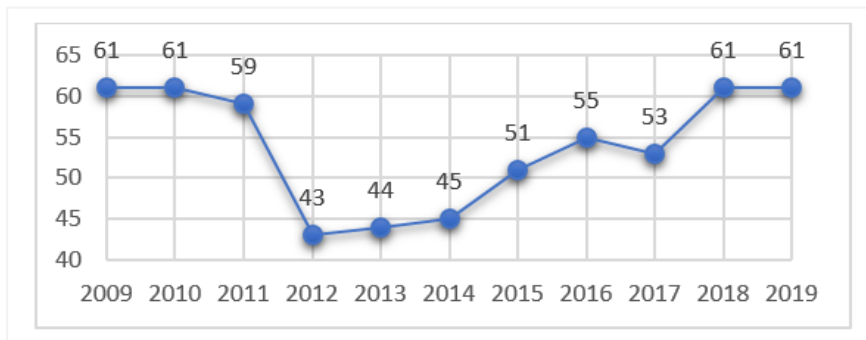
Figure 7. Headings and Subheadings of the Global Competitiveness Index Assessment



Source: World Economic Forum, 2019

Türkiye's ranking in the index is presented in Figure 8. According to this figure, while Türkiye ranked 61st in 2018 and 2019, it is also seen that there was an improvement from time to time in the previous 10-year period. In the report, Türkiye scores highest on the market size criterion and worst on the macroeconomic stability criterion. The index, which also identifies weaknesses and strengths in terms of competitiveness, is very important for the country. In addition, by making comparisons with countries such as Singapore, the USA, and Hong Kong, which rank in the top three in terms of the criteria determined, it is possible to direct the necessary investments to these areas. Especially by focusing on the innovation criterion, competitiveness can be increased by ensuring that enterprises and the country achieve sustainable economic growth. In addition, in the infrastructure criterion, factors such as quality roads, railways, ports, air transportation and safe and timely delivery of goods and services are evaluated and scored, which are also very important for the effective functioning of the logistics sector and the economy (Erat & Demirkanoğlu, 2021). Therefore, improvements in these areas can be effective both in raising the country's score and in the growth of the sector and its contribution to exports and GDP. However, Türkiye has made limited progress in the infrastructure criterion. Therefore, the infrastructure needs to be supported by investment.

Figure 8. Türkiye's Global Competitiveness Index Ranking



Source: World Economic Forum, 2019

The Global Competitiveness Index is an important report that countries take into account in their logistics-related decisions, as well as in FDI in the sector and in the decision-making of investors (Investment Office of the Presidency of the Republic of Türkiye, 2022). Because the report provides critical services to investors in terms of ensuring sustainable growth with more realistic data on the business environment and economic productivity of countries (Schwab, 2019). Thus, by analysing the report, investors have information on many issues about the country they can invest in and decide whether to invest or not. Therefore, improving the score and ranking in the report for Türkiye would be beneficial for both FDI in the logistics sector and FDI in other sectors.

4. PURPOSE AND IMPORTANCE OF THE STUDY

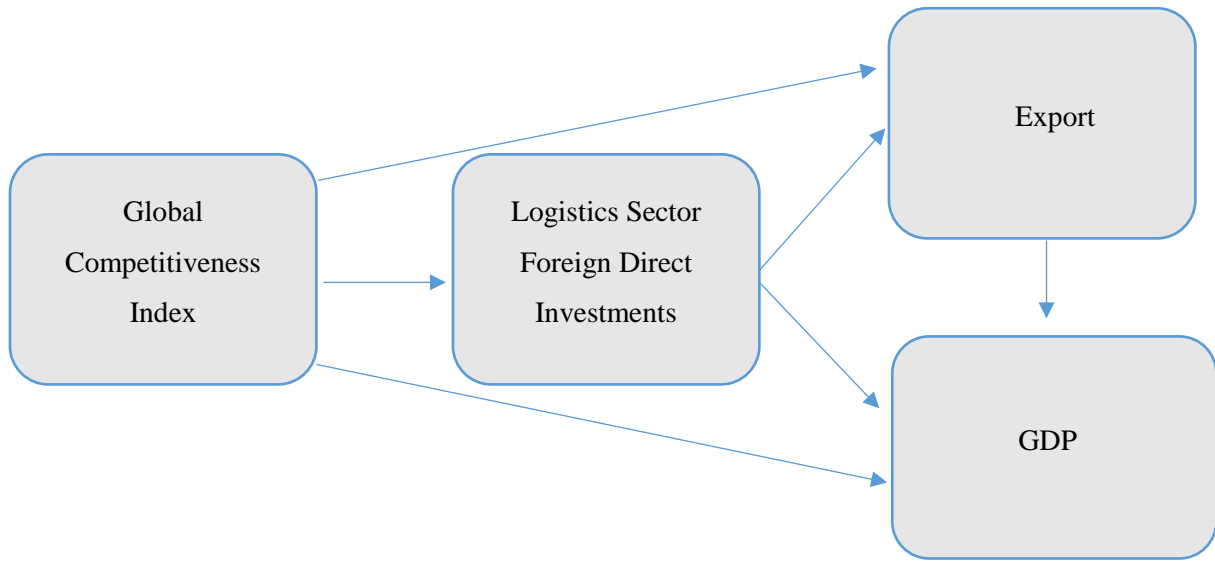
For developing countries like Türkiye, exports, GDP and FDI are very important. The global competitiveness index, which influences the decisions of investors in investments to be made on a global basis, is also an important report that should be considered in ensuring stable growth. In this framework, the aim of the research is to investigate the relationship between Türkiye's global competitiveness index ranking and exports and GDP data and whether there is a mediating role of foreign direct investments in the logistics sector in this relationship. Since the determined variables are of critical importance for the country's economy, the determination of the relationship between them can be important for the decisions on these issues. Although there are many studies on foreign direct investments in the literature, there is a limited number of studies on foreign investments in the logistics sector. Conducting a research on foreign investments in the sector can contribute to both the literature and the sector. In addition, there is no study investigating the relationship between the variables determined in the literature in the intermediary variable dimension. For this reason, a new model can be introduced to the literature with the research to be conducted and contributions can be made to the researchers in this regard in the future studies.

5. RESEARCH MODEL, HYPOTHESES AND DATA SET

The model was created as shown in Figure 9 by examining the domestic and foreign literature on the subject. It has been determined that studies on foreign direct investments have attracted interest by researchers. However, studies on foreign investments in the logistics sector, which serves many sectors, has the potential to become a logistics base with the advantage of geographical location, has been the largest share among Türkiye's public investments for years and has strategic importance in achieving the country's economic goals, have remained very limited (International Transportation and Logistics Service Producers Association, 2022). In addition, there is no study investigating the relationship between the global competitiveness index, which has a great impact on investors' decisions and provides investors with information about countries (Investment Office of the Presidency of the Republic of Türkiye, 2022), and foreign investments in the logistics sector, which is one of the promising sectors that has been growing over the years in the world as well as in Türkiye. Since foreign direct investments to be made in the logistics sector, where there is a great expectation for Türkiye to achieve

its export targets, are of strategic importance for the country to achieve its export and growth targets, these variables are included in the research model. In the literature, there is no study investigating the mediating variable dimension the relationship between exports, GDP, FDI and global competition index, which have a great impact on the decisions of foreign investors, which are very important for countries to achieve their strategic, political and economic goals. Therefore, these variables are included in the model and it is aimed to obtain important results for the country's economy by presenting an original study.

Figure 9. Research Model



In the study, Türkiye's Global Competitiveness Index data published by the World Economic Forum for the years 2005-2019, foreign direct investment data for the Transport and Storage Sector published by the Central Bank, GDP data published by the World Bank and export data published by Turkish Statistical Institute (TURKSTAT) were used. While the Global Competitiveness Index was calculated as two separate indices as business competitiveness and growth competitiveness before 2005, it has been updated since this year and started to be published as a single index under the name of global competitiveness index. Since the last year data was published in 2019, the study is limited to the years 2005-2019. In addition, since the global competitiveness index scoring system changed in 2018, the study is based on this ranking. Foreign direct investments in the logistics sector are also referred to as foreign direct investments in the transport and storage sector in the Central Bank.

As a result of the review of national and international literature related to the research, 10 main hypotheses were determined in line with the model developed for the purpose of the research. It has been reported in different studies that the variables used in the global competitiveness index are effective on exports and that there is a strong relationship between global competitiveness and export performance (Öztürk & Kurt, 2023; Madzova, 2018; Akhuand & Abbas, 2023). In this direction, the hypothesis "H1: There is a relationship between global competitiveness index ranking and exports" was formed to

determine the relationship between global competitiveness index ranking and Türkiye's exports in the determined periods.

The impact of foreign direct investments on the exports of the investing country is expressed by product life cycles, flying geese model and new growth theories. These theories emphasize that foreign investments have a positive, direct and indirect effect on a country's exports. The relationship between FDI and exports has been widely examined in the literature, and there are studies that find a relationship between the variables (Kutan & Vuksic, 2007; Temiz & Gökmen, 2009; Prasanna, 2010; Zhang, 2005; Njong, 2008; Pacheco-Lopez, 2005). There are also a small number of research results indicating that there is no relationship between FDI and export rates (Yılmaz, 2010; Gerni et al., 2014; Kıran, 2011; Prasanna, 2013). However, there is no study examining the relationship between FDI in the logistics sector and exports. In this framework, the hypothesis “H2: There is a relationship between transportation and warehousing FDI and exports” formed to determine whether there is a relationship between transportation and warehousing FDI and exports.

Achievements in the global competition index are expected to contribute to an increase in foreign investments in the transportation and storage sector. Therefore, improvements to be made in the global competition index in terms of Türkiye's goal of becoming a logistics hub can contribute to the growth and development of the sector. Since the logistics sector serves many sectors, success in the index can indirectly contribute to many sectors. In this framework, it has been wondered whether the achievements in the index contribute to transportation and warehousing FDI and the hypothesis “H3: There is a relationship between global competition index ranking and Transportation and Warehousing FDI” was formed.

The Global Competitiveness Index provides users with a comprehensive dataset on the competitiveness indicators of industrialized and developing economies. The countries included in the rankings account for approximately 98% of the world's total gross domestic product. To determine whether Türkiye's success in the index contributes to GDP, the hypothesis “H4: There is a relationship between global competitiveness index ranking and GDP” was formed.

According to the export-led growth approach, exports are the locomotive of economic growth since an increase in exports leads to an increase in production and employment (Ramos, 2001 p. 613). The Keynesian approach, the theory that exports bring positive externalities, the theories stating that technological development and growth can occur by creating economies of scale are among the theories that support the export-led growth hypothesis. In line with these theories, the hypothesis “H5: There is a relationship between exports and GDP” was formed to determine the relationship between exports and GDP.

FDI has become increasingly important due to the competition caused by globalization. Developing countries, where international competition has emerged as a result of the widespread free

market system, have had to increase their export capacities in order to meet their foreign exchange requirements. Multinational companies, which have a high share in international goods and services markets, contribute positively to the export revenues of the host country through FDI. The theoretical foundations of this idea are based on the Product Life Cycle approach developed by Vernon (1966). According to this approach, a developed country that develops a new product first introduces it to the domestic market. Then, this product, which is determined to be suitable for consumption, starts to be exported. While exporting over time, the developed country aims to make a profit by reducing the costs of production since its own labour and production costs are high, and for this purpose, it establishes factories in developing countries through FDI or carries out certain stages in developing countries through the global supply chain. In the literature, the results of the studies investigating the impact of FDI on GDP are widely concluded that there is an effect (Gunaydin & Tatoglu, 2005; Albulescu, 2015; Ekinci, 2011; Mehicet al., 2013; Omri & Kahouli, 2014; Raza et al., 2021). However, there are also rare studies that conclude that there is no effect (Naveed & Shabbir, 2006; Belloumi, 2014; Zhao & Du, 2007; Har et al., 2008). In this direction, the hypothesis “H6: There is a relationship between Transportation and Warehousing FDI and GDP” was formed to determine the relationship between Transportation and Warehousing FDI and GDP in the determined periods.

In the literature, researches on the relationship between global competitiveness index ranking, export rates and GDP variables have attracted a great deal of attention from researchers. As explained before, different results have been reached in the research results. However, it has been determined that the issue has not been examined more specifically and limitedly on a sectoral basis and there are no studies examining the mediating role in the literature. In this context, the hypotheses “H7: Transportation and Warehousing FDI has a mediating role in the relationship between exports and GDP, H8: Transportation and Warehousing FDI has a mediating role in the relationship between global competitiveness index ranking and GDP, H9: Transportation and Warehousing FDI has a mediating role in the relationship between global competitiveness index ranking and exports” were formed to determine whether Transportation and Warehousing FDI plays a mediating role in the relationship between other variables. In addition, to determine whether there is a mediating role of exports in the relationship between Transportation and Warehousing FDI and GDP, the hypothesis “H10: There is a mediating role of exports in the relationship between Transportation and Warehousing FDI and GDP” was formed.

It was examined whether the dependent and independent variables used in the research were normally distributed. The descriptive statistics, Jarque-Bera test statistic, skewness and kurtosis values obtained as a result of the analysis in this framework are presented in Table 6. Skewness values between +1.5 and -1.5 (Tabachnick et al. 2013), +3.0 and -3.0 (George, & Mallery, 2010), which are examined in order to evaluate the suitability for normal distribution, mean that the data conform to normal distribution. In addition, variables with significance values of Jarque-Bera test statistic less than 0.05 significance level do not show normal distribution. Accordingly, the p-values of the Jarque-Bera test

statistic of the variables whose logarithms are taken from Table 6 are greater than 0.05 and it is understood that they meet the normality assumption.

Table 6. Descriptive Statistics of Variables and Jarque-Bera Test Statistic Results

Analysis	Mean	Median	Max	Min	Sd	p	Skewness	Kurtosis	Jarque-Bera	P value
Export	18.78	18.84	19.35	18.11	0.32	0.7089	-0.4200	0.1682	0.5503	0.7595
Transportation and Warehousing	5.70	5.76	7.33	3.04	1.06	0.4771	-0.7501	0.9444	2.3571	0.3077
Ranking	4.02	4.08	4.26	3.76	0.15	0.2038	-0.4807	-0.4443	0.7012	0.7043
GDP	6.65	6.68	6.86	6.23	0.17	0.0514	-1.1906	1.0784	5.1245	0.0771

6. FINDINGS OF THE RESEARCH

In the study, Structural Equation Modelling (SEM) was used to determine the logistics sector FDI data of mediating role at the relationship of the independent variable GCI ranking and on the dependent variable exports and GDP data. For processing data, SAS statistical software package (Version 9.4) was used.

Table 7 shows the indices related to the fit of the model to the data. When the index values are equal to 1, it indicates that the model created in the research fits the data perfectly. In addition, the Root Mean Square Residual (RMR) value of 0 indicates an excellent fit. As the SRMR (Standardized RMR) value approaches 0, the goodness of fit of the model increases.

Table 7. Model Fit Test

Fit Summary		
	Root Mean Square Residual (RMR)	0.0000
	Standardized RMR (SRMR)	0.0000
	Goodness of Fit Index (GFI)	1.0000
	McDonald Centrality	1.0000
Incremental Index	Bentler Comparative Fit Index	1.0000
	Bentler-Bonett NFI	1.0000
	Bollen Non-normed Index Delta2	1.0000

Table 8 shows the results of which variables in the covariance matrix are well predicted by the model and which variables are not. Since the model fits the data perfectly, the standardized matrix values of all variables are calculated as 0.

Table 8. Standardised Matrix Values of Variables

Asymptotically Standardized Residual Matrix				
	Global Competitiveness Index Ranking	GDI	Export	Transport and Storage FDI
Global Competitiveness Index Ranking	0.000	0.000	0.000	0.000
GDI	0.000	0.000	0.000	0.000
Export	0.000	0.000	0.000	0.000
Transport and Storage FDI	0.000	0.000	0.000	0.000
MEAN	0.000	0.000	0.000	0.000

Table 9 includes unstandardised and standardised path coefficients, their standard errors p , t and, R^2 values. Figure 10 shows the standardised coefficient estimates of the relationships with their significance. There are direct and indirect effects of GCI ranking and direct effects of transport and storage FDI on Türkiye's export values. Only the GCI ranking has a direct effect on transport and storage FDI. GCI ranking, export values and transport and storage FDIs have a direct effect on GDP values. Transport and storage FDI and GCI ranking also indirectly affect GDP data.

The GCI ranking and transport and storage FDIs explain 39 percent of the total variance of the dependent variable exports ($R^2 = 0.3909$). GCI ranking alone explains 21% ($R^2 = 0.2144$) of the total variance of the dependent variable of transport and storage FDI. The effect of GCI ranking, export data and transport and storage FDI variables on the total variance of the GDP dependent variable is 86% ($R^2 = 0.8594$).

While international competition, which is the focus point of economic theories, is evaluated through comparative advantages in classical economic theories, it is explained by neo-classical economists through factors such as macroeconomic stability and technological development. It is stated that the variables used in the global competition index are also effective on exports and that there is a strong relationship between global competitiveness and export performance (Öztürk & Kurt, 2023; Madzova, 2018; Akhuand & Abbas, 2023). However, as a result of the research, it was determined that the global competitiveness index ranking does not have a statistically significant ($p = 0.0965$) effect on exports. Increase of performance in the global competitiveness index cannot contribute to the increase in exports. Therefore, the increase in the Global Competitiveness Index ranking did not have a positive effect on export data.

The impact of foreign direct investments on the exports of the investing country is expressed by product life cycles, flying geese model and new growth theories. These theories emphasise that foreign investments have positive, direct and indirect effects on country exports. In this study, it is concluded

that transport and storage FDI do not have a significant effect on export data ($p= 0.0886$). Therefore, it has been determined that foreign investments made in the transport and storage sector have no effect on the increase in Türkiye's exports in the specified years. In the literature, the relationship between FDI and exports has been widely examined and there are studies that determine that there is a relationship between the variables (Kutan & Vuksic, 2007 Temiz & Gökmen, 2009; Prasanna, 2010; Zhang, 2005; Njong, 2008; Pacheco-Lopez, 2005). However, the result similar to the result reached in the study was also found in a limited number of other studies in the literature (Yılmaz, 2010; Gerni et al., 2014; Kıran, 2011; Prasanna, 2013). Therefore, the relationship between FDI and exports may differ depending on the time period, country and sector analysed.

As a result of the analysis, it was determined that there is a statistically significant and negative relationship between Türkiye's global competitiveness index ranking and transportation and storage FDI ($p= 0.0225$) and GDP ($p= 0.0035$) at 5% significance level.

Export data have a statistically significant ($p= 0.0001$) effect on GDP data at 5% significance level and there is a positive relationship between them (0.7075). In the export-led growth hypothesis, exports are the locomotive of economic growth since an increase in exports leads to an increase in production and employment (Ramos, 2001 p. 613). Keynesian approach, the theory that exports bring positive externalities, the theories stating that technological progress and growth can be experienced by the formation of economies of scale are among the theories that support the export-led growth hypothesis. In this framework, the results of the research coincide with these theories and the increase in export data leads to an increase in GDP data. There is no statistically significant relationship between FDI in transport and storage sector and GDP data ($p= 0.6819$). It is concluded that foreign investments in the sector do not contribute to the increase in GDP data. In the literature, there are studies that investigate the effect of FDI on GDP and rarely conclude that there is no effect (Naveed & Shabbir, 2006; Belloumi, 2014; Zhao & Du, 2007; Har et al., 2008).

In order for transport and storage FDI to be an intermediary variable, it should be directly affected exports and GDP. The results of the analysis show that transport and storage FDI has no direct effect on exports (0.37) and GDP (-0.05). It was also revealed that there was no significant relationship between the variables. Therefore, it is proved that transport and storage FDI do not have a mediating role between the variables.

Table 9. Path Coefficients of Variables

Dependent Variable	Predictor	Unstandardized Effects				Standardized Effects				R ²	Tolerance	Variance Inflation (VIF)
		Estimate	Standard Error	t	p	Estimate	Standard Error	t	p			
Export	Intercept	20.9051	1.8947	11.033	<.0001							
Export	Global Competitiveness Index Ranking	-0.6811	0.4283	-1.590	0,1118	-0.3615	0.21752	-1.662	0.0965		0.785	1.272
Export	Transport and Storage FDI	0.0922	0.0567	1.624	0,1042	0.3694	0.21698	1.702	0.0886	0.3909	0.785	1.272
Transport and Storage FDI	Intercept	19.7882	6.9355	2.853	0,0043							
Transport and Storage FDI	Global Competitiveness Index Ranking	-3.4920	1.7260	-2.023	0,0431	-0.4630	0.20285	-2.282	0.0225	0.2144	1.000	1.000
GDP	Intercept	-0.3803	1.8573	-0.204	0,8377							
GDP	Global Competitiveness Index Ranking	-0.4661	0.1503	-3.100	0,0019	-0.3660	0.12541	-2.919	0.0035		0.672	1.487
GDP	Export	0.4781	0.0838	5.703	<.0001	0.7075	0.11724	6.035	<.0001		0.609	1.641
GDP	Transport and Storage FDI	-0.0082	0.0200	-0.411	0,6811	-0.0486	0.11876	-0.409	0.6819	0.8594	0.668	1.496

Figure 10. Trace Plot of Standardised Direct Effects Between Variables

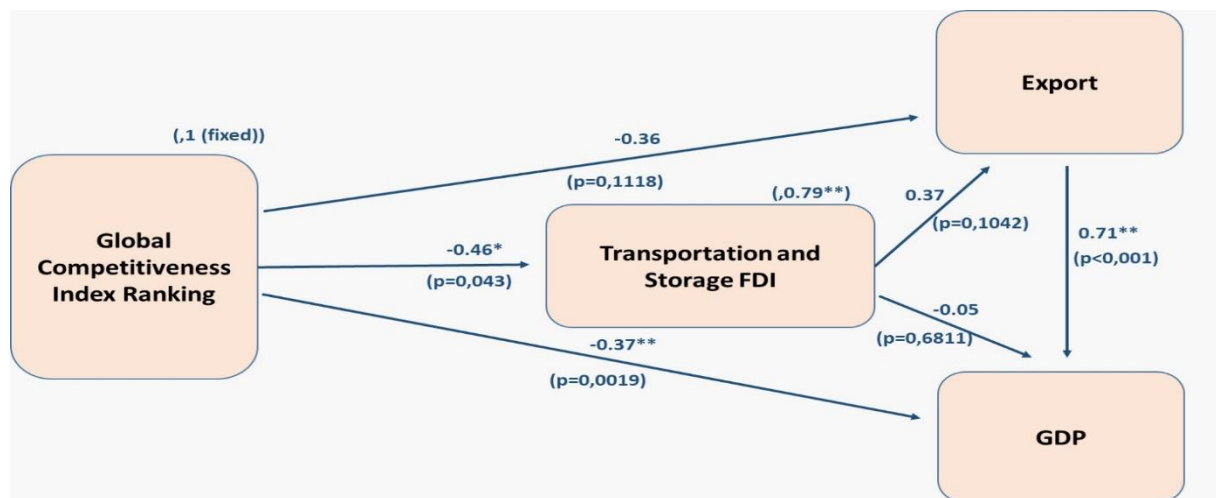


Table 10 shows the standardized direct, indirect and total effects obtained from path analysis. The total effects in this table are the sum of direct and indirect effects. These results show in detail that the structural equation model (SEM) impact analysis shows some impact structures that cannot be accurately analysed by linear regression analysis method. Therefore, this table presents more detailed results of SEM effect analysis and more refined results in terms of the overall theory. When Table 10 is examined in detail, it is seen that the statistical significance values for direct effects are the same as the standardized values in Table 9. Therefore, the interpretations of direct and total effects are the same as in Table 9. The most striking effect in Table 10 is the mediating effect of Transportation and

Warehousing FDI on the effect of global competitiveness index ranking on GDP ($t=-2.6894$, $p=0.0071$). Therefore, the result of the research shows that it is important to consider the FDI to be made to the sector in order to increase the GDP data. On the other hand, the mediating effects of Transportation and Warehousing FDI on the effect of global competitiveness index ranking on exports and also the mediating effects of exports on the effect of Transportation and Warehousing FDI on GDP are not statistically significant.

In the literature, there are studies that find positive and negative effects of the global competitiveness index on exports and FDI on country GDP, as well as studies that find no effect. The results obtained may differ depending on the period analysed the model used and the sector selected. The emergence of these results in the research may be due to the fact that FDI in the transportation and storage sector has a share of 3.8% in total FDI between 2005-2019, as well as the period examined (CBRT)

Table 10. Standardized direct, indirect and total impacts (Impact/Std Error/t Value/p Value)

	Standardized Direct Effects			Standardized Indirect Effects			Standardized Total Effects		
	Transporta- tion and Warehousing	Export	Ranking	Transporta- tion and Warehousing	Export	Ranking	Transporta- tion and Warehousing	Export	Ranking
GDP	-0.0487	0.7075	-0.3661	0.2614	0	-0.3543	0.2127	0.7075	-0.7204
	0.1188	0.1172	0.1254	0.1669		0.1317	0.1933	0.1172	0.1242
	-0.4099	6.0351	-2.9192	1.5663		-2.6894	1.1002	6.0351	-5.7996
	0.6819	<.0001	0.0035	0.1173		0.0071	0.2713	<.0001	<.0001
Transportation and Warehousing	0	0	-0.4630	0	0	0	0	0	-0.4630
			0.2028						0.2028
			-2.2825						-2.2825
			0.0225						0.0225
Export	0.3694	0	-0.3615	0	0	-0.1710	0.3694	0	-0.5326
	0.2170		0.2175			0.1263	0.2170		0.1850
	1.7026		-1.6621			-1.3545	1.7026		-2.8795
	0.0886		0.0965			0.1756	0.0886		0.0039

The results of the hypotheses tried to be true as a result of the analyses are given in Table 11.

Table 11. Hypothesis Results

Code	Hypothesis	Results
H1	There is a relationship between global competitiveness index ranking and exports.	Rejected
H2	There is a relationship between transportation and warehousing FDI and exports.	Rejected
H3	There is a relationship between global competition index ranking and Transportation and Warehousing FDI.	Not rejected
H4	There is a relationship between global competitiveness index ranking and GDP.	Not rejected
H5	There is a relationship between exports and GDP	Not rejected
H6	There is a relationship between Transportation and Warehousing FDI and GDP.	Rejected
H7	Transportation and Warehousing FDI has a mediating role in the relationship between exports and GDP.	Rejected
H8	Transportation and Warehousing FDI has a mediating role in the relationship between global competitiveness index ranking.	Not rejected
H9	Transportation and Warehousing FDI has a mediating role in the relationship between global competitiveness index ranking and exports.	Rejected
H10	There is a mediating role of exports in the relationship between Transportation and Warehousing FDI and GDP.	Rejected

To obtain valid and accurate results from the multivariate linear regression model obtained in the last step using the multivariate stepwise regression method, there are some assumptions that must

be met. The assumptions that the regression model used in this study must meet are the assumption of multicollinearity (VIF and Tolerance values), the assumption of normality of errors (residual values) (Kolmogorov-Smirnov test), the assumption of the mean of error values and the assumption of constant variance.

One of the assumptions that the linear regression models obtained in the research should meet is the assumption of multicollinearity (VIF and Tolerance values) and for this purpose, tolerance and VIF values were obtained. High VIF values and low tolerance values are indicators of multicollinearity. Variance inflation factors (VIF) should be less than 10 and tolerance value should be greater than 0.1. It is determined that the tolerance values of the three different regression models given in Table 9 are greater than 0.1 and the VIF values are less than 10. This shows that multivariate linear regression models do not have multicollinearity problem.

Moreover, in multivariate linear regression analysis, it is desirable that there is no strong correlation between independent variables. In order to investigate this situation, the Pearson correlation analysis results of all variables used in the study (Global competitiveness index ranking, Transportation and Warehousing FDI, Exports, GDP) are presented in Table 12. When the correlations of all variables with each other are analysed it is found that the highest correlation is between Exports and GDP ($r=0.7854$, $p=0.0001$) and Global competitiveness index ranking and GDP ($r=-0.7204$, $p=0.0001$). It is thought that a relationship of more than 85% between independent variables would cause the problem of multicollinearity. Therefore, it can be said that there is no serious multicollinearity problem between the independent variables used in the study.

Table 12. Pearson Correlation Analysis between Dependent and Independent Variables

	Export	Ranking	GDP	Transportation and Warehousing
Export	1.0000			
Ranking	-0.5326 0.0410	1.0000		
GDP	0.7854 0.0001	-0.7204 0.0025	1.0000	
Transportation and Warehousing	0.2419 0.3335	-0.4630 0.0822	0.3634 0.1383	1.0000

The mean errors for the three linear regression models presented in Table 9 are -0.05 ± 1.11 , -0.09 ± 1.20 and -0.05 ± 1.10 and the skewness values are close to zero, respectively. This means that the errors are approximately normally distributed with mean 0 and variance 1. White test was used for the constant variance assumption. This test tests the null hypothesis that the error variance is constant. Therefore, if the p value is very small, we should reject the null hypothesis in favour of the alternative hypothesis that the error variance is not constant. The White test results of the three regression models in Table 9 obtained in this study are $\chi^2(5) = 4.50$, $p = 0.4804$ $\chi^2(2) = 2.05$, $p = 0.3596$ and $\chi^2(9) = 6.68$,

$p = 0.6708$, respectively, and therefore the null hypothesis is not rejected. In other words, the model satisfies the constant variance assumption.

After estimating the model in regression analysis, whether the residual terms are correlated or not, i.e. whether there is a suspicion of auto-correlation or not, is tested by Durbin-Watson analysis. The Durbin-Watson test statistic takes values between 0-4 and when it takes a value of 2, it shows that there is no correlation between the error terms of the independent variables. It is desirable that the Durbin-Watson value, which indicates the auto-correlation value, is between 1.5 and 2.5. The Durbin-Watson values of the three separate regression analyses obtained in this study are 1.930, 1.525 and 1.564, respectively, which eliminates the suspicion of autocorrelation.

7. CONCLUSIONS

In order to increase FDIs, which are effective in the economic growth of countries, necessary amendments have been made in the relevant law from time to time in Türkiye. Despite these amendments, Türkiye, which has a great market potential and a favourable labour force in attracting foreign investments, has not received the desired level of foreign investment inflow. Türkiye has a target of 1.5 percent share of foreign investments and ranking among the top 10 countries. In order for Türkiye to reach this target, it should have a good score and ranking in the GCI, which is effective in the decisions of investors. In addition, in Türkiye, which is developing day by day with the foreign investments to be made in the logistics sector, the capital and technology required by the logistics sector can be provided. In this way, both the country's share in global foreign investments can increase and can contribute to the increase in exports and GDP data. Also serving all sectors, the logistics sector has an important position in the national economy due to its contribution to employment and national income and directing FDIs (Duran, 2022). In this regard the study obtained the relationship between the global competition index, logistics sector FDIs, exports and GDP data and the mediating role of export and logistics sector FDIs in this relationship. As a result of the analysing of the structural equation model, it was determined that transportation and storage FDI does not play a mediating role in the relationship between exports and GDP and between global competitiveness index and exports, while it plays a mediating role in the relationship between global competitiveness index and GDP. It is also concluded that exports do not play a mediating role in the relationship between transportation and storage FDI and GDP. According to the results, it is predicted that it would be beneficial to focus on FDI in the transportation and warehousing sector to increase GDP further with the success to be achieved in the global competitiveness index. Thus, both GDP can increase and the competitiveness of the sector can be contributed.

In the literature, in the research results of researchers such as Allahverdi and Ay (2021), Şahin (2022), Popovici and Călin (2015), Güneş (2014), Zlatković (2016), İnançlı and Aydın (2015) and İnançlı and İnal (2017), it has been determined that the global competition index contributes to

increasing FDI. However, when analysed in the context of the logistics sector, a negative relationship was found between the two variables. A similar result was determined in the analysis of the relationship between the global competitiveness index and GDP. While it is expected that the achievements in the global competition index can contribute to the increase in both logistics sector FDIs and GDP data, the results of the research are unexpected.

As a result of the analyses found that export data have a significant effect on GDP data. The increase in export data can both increase the GDP data of the country and increase the welfare level of individuals. The results of the research are consistent with the results of the studies on this subject, as well as supporting the export-led growth hypothesis. Researchers such as Sharma et al. (2018), Abdullah et al. (2017), Karaca and Sancak (2021), Külünk (2018), Alam and Myovella (2017), Çelik (2022) and Elbeydi et al. (2010) have also determined that exports have a significant effect on GDP. Therefore, within the framework of the research result, it is thought that export-enhancing policies should be given importance in order to increase GDP.

In the study, it was concluded that the global competitiveness index ranking has no effect on export data. In the literature, there are studies such as Öztürk and Kurt (2023), Madzova (2018), Akhuand and Abbas (2023), Xu (2016) and Bierut and Pawlak (2017), which found that the global competitiveness index has a significant effect on exports. However, contrary to these studies, it is determined in the research that the increase in the Global Competitiveness Index ranking does not have a positive effect on export data. Therefore, it can be stated that the years and countries taken as the basis of the research have an impact on the results of the research.

Another result obtained is that foreign investments made in the transport and storage sector between 2005-2019 did not have a significant effect on exports and GDP data in these years. In the literature, researchers such as Kutan and Vuksic (2007), Temiz and Gökmen (2009), Prasanna (2010), Zhang (2005), Njong (2008) and Pacheco-Lopez (2005) have determined that FDI has a significant effect on GDP. It is thought that the selection of the transport and storage sector in the research, the analysis of the data for the years 2005-2019 and the fact that the research was conducted on Türkiye are effective on this difference. Although limited in number, researchers such as Yılmaz (2010), Gerni et al. (2014), Kıran (2011) and Prasanna (2013) have also concluded that exports have no significant effect on GDP. Similarly, there are researchers such as Naveed and Shabbir (2006), Belloumi (2014), Zhao and Du (2007) and Har et al. (2008), who determined that a limited number of FDIs have no effect on GDP. It has been determined that foreign investments made in the logistics sector between the years mentioned did not contribute to the increase in GDP data. However, since the logistics sector is a multidisciplinary sector serving many sectors, it can be stated that it indirectly contributes to the increase in exports and GDP data. In addition, since the development of the sector can affect other sectors and the global competition index can be effective in the decisions of investors, it is thought that improvements to be made on all variables can contribute to the country in economic terms.

The limitations of the research can be stated as the fact that the research is based on data from 2005-2019 and FDI in transport and storage is taken as the basis. In future studies, conducting studies based on different sectors and data from different years can be beneficial in terms of enriching the literature and better understanding of the subject. In addition, an original and new model has been introduced to the literature with the research and it is expected that the research can contribute to the researchers in the future studies.

Ethics Committee approval was not required for this study.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors declare that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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Low Income more Challenging for Women: Social and Economic Problems of Women in Minimum Wage Families

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Abstract

The minimum wage is defined as the lowest payment sufficient to meet an employee's essential needs. Nearly half of the employees in Turkey are paid at the minimum-wage level. Although there is a second working person in many of these families, some rely on a single-income earner who is a minimum-wage worker. In such cases, the only stable income in the household is the minimum wage earned by one family member, which is insufficient to cover the expenses of all family members. In this study, a questionnaire was conducted with 100 women from different families whose sole income was the minimum wage, and 30 of these participants were interviewed. The study revealed that women in minimum-wage families experience the disadvantages of low income and poverty more acutely than men. In particular, women bear the harshest consequences of poverty, as they are often burdened with all domestic responsibilities, including childcare, care for elderly or disabled family members, household chores, and cooking. As a natural consequence of this situation, the social lives of women in low-income families are severely restricted. In almost every case, they lag behind the social lives of men.

Keywords: *Minimum Wage Families, Women, Challenges Faced by Women, Unpaid Labor.*

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1. INTRODUCTION

In the modern world and under capitalist market conditions, economic income has become a crucial determinant not only of the standard of living of the individual, family, and people but also of the level of prestige that one individual has in society. Similarly, low income is an issue that needs to be addressed separately as individuals living in different segments of society feel it to different degrees.

The economic, social, cultural and psychological effects of low-income levels can be felt differently in rural areas compared to cities. Since life in cities depends more on market conditions and the money economy is much more effective, low-income people living in cities may be more affected by these than people in rural areas.

A similar level of differential impact exists for different genders, especially within the family. Women in low-income families tend to be more affected by this condition than men because the responsibility of preparing three meals a day and serving them to the household falls on the shoulders of women (Öztekin, 2024; Yılmaztürk, 2016; Şener, 2012). This responsibility means that women directly face the limitations of low income or wages daily compared to men.

When the responsibility of taking care of children's daily school-related and educational needs is added to women's food-related responsibilities in the household, the number of women affected by low income and wages increases with a multiplier effect. Accordingly, this study will focus on the economic and social difficulties experienced by women in families whose only regular income is the minimum wage.

2. MATERIALS AND METHODS

2.1. Problem, Hypothesis and Purpose of the Study

The dominant traditional-patriarchal perspective in the world and Turkey perceives women as responsible for household chores and solving house-related problems. In this case, women often have to shoulder all the responsibilities in the family. The idea is that the man's job is to work outside the home, and the woman's job is to handle house chores with the "female bird makes the nest" approach, which puts women under an additional burden.

According to the established conception in Turkish culture, a 'housewife' or 'homemaker' woman is responsible for cleaning, organizing, and managing the house, taking care of the children, caring for the elderly, the sick, or the disabled, and finally running the kitchen. A woman who is economically dependent on a man cannot spare a budget for herself from the family income, which is often insufficient, and can only meet all her needs to a minimum extent with the approval of the man. The most important reasons women cannot spare a budget for themselves are the limited general budget, the failure to integrate the general budget into the home, and the lack of the idea that women may have their own special needs. The fact that the labor of women encountering all the difficulties is often invisible, the women do not have a monetary reward, and their labor is undervalued has led to many

personal, spiritual, social and cultural problems for homemakers. Those problems take on a more dramatic dimension in families where the family budget is much more limited, and the only income is the minimum wage. Due to the reasons listed above, in this study, we aimed to identify the problems experienced by women in low-income families with only minimum wage earnings.

The study's hypothesis relates to the research problem's local dimension. In the Black Sea Region in northern Turkey, women are generally known as very hardworking, productive and strong individuals. It is generally thought that Black Sea women can easily overcome economic difficulties within the household and beyond. However, in this study, we argue that women across Anatolia and the country, for whom the Black Sea women serve as a central example, are also negatively affected by insufficient family budgets within the family, and that these processes cause excessive strain on them.

The purpose of our study is to draw attention to the problems experienced by women in low-income families who earn only minimum wage and to raise awareness about their plight. We believe that publishing this study and sharing the findings with a broader audience can serve this purpose.

2.2. Research Method and Data Collection Technique of the Study

We applied a mixed-method approach combining quantitative and qualitative methods in this research. Creswell (2017) explains a mixed-method study as a type of research that allows data collection, analysis, and interpretation using both qualitative and quantitative methods. Mixed method research uses a combination of qualitative and quantitative methods to examine the research problem from multiple dimensions. The multifaceted and multidimensional nature of the subject required the use of a mixed-method approach (Neuman, 2016). Similarly, the data collection techniques of the research were dual, resembling a mixed method, and a combination of quantitative and qualitative techniques, such as survey and interview, were employed in this research. The need to obtain concrete statistical information from the participants in the field through closed-ended questions and the need to obtain interpretive opinions through open-ended questions necessitated this type of dual technique. The information and data source of the research is the declaration of women living in families with minimum wage earnings in Trabzon, an Anatolian city. A survey consisting of both semi-structured questions and five-point Likert-type propositions was applied to the women participating in the research in addition to the conducted interview. The survey and interview questions were developed in a completely original way, as no model study on this subject has been previously made. In Likert-type questions, as can be seen from the study of Dursun and Alniaçık (2019), since the “partially agree” choice cannot be collected in the disagree category, they were considered as positive answers and were evaluated as a low-intensity acceptance, as opposed to the “definitely” emphasized version of the “agree” choice.

The research population is women in families with minimum wage earnings living in Trabzon. The sample group of the research is 100 female participants from one hundred families who are in this population and do not have any special obstacles to represent the whole. In Trabzon, with a population

of 824.000 (DOKA, 2023), the required sample size for 43% of households, according to TURKSTAT (2023) data, is 96 minimum-wage-earning families (Yazıcıoğlu and Erdoğan, 2014, p.50), and this number has been rounded up to 100 for convenience. The participants were selected from the sample group using the random sampling method. Among a hundred people, 30 relatively talkative and interested people were determined as the interview group. Since the research process coincided with the COVID-19 pandemic, some of the surveys were conducted face-to-face and the remainder of the interviews were conducted over the phone. The research approval regarding the survey and interview was obtained from the Social Sciences Ethics Committee at the Karadeniz Technical University. During the data collection process, telephone interviews were found to be more efficient because participants felt more comfortable and were able to provide more detailed information during phone conversations conducted without confrontation, which they perceived as private.

3. CONCEPTUAL AND THEORETICAL FRAMEWORK

3.1. Minimum wage

The minimum wage is the lowest daily, weekly, or monthly wage that an employee may be paid. It is considered to be sufficient to meet a person's essential on a daily, weekly or monthly basis at a minimum level (Kurtcebe & Horzum, 2017).

Since the minimum wage is an amount that can cover a person's monthly essential expenses, we may consider it as an exceptional method for paying wages, not actually a principle. In fact, in the Minimum Wage Regulation (Article 4), it is envisaged that the working person, not a couple or a family, can live on the minimum wage. Similarly, the share of the minimum wage rate should be continuously reduced in total employment in a country. However, in practice, those principles tend to be ignored in varying degrees around the world.

3.2. Negative Effects of Economic Disadvantages within the Family on Women

Despite the modernization processes that Turkey has experienced in the last hundred years or so, Turkish women still maintain their disadvantaged position from a social and family perspective. Women work more in relation to family affairs, take on more responsibilities, and benefit less from the opportunities of daily life. This situation is much more striking in low-income families, including those earning minimum wage.

Women in minimum-wage families are more affected by the negative aspects of poverty. In low-income families, women are kept away from the decision-making processes within and around the family. In other words, women from low-income families experience social exclusion (Savcı & Köroğlu, 2022; Karaman, 2019; Çakır, 2002). A Turkish proverb says: "The face of the poor is cold." By working outside, men are deemed to have fulfilled their duties according to the criteria set by the rules of the patriarchal society. The limited budget left to women is neither sufficient for food expenses nor other expenses such as education, health and social life. Under those conditions, women are crushed under

the limited budget, cannot meet their needs, and their social lives come to an end (Kayalar, 2019; Öztürk and Çetin, 2009).

The stabilization of such economic and social problems causes women of low-income families to experience physical, mental, and psychological health problems (Alptekin, 2014; Yanikkerem et al., 2007), and all those processes turn into a vicious circle and surround them like a network, like a cocoon and cause women to be excluded and isolated within and around the family and condemn women to a victimized position.

3.3. Living on Minimum Wage and Housewives in an Anatolian City

Within the scope of the research, we have identified some families with only minimum-wage earnings, concentrated in some neighborhoods in Trabzon. We conducted our research in those neighborhoods; namely, we conducted the surveys and interviews in the neighborhoods named Açıya, Manolya, Papatya, Lavanta, and Leylak. In those neighborhoods, we generally contacted more than one household earning minimum wage in the same building. In many of those neighborhoods, the families live in rental apartments, and women often perform house chores. In the sub-province of Lavanta, we encountered relatively more homeowner families, but we found out that most of those houses or apartments were unplastered, uninsulated, and without any elevators. Among the participants, those who own a home live in more comfortable conditions than those who do not. However, we found that those participants also used expressions similar to the other participants and stated that they had difficulties regarding the house chores they performed during the day. The participants also declared that they were trying to “take care of” the house with a low income by spending time at home all day long and trying to “raise their children”. We understood from those statements that it is not quality but quantity that matters in making a living for the minimum-wage women in Trabzon, and it is not educating but raising and partly surviving that matters when it comes to children.

4. ANALYSIS, INTERPRETATION AND DISCUSSION OF THE FINDINGS

4.1. Making a living for families with only minimum-wage earnings

Table 1. My husband cannot leave me enough money for my domestic needs

	Frequency	Percentage %
Absolutely agree	28	28.0
I agree	23	23.0
Partially agree	30	30.0
Disagree	17	17.0
Absolutely disagree	2	2.0
Total	100	100.0

In the table above, 81% positive response was received for the proposition, which reads as follows: “My husband cannot leave me enough money for domestic needs!”. The percentage of participants who responded negatively was only 19%. We understood that the participants who

responded negatively thought that the minimum wage that men received was insufficient by responding as follows: “If he had money, he would quit, he is working for his home, what else will he do?” Additionally, we found out that among the participants who responded negatively by 19%, 10 participants received monetary assistance from their families, 11 participants had 1 or 2 children, 5 participants worked extra jobs, 8 participants prepared some food items at home instead of buying them from the market, and 2 participants received monetary assistance from the government. Probably due to these reasons, the grievance of the 19 people in question seems to have become a little less severe, and instead of complaining directly, they have resorted to “reasoning”. Studies indicate that minimum-wage families cannot allocate sufficient money for food. For example, in the study conducted by Kocakahya (2007), among those who stated that they could not buy enough food items, red meat, and the like, the percentage of those who declared that they could not buy the products was 9%. However, according to the same study, 84.1% of minimum-wage earners thought they had a health problem due to malnutrition.

Table 2. The needs of the house and the children are on me

	Frequency	Percentage %
Absolutely agree	26	26.0
I agree	24	24.0
Partially Agree	19	19.0
Disagree	26	26.0
Absolutely disagree	5	5.0.0
Total	100	100.0

The positive responses to the proposition of “The needs of the house and the children are left to me!” constitute 69%. This percentage coincides with the following statements of the participants in the interviews: P9: “I would like to leave a future for my children. I have a disabled daughter; I wish she were normal. I have difficulty caring for her; I wish I could take care of her. I have difficulty in taking care of my child along with the house chores.” P14: “I devoted myself to my children. We are in a disadvantaged position and a difficult situation. What can I say? I am in a difficult situation. P16: “When the children want something, they cannot tell their father; they tell me, so I mediate between my husband and the children. I cannot meet the needs of the children.” P17: “There were times when I did not turn on the heater so I could save some money and use it for my children’s education, and they could go to private supplementary courses and buy their books with the money I saved. If they do not study, it means that I am done.” On the other hand, the percentage of those who responded negatively to the proposition is 31%. This situation may be based on the internalization of those responsibilities and perceiving it as their duty to meet their children’s needs by the women who expressed this opinion.

Table 3. I Face the Difficulties that We Experience in Meeting Our Needs More than My Husband!

	Frequency	Percentage %
Absolutely agree	20	20.0
I agree	24	24.0
Partially Agree	11	11.0
Disagree	36	36.0
Absolutely disagree	9	9.0
Total	100	100.0

The percentage of those who responded positively to the statement, “I face the difficulties that we face in meeting our needs more than my husband!” was 55%, while the percentage of those who responded negatively was 45%. Most women thought they had to deal with most of the problems alone. On the other hand, the fact that women worked for their own families and did not expect anything in return normalizes the invisibility of the labor performed by women. Although it cannot be said that there is an absolute, systematic relationship between poverty and gender, Arıkan found out that as women become poorer, they become more disadvantaged in the family and their marital relations (Arıkan, 2002). It was also observed that the fact that women are a segment of society more affected by low-income levels, minimum wage and poverty in the world, as in Turkey, is fueled by the perception and understanding of gender. It was also found that low income, minimum wage or varying degrees of poverty negatively affected women more than men due to the gender roles of women (for the example studies in this matter, see Lustig & McLeod, 1996; Saget, 2001; Devereux, 2005). The participants of this study expressed this matter in the interviews as follows: P20: “This is my second marriage. I have never seen a man taking responsibility properly. In this house, there is a man and a woman, and my husband is not the one who takes responsibility. I do every task in the house.” This tendency towards irresponsibility in Turkish society in general and in the minimum-wage families, in particular, may mean that the women in the relevant families cease to be women; they become relatively masculine with the masculine roles they assume, and they cannot even experience their femininity.

Table 4. In my opinion, the addressee of the proverb “Poverty is the Shirt of Nessus” is mostly women

	Frequency	Percentage %
Absolutely agree	23	23.0
I agree	28	28.0
Partially Agree	15	15.0
Disagree	27	27.0
Absolutely disagree	7	7.0
Total	100	100.0

The percentage of those who responded positively to the preposition, “In my opinion, the addressee of the proverb “Poverty is a shirt of fire” is mostly women!” was 66%. From the responses, we understood that women were more severely affected by the disadvantages of poverty. All responsibilities attributed to women due to the gender roles negatively affect women. However, these roles may affect women in high-income and low-income families differently.

Women experience and evaluate poverty and wealth more than men do. The participants expressed the following statements in the interviews: P9: “I envy those with high incomes very much. If I want to do something, my resources are always inadequate. But they have the chance to use their wealth for their needs.” On the other hand, the rate of those who responded negatively to the proposition was 34%. While we found out that the majority of the participants who gave negative responses did not pay rent and received monetary assistance from their families or the government, the relatively low number of children and persons in those families was actually noteworthy. When the previously mentioned conservative* concerns come into play, it becomes understandable that about one-third of the answers turned out to be in the negative direction.

4.2. Women in Minimum-Wage Families Have to Take Financial Responsibility

Table 5. The Economic Inadequacy Pushes Me to Work More

	Frequency	Percentage %
Absolutely I agree	14	14.0
I agree	13	13.0
Partially Agree	5	5.0
Disagree	34	34.0
Absolutely disagree	34	34.0
Total	100	100.0

The percentage of the positive responses for the proposition of “The economic inadequacies push me to work more!” was 32%. The fact that the participants who responded positively had to do additional work was expressed in the interviews as follows: P23: “Now I have to work. We borrowed money from our relatives to buy a house. The house we lived in belonged to my father. When they told us to leave, we had to buy a house.” P27: “I’m doing more than compromising my femininity, I’m compromising my humanity. I’m going to wipe the stairs; I’m going to do cleaning.” P28: “I have to do extra work. We couldn’t afford to pay our debts.” P30: “I have to sacrifice myself all the time, I would work if I can find a job, but nobody employs women. I have been looking for a job for two years.” We found out that the women in families trying to survive on minimum wage were forced to work irregular jobs and earn income that supported the minimum wage due to economic difficulties. However, the women also stated that society did not give jobs to women who wanted to work by making sacrifices out of their “femininity” or even “humanity”. Due to the traditional conception of gender, the patriarchal society does not give jobs to female job seekers. The patriarchal society does this either because it does not think that the job suits women, or it thinks that working women will create some ethical issues, or it does not want women to become stronger in society. Regardless of the reason why the patriarchal society does not give jobs to women, this situation has the effect of increasing the victimization of women. In

* In the article, the concept of conservatism, mentions in two instances, is used not in its political sense, but in its social, cultural, and psychological contexts.

some studies (Dedeoğlu, 2000), in-depth interviews were conducted with women who defined themselves as housewives, and when they were asked whether they had any well-paying jobs recently, it was found out that most women worked as farmhands, vegetable vendors, tailors, and day laborers. This data confirms the findings of our study. Under normal circumstances, a family is expected to be able to make ends meet with one person working in the household. However, we observed that this opportunity does not exist in minimum-wage families and women tend to work various jobs to support the family budget.

Table 6. I Have to Produce Some Items at Home Instead of Buying them from the Market!

	Frequency	Percentage %
Absolutely I agree	18	18.0
I agree	31	31.0
Partially agree	13	13.0
Disagree	17	17.0
Absolutely disagree	21	21.0
Total	100	100.0

The percentage of those who responded positively to the proposition “I have to produce some items at home instead of buying them from the market” was 62%. The reason for such a positive response is that the women are held responsible for such matters. In their social circles, women are seen to encourage each other with questions such as “What did you do to prepare for the winter?”, “Did you dry peppers this year?” We understood that the most important reason for this situation is that women have internalized these tasks and perceived them as their primary duties. In his study, Kocakahya (2007) found out that pickles (96%), canned foods (83.7%), tomato paste (79.7%), jam-marmalade (79%) and pickled grape leaves (67%) came first among the foods prepared by the minimum wage individuals at home. Freezing vegetables and fruits was performed by 30.1% and drying was performed by 29% of the individuals. Bulgur and roasted meat (25.4%) were among the least prepared foods. Similarly, Çiçek et al. (2005), in their study, found that the foods most prepared by low-income homemakers at home were pickles (87.5%), jam-marmalade (83.3%), tomato paste (74.3%) and noodles-pasta (73.6%). P20, one of the interviewed participants, stated that the economic difficulties prevented her from going to the market by saying: “When I have money, I go to the market, but this is very rare.” In this case, what needs to be done is to produce as many food items at home as possible. While this type of food preparation and stocking at home is more feasible in rural areas and villages, carrying out these activities in the cities is extremely difficult, arduous and heavy for women.

4.3. In Minimum-Wage Families, Women May Become the “Receiving Hand”

Table 7. My husband does not pay attention to the kitchen expenses but expects to eat the best meal!

	Frequency	Percentage %
Absolutely agree	9	9.0
I agree	22	22.0
Partially agree	14	14.0
Disagree	39	39.0
Absolutely disagree	16	16.0
Total	100	100.0

The percentage of the participants who positively responded to the proposition, “My husband does not pay attention to the kitchen expenses but expects to eat the best meal!” was 45%. This percentage is extremely high and shows that nearly half of the women in minimum-wage families try to meet their kitchen needs without the active contribution of their husbands. As a matter of fact, this issue was brought up in the interviews. One of them, P26, expressed her feelings and the difficulty of her situation as follows: “My husband works until the evening, comes home in the evening, he does not know anything, he does not ask what was given, what was paid, or what kind of problems took place at home whether something was broken, or an emergency happened. Having his food in front of him on the table is enough for him.” In other words, it is women, not men, who are “cracking” and “exploding”, in the women’s own words, and shouldering all the responsibility in this field, with expressions in line with the literature, in order to earn a living and set the table for the household at home.

Table 8. I Have to Get Assistance from My Family!

	Frequency	Percentage %
Absolutely agree	13	13.0
I agree	19	19.0
Partially agree	13	13.0
Disagree	26	26.0
Absolutely disagree	29	29.0
Total	100	100.0

45% of the participants responded positively to the proposition, “I have to get assistance from my family.” We found out that a significant part of this assistance was relatively in the form of durable food items such as canned foods, pickles, jams and dried fruits, and this assistance could also be in the form of direct cash assistance. On the other hand, the percentage of those who responded negatively to this proposition was 55%. P1, one of the women who did not receive help from her family, responded: “My husband would not accept such a thing.” As we may understand from the data obtained, it is clear that the family is in need; women volunteer to receive this type of assistance from their own families, but men do not generally allow it. Again, as far as we understand from the data, men are largely unaware of the extent of the difficulty of making ends meet at home or they consciously avoid the subject matter. Since the burden falls mainly on women’s shoulders, men can more easily engage in this type of “cheap

ingratitude” attitude, so to speak. However, the woman (P1), who was not allowed by her husband to get assistance from her family, was the same woman who had to collect bruised and half-rotten vegetables and fruits from the market. Such approaches are the clearest example of the situation in which a crude form of patriarchy puts women in low-income families.

4.4. Social Problems of Women in Minimum-Wage Families

Table 9. I Had to Make Sacrifices by Ignoring Many of My Personal Needs!

	Frequency	Percentage %
Absolutely agree	68	68.0
I agree	17	17.0
Partially agree	8	8.0
Disagree	6	6.0
Absolutely disagree	1	1.0
Total	100	100.0

93% of the participants responded positively to the proposition, “I had to make sacrifices by ignoring many of my personal needs.” P5, one of the participants who responded positively, stated: “Of course, sometimes I have to compromise myself. I do men’s work as much as I can, renovations in the house, and the like.” P14: “I devoted myself to my children. We are in a disadvantaged and difficult situation.” P8: “I have to constantly think about supporting the family, being a woman is difficult. Women with high income levels can travel a lot, but I can’t.” P15: “I feel very bad. I don’t feel like a woman. I let myself go. I was all about my children. If we had a little bit more income, maybe this wouldn’t have happened.” P18: “Before marriage, I was doing most of the work that a man did. I said that if I got married, I would be at peace, I know that I am a woman, but that was not the case, of course, I had to make more sacrifices.” P21: “I compromise myself too much. I struggle both in and out of home. My husband is not someone who will put himself in trouble, so I don’t care about the fact that I am a woman, I keep working.” P23: “There is no femininity left, you can’t take care of yourself, you can’t buy clothes, you can’t go shopping for yourself. The money you earn only goes into debt and then ends up paying for food for the little kids.” P27: “I am no longer compromising my femininity; I am compromising my humanity. I go and wipe the stairs; I go and do cleaning. I see something I want, but I say, I can’t spend that money now, this is not the time, now I have this and that debt.” We understand that she was crushed under the mentality of poverty, and she did not experience any comfort both in her father’s house and her own house. The data coincide with the findings of other studies in the literature (Delenay, 1987; Dedeoğlu, 2000). On the other hand, we found out that 9 women out of the 9% of participants who responded negatively to this proposition had 3 or fewer children and they did not live with a dependent elder in the family. It is also an important finding that some participants who answered negatively to the proposition above-received help from their families. The situation can become much

more understandable considering the possibility that the house they live in was not rented but owned, and the fact that they received assistance from the government and their relatives but failed to state them clearly and they had conservative feelings and thoughts.

Table 10. I feel embarrassed about my environment, relatives and friends!

	Frequency	Percentage %
Absolutely agree	15	15.0
I agree	15	15.0
Partially agree	16	16.0
Disagree	27	27.0
Absolutely disagree	27	27.0
Total	100	100.0

The percentage of those who responded positively to the proposition of “I feel embarrassed about my environment, relatives and friends” was 46%. In other words, at least a quarter of women are embarrassed by their social environment. This factor directly and negatively affects their participation in social activities. All of these are processes that can negatively reflect on the functioning of a society. The participants expressed this situation verbally in the interviews: P14: “We are in a disadvantaged and difficult situation. I’m in trouble, what can I say? It makes you feel ashamed. “I can’t even enter a social environment.” P27: “I was getting help from the district headman, but now they don’t give me any help. I am reluctant to accept guests. My friends came over a few times and I couldn’t find anything to offer them. They understand the situation and don’t want to come to my house anymore.”

On the other hand, most women do not accept their embarrassment because they try not to show their neediness as much as possible. One participant (P2) expressed this situation in the interviews: “I am in a needy situation, but I cannot tell anyone. I withdrew and I don’t express it.”

4.5. Children’s Educational Expenses and Problems Increase the Burden of Women

Table 11. We Can’t Pay Children’s School Fees!

	Frequency	Percentage %
No dues/ No Answer	44	44.0
Absolutely agree	11	11.0
I agree	24	24.0
Partially agree	10	10.0
Disagree	7	7.0
Absolutely disagree	4	4.0
Total	100	100.0

Regarding the proposition, “We cannot pay the school fees of our children!”, 44 participating women declared that there were no school fees in their children’s schools and actually left this proposition unanswered. The fact that this number is so high is at least suspicious because we may think that women did not express this situation and preferred to “experience it inside”. As a matter of fact, there is a significant group of participants who responded positively to this proposition by 45% and they declared that they could not pay their children’s school fees. From our personal experience, we also know that such payments do not officially exist. However, the schools unofficially request the parents to make those payments in almost every school in varying forms and amounts. Although a minority of the group of 44 women probably did not encounter such a request for dues, we believe that most of them actually did, and they were hesitant to express this situation. Despite everything, 45% of the participants responded positively to this proposition and declared that they did not have enough money to pay their children’s school fees. These dues are covered in different ways. One of them is that the neighborhood headman pays such dues instead of the parents. As a matter of fact, one participant (P27) explained this situation as follows: “Thanks to the headman, the school needs are provided to us, they ask for dues and other fees, I cannot pay them, instead I spend the money on other things.” Another practice is that the dues that these families have to pay are distributed among the parents of other children in the class.

We may think that the 11% of women who responded negatively to this proposition and declared that they could pay their children’s school fees provided this answer for the rational and irrational reasons mentioned before.

Table 12. My husband does not attend the parent-teacher conferences at school; he wants me to attend as a parent!

	Frequency	Percentage %
No Answer	36	36.0
Absolutely agree	27	27.0
I agree	21	21.0
Partially agree	9	9.0
Disagree	4	4.0
Absolutely disagree	3	3.0
Total	100	100.0

Thirty-six people did not respond to the proposition, “My husband does not go to the parent-teacher conferences at school and wants me to attend as a parent.” We may assume that some of the members of this group do not have children, those children do not go to school yet, or some of their children graduated from school. Only 7% of the remaining majority responded negatively and stated that their husbands went to the parent-teacher conference. However, 57% of the participants responded positively to this proposition and stated that they went to school for the parent-teacher conference at their children’s schools. In fact, when 36 people who do not have school-age children are excluded, the

percentage reaches 89% of the remaining 64 persons. Even if this is the case in all income groups, it should be taken into account that the reasons may differ, and the voluntary/compulsory status may also vary. Women in minimum-wage families reluctantly attend those conferences because rather than facing financial difficulties alone, men leave this obligation to women. However, we may think that either spouse should attend the parent-teacher conferences together, or they should go in turns, or mostly men should go because in Anatolia, while women are generally not allowed to go out of the house to travel, it is contradictory that women are allowed to go to school for parent-teacher conferences, or even asked to do so. This contradiction can be explained by the fact that men avoid these conferences where financial issues may be brought to the agenda, leaving this responsibility on women's shoulders. As a matter of fact, for families with relatively higher incomes, it is possible for spouses to attend parent-teacher meetings together or in turn. The fact that women in low-income families perform this task is a difference that can be explained entirely by financial means, and even here, it is women who have to face the disadvantages of poverty.

5. DISCUSSION AND CONCLUSION

A minimum wage is a wage that can meet the essential needs of an employee for one day. While the minimum wage needs to be an exception, it has a higher application rate than it should in many countries and tends to turn into the average wage in our country. Spreading the minimum wage to the base in this way causes poverty to spread and get acculturated in this segment of society. It should not be forgotten that one day, poverty can be minimized, but rehabilitating the culture of poverty may require a much longer time.

On the other hand, while the minimum wage is designed as a wage that is capable of covering a person's essential expenses at the minimum level, in an important segment of society, the family's only income consists of the minimum wage. Most of these families have two, three, or more people in the household. As the number of people in the household increases, the difficulty of making ends meet increases proportionally. This problem becomes much more evident, especially in cases where the house is not owned but rented, representing a significant expense item in the family's budget.

As the findings of this study reveal, poverty is a serious situation in families trying to survive on a single minimum wage. However, we have observed that the spouses affected by poverty in these families are more likely to be women rather than men. We may say that the minimum wage and poverty affect women more than men and it mostly victimizes women. Almost all the women in the sample group of this study who try to survive on the minimum wage emphasized the inadequacy of the minimum wage in supporting their families. This difficulty affected women in two main ways. The first is in the form of economic distress or financial difficulties. Almost all participating women used definite statements such as "we cannot make ends meet" or "we cannot afford food and children's educational expenses".

However, the problems experienced by women in families trying to make ends meet on minimum wage, which need to be emphasized more than economic problems, are social. Women from minimum-wage families cannot socialize, cannot participate in society, and are forced to neglect themselves. As a result, they become isolated and alienated from society, excluded from the decision-making processes and society, and may be discriminated against and ignored. As the number of minimum wage families in the country increases, the number and rate of women victimized by the minimum wage also increases. This unsustainable situation clearly highlights the urgent need for comprehensive social and economic interventions.

The general public perceives that Black Sea women are powerful, astute, and can overcome all difficulties. Based on this perception, there is an unnamed memorization and tendency that the problems of women from the Black Sea region in general and Trabzon in particular can be ignored. However, regional women are like all others and have economic and social needs. Their strength and resilience should not become an excuse to ignore their problems forever. It should be questioned once again how women who cannot socialize and realize themselves in this sense can raise children, who are the future of a country, in a better spiritual and physical manner. Both the public and public institutions should address this problem seriously. In fact, money and financial means can be seen as nothing on their own, but social competence cannot be achieved without a minimum level of financial means. Actually, the prerequisite for a mother to raise good children is not primarily money and financial means, but a minimum level of financial means is fundamental in this sense. Minimum financial conditions are indispensable for children to be raised with minimum social satisfaction. In this sense, the situation of women as mothers is extremely fragile and noteworthy. Since child rearing is seen as a responsibility of women rather than men and of mothers rather than fathers, the presence or absence of financial means is an issue primarily faced by women. In this sense, the difficult conditions experienced by women are worth paying more attention to at the individual, social and institutional levels so that children in minimum-wage families can develop better spiritually and physically. It should be questioned once again how women who cannot socialize and realize themselves in this sense can raise children, who are the future of a country, more healthily. Both the public and public institutions should address this problem in depth.

If the expression is correct and no pun intended, we may say that women enjoy the pleasures of life and suffer the pain. Conversely, men are actors who devote themselves to work and are not interested in anything else. For men, going to work and working is equivalent to fulfilling their family responsibilities. For wealthy men, taking care of family members, spouses and children is not a priority. Similarly, the situation is not very different for male minimum-wage earners. For them, simply being able to work is sufficient, while whether the household needs are fully met becomes a secondary concern. This burden predominantly falls on women.

We argue that, just as it is unique for women to display wealth on themselves in their homes and lives, it is also their responsibility to experience poverty daily and practically. Women are the main actors of both socio-economic extremes in social life. Although the first situation can be experienced optionally, the second situation is not a choice but a wholly imposed and unpleasant obligation. We may also argue that half of the country's women are in this situation. The situation will likely evolve into acculturation and spread further into future generations. A solution must be produced, and the problem must urgently be rehabilitated.

Ethics committee approval for the study was obtained from the Karadeniz Technical University Ethics Committee on February 24, 2020, with document number 82554930-449.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

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Related Party Transactions from the Perspective of Public Shareholders

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Abstract

Transactions between related parties, particularly those involving controlling shareholders, may pose a risk of financial detriment to minority shareholders while simultaneously providing a mechanism for controlling shareholders to accumulate profits in a manner that may be considered inequitable. This research seeks to examine the effects of related party transactions on shareholders from four distinct analytical angles, to enhance the investment decision-making process for investors. The study explores the relationship between related party transactions and several financial indicators of companies listed on Borsa Istanbul, including the free float ratio, stock price performance, dividend payout ratio, and Tobin's Q. The research utilized financial data from 339 companies listed on Borsa Istanbul, resulting in 1478 instances within an unbalanced panel data set. Methodologically, both fixed effects and random effects regression analyses were conducted. The analysis shows a positive relationship between debts owed to related parties and the free float ratio, as well as Tobin's Q ratio. Furthermore, a positive relationship is identified between receivables from related parties and the free float ratio, while a negative relationship is observed between receivables from related parties and Tobin's Q ratio. These findings corroborate the existence of agency costs and conflicts of interest between majority shareholders and minority shareholders. Despite the statistical significance of the findings, it is pertinent to note that the explanatory efficacy of the equations utilized is relatively modest.

Keywords: *Related Party Transactions, Agency Costs, Tunneling.*



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1. INTRODUCTION

Related party transactions (RPTs) involve interactions between a corporation and its associated entities, which may include partnerships, subsidiaries, shareholders, stakeholders, employees, family members, and affiliated or controlled organizations. Such transactions often exhibit a tendency for the redistribution of wealth in favor of entities or individuals possessing majority ownership (Johnson et al., 2000). Due to the diverse definitions of RPTs in the literature, several studies have categorized these transactions from various perspectives. Cheung et al. (2006) classified RPTs into three distinct groups: those precipitating the transfer of wealth away from minority shareholders, those that confer benefits upon minority shareholders, and those executed with strategic intent that do not harm the financial interests of minority shareholders.

In the broader literature, RPTs are commonly analyzed based on various theoretical foundations, with three salient theories gaining attention. Agency theory and conflict of interest theory suggest that RPTs tend to manifest as transfers of wealth from other shareholders in favor of controlling shareholders or for the benefit of managerial personnel. These theories argue that potential actions such as the misappropriation of business resources and manipulation of information may introduce biases into financial statements, raising concerns about their validity and fostering uncertainty. Dinç and Varici (2012) investigated the association between fraudulent reporting and RPTs. Their research contrasted 37 companies suspected of fraudulent reporting with 37 companies lacking such suspicions. The findings suggested that receivables from and debts to related parties are more prevalent in companies associated with suspected fraudulent reporting.

Kohlbeck and Mayhew (2017) conducted a comprehensive analysis to ascertain whether RPTs serve as indicators of inaccurate financial reporting. The research gathered data from companies listed in the S&P500 for the years 2001, 2004, and 2007. The results revealed a positive relation between the frequency of RPTs and the restatement of financial reports. This relationship appeared particularly pronounced in transactions conducted under the influence of the "tone at the top" rather than being essential commercial transactions. Conversely, the efficient transaction hypothesis asserts that these transactions are necessitated by business requirements and align with the interests of shareholders. Furthermore, this theory contends that potential benefits, such as the mutual exchange of information and risk reduction, may ensue (Huang and Liu, 2010).

RPTs may adversely impact company shareholders in several ways. Firstly, conflicts of interest and a loss of trust, as defined in the literature, can emerge when controlling partners unethically transfer wealth to themselves by exploiting the company's opportunities. Public awareness of such situations can diminish the company's stock performance and curtail its access to financial opportunities, such as bank loans. Secondly, RPTs prompt changes in the financial structure and profitability of the company. For instance, loans extended to related parties may increase the company's debt ratio, while tunneling may diminish its profitability. Consequently, this complexity hinders effective financial analysis and

obstructs a fair valuation of the company. Thirdly, RPTs can influence the company's decision-making processes, diverting attention from long-term profit maximization and compromising effective management during strategic planning. Lastly, unethical utilization of RPTs can disrupt the company's dividend distribution processes, diminishing potential earnings for shareholders.

Despite the potential negative effects, RPTs, if implemented righteously, can positively impact shareholder returns. Many holding companies, operating in diverse areas, can create synergy and enhance profitability through cooperation among their entities. Joint projects developed through strategic collaboration can mitigate risks, fostering increased profitability for all parties involved. Trust issues can be resolved in commercial relations between companies managed by the same controlling partner. RPTs can offer cost advantages, aiming to maximize joint profits rather than individual company profits, potentially leading to increased sales volume and long-term growth. Joint material purchases may lower costs and yield labor savings. Companies may also benefit from the distribution channels of related parties, providing a significant strategic advantage. Finally, obtaining financial debt from related parties in the event of financial distress will create value for the company.

According to data from Central Securities Depository & Trade Repository of Türkiye (Merkezi Kayıt İstanbul), the number of equity investors in Borsa İstanbul exceeded 8 million as of December 2023 (<https://www.vap.org.tr>). Understanding the impact of RPTs on stocks becomes imperative for these investors. This study endeavors to discuss the various dimensions of RPTs' impact on stock investors of Borsa İstanbul and provide critical insights for investment decisions. Additionally, it aims to offer valuable insights to regulatory authorities for prudent decisions and audits related to RPTs.

The article assesses the impact of RPTs on stock investors from four different perspectives. Firstly, the relationship between the free float ratio and RPTs is scrutinized. If controlling shareholders prioritize the interests of the company over their own, there should be no significant relationship between the free float ratio and RPTs. Secondly, the relationship between stock returns and RPTs is analyzed. If shareholder interests are prioritized in company management, a nonexistent or beneficial relationship between stock returns and RPTs is expected. Thirdly, the relationship between the dividend payment ratio and RPTs is investigated. If controlling shareholders unethically transfer free cash to their accounts, the companies' dividend payment ratio is likely to diminish. Lastly, the effect of RPTs on company valuation is assessed through the evaluation of Tobin's Q ratio.

This article advances the literature in several ways. (1) Firstly, it is compiled with the largest data set covering Borsa İstanbul, including most of the companies and spanning a wide period of seven years. (2) The research period encompasses the years 2021 and 2022, crucial for understanding market dynamics post-Covid-19, when interest in the stock market surged. (3) The study embraces a broad perspective, examining the multi-dimensional effects of RPTs, including the free float ratio, stock return, dividend distribution, and valuation.

The subsequent sections of the article are organized as follows: Section 2 reviews other studies in the literature and develops hypotheses. Section 3 details the research data set, methodology, and findings, while Section 4 concludes the article.

2. LITERATURE

A review of the extant literature reveals that the impact of RPTs on firm value, firm performance and stock performance has been extensively investigated, yet consensus remains elusive. While revealing the impact of RPTs, both the regulations made in the capital markets of the country and the structure of the company play an important role. Nekhili and Cherif (2011) stated that factors such as the ownership rate of the main shareholder, the size and independence of the board of directors, audit mechanism and capital structure are effective on the impact of RPTs. Cheung et al. (2009) investigated the relation between RPTs in Chinese companies between 2001-2002. The RPTs in the research includes asset acquisitions, asset sales, asset swaps, trading goods and services and cash payments. Their findings indicated the occurrence of both tunneling and propping within several entities, with tunneling being more prevalent in the sample. Propped companies are larger in scale compared to tunneled companies. Propped companies have a higher rate of foreign shareholding and are more likely to be traded in foreign markets. Propped firms generally have worse financial performance in the year before the related party transaction. Pozzoli and Venuti (2014) investigated the relation between RPTs and financial performance in their study. In the research, data of companies traded on the Italian stock exchange between 2008 and 2011 were used. According to the research results, there is no relationship between RPTs and financial performance. Consistent with the findings in the literature, the present research endeavors to test the validity of 4 distinct hypotheses.

H₁: There is a relationship between RPTs and free float.

Ryngaert and Thomas (2012) note that RPTs Pre-IPO's are significantly detached from shareholder wealth. Kang et al. (2014) stated that RPTs negatively affect firm value, especially in cases where the ownership structure of the main shareholder is high. Byun et al. (2011) stated that the dominance in ownership structure concentration increases information asymmetry and paves the way for transactions against minority shareholders. Khalili and Mazraeh (2016) showed that as the free float ratio increases with corporate governance, RPTs decrease. It is seen that RPTs are used to make up the company, especially before going public. Chen et al. (2011) examined the earnings management in initial public offerings (IPOs) in Chinese market. Their research includes 257 IPOs during the 1999-2000 period. According to their findings, controlling shareholders use RPTs to improve operating performance of the companies during pre-IPO period. It is also found that there is a decrease in the operating performance of these companies during post-IPO periods. There are also studies arguing that in addition to going public, the ownership structure of the company is also effective in RPTs. In their study, Wan and Wong (2015) compared the impact of RPTs on performance in publicly and privately

managed companies. Their research, utilizing data from 90 companies listed on the Chinese stock exchange between 2007 and 2009, reveals that tunneling is prevalent in publicly managed companies, whereas it is absent in privately managed firms. Despite higher operational performance, publicly owned companies fall short compared to their private counterparts due to tunneling.

As the free float ratio increases, it can be expected that conflicts of interest will increase and, accordingly, RPTs carried out against shareholder value will increase. However, this trend may differ in companies where shareholder rights are safeguarded and a trustworthy environment is fostered through factors such as exemplary corporate governance, confidence in the board of directors, and rigorous independent auditing.

H₂: RPTs affect stock performance.

Gordon et al. (2006) investigated the impact of RPTs on companies listed on the stock exchange in the USA. They found an inverse relationship between above-index return and RPTs and that there may be moral hazards inherent in these transactions. In their study, Utama and Utama (2009) divided investment announcements into two groups: those involving RPTs and those that did not. In their analysis of the Indonesian stock market's response to these announcements using the cumulative abnormal return method, they observed that the market's reaction to RPTs was less pronounced than to other types of transactions, which they ascribed to insufficient public oversight of wealth transfer. Ryu (2018) and Habib et al. (2021) showed that there is a positive relation between the escalation of RPTs in China and the heightened risk of stock price collapse. As RPTs increase, the credibility of financial reports diminishes, and the asymmetry of information between controlling and minority shareholders intensifies, potentially exerting a deleterious effect on future stock prices.

H₃: There is a relationship between RPTs and dividend distribution.

Gugler and Yortuglu (2003) contend that the dividend distribution policy engender conflicts of interest between principal and minority shareholders, while Louis and Urcan (2015) suggest that dividends may be utilized to mitigate such conflicts. Similarly, El-Helaly and Al-Dah (2022) state that if there is a significant relationship between high dividend payments and RPTs, there is a conflict in the business and, in turn, the dividend payment increases. Should RPTs emit negative signals to minority shareholders, major shareholders might elect to enhance the dividend policy as a countermeasure. This dynamic could be contingent upon the presence of regulations safeguarding minority rights or specific company policies. In scenarios where principal shareholders execute RPTs with the intent of wealth transfer, indifferent to negative repercussions, they may opt for minimal or no dividend payouts. La Porta et al. (1999) assert that robust investor protections are pivotal, as dividends play a crucial role in addressing agency issues; conversely, in jurisdictions with feeble regulations, dividend relevance diminishes. Li and Zhao (2008) postulate that in environments with frail legal protections for minority

rights and pronounced information asymmetry, dividend distributions tend to be lower. Sari et al. (2017) observe a negative association between cash dividend payouts and RPTs.

H₄: RPTs affect firm valuation.

Scholars do not unanimously agree on the impact of RPTs on firm valuation. Bona-Sánchez et al. (2017), Gordon et al. (2006), and Elkelish (2017) explored the negative impact of related party relationships on firm value. In contrast, Djankov et al. (2008) emphasized their positive effects. Suryani and Putri (2019), Diab et al. (2019), Varıcı and Küçüktüfekçi (2021) found no significant effect. It is also noted that this relationship may vary depending on the type, content and purpose of the related party transaction. Wang et al. (2019) reported in their study that RPTs have a negative effect on firm value, but this effect turns positive for RPTs made with sectorally similar companies or those with a vertical relationship. Lei and Song (2011) demonstrated that RPTs positively impact firm value if information asymmetry is mitigated by proactively informing shareholders and investors about these transactions, provided the information aligns with strategic objectives. Dahya et al. (2008), considering investor protection regulations, focused on countries with low levels of such protections. They observed that the values of companies engaging in RPTs were lower than those that did not, with a consequent negative impact on market valuation.

Şendurur and Gelen (2023) analyzed the relationship between RPTs and firm value, utilizing data from 21 companies in the BIST100 index that published sustainability reports between 2015 and 2021. Their findings indicate that debts to related parties positively affect firm value, whereas related party acquisitions have a detrimental effect. Kohlbeck and Mayhew (2010) examined the relationship between RPTs and company valuations, using data from companies in the S&P500 in 2001. Following the enactment of the Sarbanes-Oxley Act (SOX), which restricted loans to related parties, the study examined the returns of companies with RPTs before and after the implementation of these restrictions. The results reveal that companies with RPTs are valued with a lower multiplier compared to others and experienced lower stock return performance post- SOX. Varıcı and Küçüktüfekçi (2021) examined the impact of RPTs on firm value, analyzing data from 41 industrial companies traded on BIST100 in 2019. This research concludes that there is no relationship between RPTs and company valuation.

The existing literature presents diverse findings regarding the relationship between RPTs and free float, stock performance, dividend distribution, and firm valuation. While some studies suggest that a higher free float ratio may lead to increased RPTs due to conflicts of interest, others argue that strong corporate governance can mitigate this effect. Similarly, research on the impact of RPTs on stock performance reveals that these transactions often contribute to stock price declines by increasing information asymmetry and financial report manipulation. Regarding dividend distribution, findings indicate that RPTs may either serve as a tool for wealth transfer at the expense of minority shareholders or, conversely, lead to higher dividend payouts as a compensatory mechanism. Finally, the impact of

RPTs on firm valuation remains inconclusive, with some studies highlighting their negative influence due to tunneling, while others emphasize their potential benefits when conducted transparently and strategically. These inconsistencies suggest that the consequences of RPTs largely depend on contextual factors such as ownership structure, regulatory environment, and corporate governance quality. These insights provide a strong foundation for testing the proposed hypotheses, while also emphasizing the need for further research to reconcile divergent findings and account for contextual nuances.

3. RESEARCH

3.1. Data

In this study, data from companies listed on Borsa Istanbul were utilized. Companies within the financial sector and investment trusts were excluded from the research scope. The study included 339 companies that have been actively traded on the stock exchange over the past year. A total of 1478 observations were encompassed in the study, employing an unbalanced panel data set. The data set comprises company financials published on Public Disclosure Platform (PDP) from 2016 to 2022. As company financials published on PDP adopted a standardized format starting from the second quarter of 2016, the commencement date for the financial statements data set is 31 December 2016. The year 2022 represents the most recent period for which annual financial data was available at the time the research was conducted. The study's frequency is annual. The variables employed in the research, along with their definitions, are delineated in Table 1 below.

Table 1. The Variables Employed in the Research and Their Definitions

Abbr.	Variable Name	Description of Variable Formula
RRP/TA	Receivables from Related Parties / Total Assets	Ratio of receivables from related parties to total assets
LRP/TA	Liabilities to Related Parties / Total Assets	Ratio of liabilities to related parties to total assets
TRRP/TR	Trade Receivables from Related Parties / Trade Receivables	Ratio of trade receivables from related parties to total trade receivables
TLRP/TL	Trade Liabilities to Related Parties / Trade Liabilities	Ratio of trade liabilities to related parties to total trade liabilities
ORRP/TA	Other Receivables from Related Parties / Total Assets	Ratio of other receivables from related parties to total assets
RPV	Represents each of the related party variables. Namely RRP/TA, LRP/TA, TRRP/TR, TLRP/TL and ORRP/TA	N/A
APS	Stock Price Performance	Yearly performance of shares
DPR	Dividend Payout Ratio	Ratio of dividends distributed to net income
FFR	Free Float Ratio	Ratio of publicly traded shares to total shares outstanding
TQ	Tobin's Q Ratio	Ratio of market value of assets to book value of assets
LNMF	Natural Logarithm of Market Cap of Free Float	Natural logarithm of the market capitalization of free float

3.2. Methodology

In the study, five variables were employed to ascertain the presence of RPTs, drawing upon the data in the comprehensive financial statements. Companies engaging in financial lending or sales transactions with related entities report receivables from related parties. Conversely, companies that engage in purchases or loans from related parties report debts to related parties. The analysis of receivables from related parties was conducted using three different variables. Firstly, the ratio of total receivables from related parties to total assets was calculated. Secondly, transactions exclusively between related parties were scrutinized, leading to the calculation of the ratio of trade receivables from related parties to total trade receivables. Thirdly, the ratio of receivables, excluding trade receivables, to total assets was determined. Debts to related parties were evaluated using two variables: initially, the ratio of total debts to related parties to assets was computed; subsequently, the ratio of trade payables to related parties to total trade payables was calculated.

A positive relation between the free float ratio and agency costs in Borsa Istanbul has been identified (Unal & Derdiyok, 2020). From the perspective of agency costs, an elevated free float ratio might serve as an incentive for engaging in RPTs. To examine the relationship between free float ratio and RPTs, the following Equation (1) was formulated. The variable RPV represents related party variables; specifically RRP/TA (Receivables from Related Parties / Total Assets), LRP/TA (Liabilities to Related Parties / Total Assets), TRRP/TR (Trade Receivables from Related Parties / Trade Receivables), TLRP/TL (Trade Liabilities to Related Parties / Trade Liabilities) and ORRP/TA (Other Receivables from Related Parties / Total Assets). Regression analyses were conducted for each related party variable. The natural logarithm of the market capitalization of the free float was utilized as a control variable. The acronym FFR signifies the free float ratio, LNMF represents the natural logarithm of the market capitalization of the free float, ε denotes the error term, n indicates the company number, and t denotes the year. Both fixed effects and random effects regression analyses were implemented.

$$RPV_{nt} = \beta_1 FFR_{nt} + \beta_2 LNMF_{nt} + \varepsilon \quad (1)$$

In the study, the impact of RPTs on stock investors is analyzed from three distinct perspectives. The first aspect is the association with stock returns. It is posited that if RPTs engender corporate governance challenges and incur agency costs for minority shareholders, then it may be anticipated that companies with frequent RPTs will exhibit lower stock returns. Consequently, Equation (2) was formulated to examine the relationship between RPTs and stock returns. The variable APS denotes stock price performance, and the definitions of the remaining symbols are consistent with those in equation (1).

$$APS_{nt} = \beta_1 RPV_{nt} + \beta_2 LNMF_{nt} + \varepsilon \quad (2)$$

If controlling shareholders engage in tunnelling funds through RPTs, they may lack the incentive to make decisions that would result in profit distribution to shareholders. This hypothesis

would be corroborated by a negative relation between the magnitude of RPTs and dividend payout ratios. Therefore, the regression analysis outlined in Equation (3) was conducted to investigate the potential relationship between RPTs and the dividend payout ratio (DPR). The variable DPR represents dividend payout ratio, and the definitions of the other symbols remain as delineated in equation (1).

$$DPR_{nt} = \beta_1 RPV_{nt} + \beta_2 LNMF_{nt} + \varepsilon \quad (3)$$

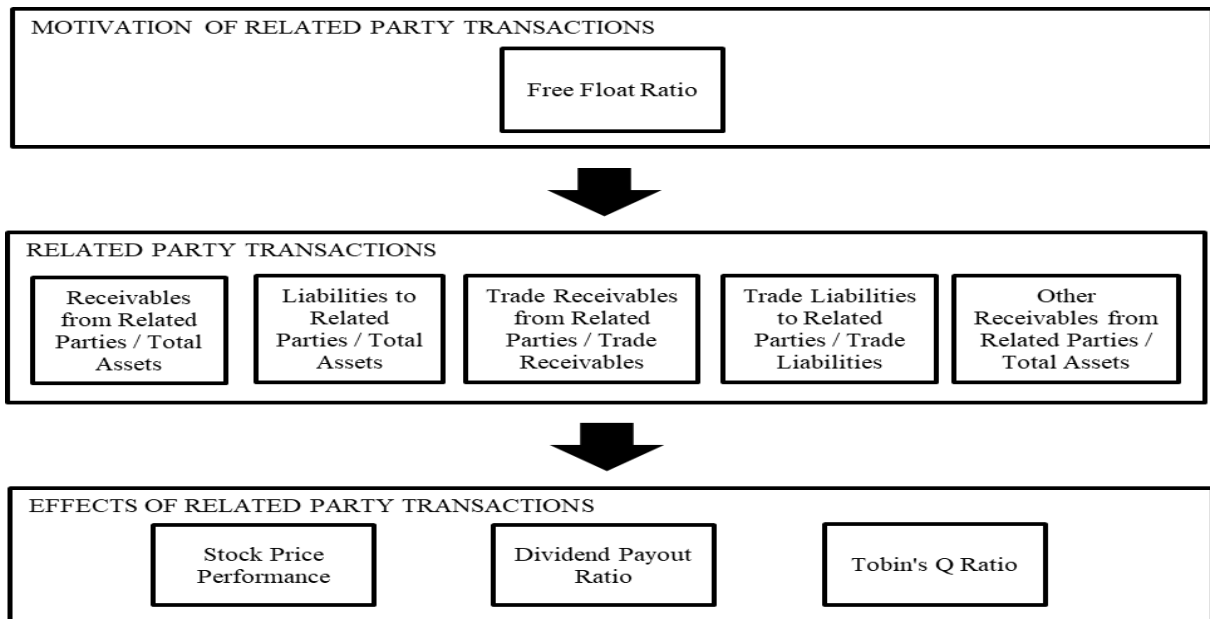
In the fourth phase of the analysis, the study explored the potential relationship between RPTs and the market's perception of the company. Should RPTs be viewed unfavorably by market participants, it is expected that the valuation of companies engaging in such transactions would be adversely affected. To assess the impact on company valuation, the association between companies' RPTs and their Tobin's Q ratios was examined. Equation (4) was developed to facilitate this investigation. The variable TQ represents Tobin's Q ratio, while the definitions of the other symbols remain consistent with those presented in equation (1).

$$TQ_{nt} = \beta_1 RPV_{nt} + \beta_2 LNMF_{nt} + \varepsilon \quad (4)$$

RPTs present a heightened risk in small-scale companies; however, this risk may be mitigated in well-institutionalized companies with robust internal control systems and a diversified controlling shareholder base among various large holding entities. Consequently, foreign companies and those associated with Koç Holding, Sabancı Holding, Anadolu Group and Oyak – Turkey's four major holding companies with a combined market value of their publicly traded firms surpassing 100 billion TL as of 01 December 2023 - were excluded from the research scope. The analyses delineated in Equations (1), (2), (3) and (4) were subsequently conducted to gain more precise understanding of the impact of RPTs.

The relationships among the variables tested in the study are illustrated in Figure 1.

Figure 1. Research Model



4. FINDINGS

Descriptive statistics for the variables utilized in the study are presented in Table 2. The variables Receivables from Related Parties / Total Assets (RRP/TA), Liabilities to Related Parties / Total Assets (LRP/TA), and Other Receivables from Related Parties / Total Assets (ORRP/TA) exhibit very low average values, while their maximum values approach 1.0, indicating significant variability.

Table 2. Descriptive Statistics

	RRP/TA	LRP/TA	TRRP/TR	TLRP/TL	ORRP/TA	APS	DPR	FFR	TQ	LNMF
Mean	0.05	0.04	0.15	0.10	0.02	0.98	0.22	0.38	1.84	19.57
Median	0.01	0.01	0.01	0.01	0.00	0.51	0.00	0.34	1.00	19.49
Maximum	0.93	0.69	1.00	1.00	0.84	14.31	15.67	1.00	61.21	25.31
Minimum	0.00	0.00	0.00	0.00	0.00	-0.81	0.00	0.01	0.02	14.16
Std. Dev.	0.10	0.08	0.26	0.19	0.06	1.64	0.62	0.22	3.33	1.88
Skewness	3.56	3.33	2.01	2.69	5.48	3.45	14.13	0.78	8.40	0.15
Kurtosis	20.4	16.5	5.9	10.5	44.0	20.3	301.7	3.0	109.9	2.9
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Observations	1,478	1,478	1,478	1,478	1,478	1,478	1,478	1,478	1,478	1,478

Note: RRP/TA: Receivables from Related Parties / Total Assets, LRP/TA: Liabilities to Related Parties / Total Assets, TRRP/TR: Trade Receivables from Related Parties / Trade Receivables, TLRP/TL: Trade Liabilities to Related Parties / Trade Liabilities, ORRP/TA: Other Receivables from Related Parties / Total Assets, APS: Stock Price Performance, DPR: Dividend Payout Ratio, FFR: Free Float Ratio, TQ: Tobin's Q Ratio, LNMF: Natural Logarithm of Market Cap of Free Float.

The correlation matrix for the study's variables is presented in Table 3. As anticipated, there is a positive correlation among the variables associated with receivables and liabilities. Notable, a negative correlation exists between Trade Liabilities to Related Parties / Trade Liabilities (TLRP/TL) and Other Receivables from Related Parties / Total Assets (ORRP/TA). The natural logarithm of the market capitalization of the free float (LNMF), serving as a control variable, demonstrates a weak correlation with the other variables.

Table 3. Correlation Matrix

	RRP/TA	LRP/TA	TRRP/TR	TLRP/TL	ORRP/TA	APS	DPR	FFR	TQ	LNMF
RRP/TA	1.00	0.04	0.63	0.04	0.67	-0.02	0.01	-0.03	-0.03	-0.09
LRP/TA	0.04	1.00	0.06	0.43	-0.02	-0.01	-0.02	-0.02	0.06	-0.03
TRRP/TR	0.63	0.06	1.00	0.19	0.15	-0.03	0.06	-0.05	0.01	-0.01
TLRP/TL	0.04	0.43	0.19	1.00	-0.01	-0.03	0.02	-0.18	0.06	-0.03
ORRP/TA	0.67	-0.02	0.15	-0.01	1.00	-0.01	-0.03	0.02	-0.05	-0.10
APS	-0.02	-0.01	-0.03	-0.03	-0.01	1.00	-0.04	-0.01	-0.03	-0.16
DPR	0.01	-0.02	0.06	0.02	-0.03	-0.04	1.00	-0.12	-0.01	0.08
FFR	-0.03	-0.02	-0.05	-0.18	0.02	-0.01	-0.12	1.00	-0.12	0.03
TQ	-0.03	0.06	0.01	0.06	-0.05	-0.03	-0.01	-0.12	1.00	0.06
LNMF	-0.09	-0.03	-0.01	-0.03	-0.10	-0.16	0.08	0.03	0.06	1.00

Note: RRP/TA: Receivables from Related Parties / Total Assets, LRP/TA: Liabilities to Related Parties / Total Assets, TRRP/TR: Trade Receivables from Related Parties / Trade Receivables, TLRP/TL: Trade Liabilities to Related Parties / Trade Liabilities, ORRP/TA: Other Receivables from Related Parties / Total Assets, APS: Stock Price Performance, DPR: Dividend Payout Ratio, FFR: Free Float Ratio, TQ: Tobin's Q Ratio, LNMF: Natural Logarithm of Market Cap of Free Float.

Table 4 displays the outcomes of both random effects and fixed effects regression analyzes concerning the relationship between the free float ratio (FFR) and RPTs. The findings indicate no significant association between the total receivables from related parties variables in PANEL A and the trade receivables variables in PANEL C. Conversely, PANEL D illustrates a positive correlation between other receivables from related parties and the FFR. This suggests that high FFR is not associated with a higher likelihood of controlling shareholders engaging in trade with affiliated companies. Instead, it indicates an elevated propensity to extend loans. Examination of total debts to related parties in PANEL B and trade payables to related parties in PANEL E shows a positive relation with the free float ratio. It is important to note, however, that the explanatory power of these models is relatively limited.

Table 4. The Relationship Between the Free Float Ratio and RPTs

	Fixed Effects		Random Effects	
PANEL A	(1)	(2)	(3)	(4)
Dependent Variable: Receivables from RP / total assets				
Ratio of free float	0.00	0.00	0.00	-0.01
Logarithm of free float market capitalization	0.00	0.00	0.003***	0.003*
R ²	0.00	0.00	0.00	0.00
PANEL B				
Dependent Variable: Debts to RP / total assets				
Ratio of free float	0.02*	0.03**	0.03***	0.04***
Logarithm of free float market capitalization	-0.01***	-0.01***	-0.01***	-0.01***
R ²	0.02	0.02	0.01	0.02
PANEL C				
Dependent Variable: Trade receivables from RP / total trade receivables				
Ratio of free float	-0.03	-0.01	-0.03	-0.01
Logarithm of free float market capitalization	0.00	0.00	0.00	0.00
R ²	0.00	0.00	0.00	0.00
PANEL D				
Dependent Variable: Other receivables from RP / total assets				
Ratio of free float	0.02**	0.01	0.02**	0.01
Logarithm of free float market capitalization	0.00	0.00	0.00*	0.00
R ²	0.00	0.01	0.00	0.00
PANEL E				
Dependent Variable: Trade debt to RP / total trade debt				
Ratio of free float	0.07**	0.09***	-0.01	0.01
Logarithm of free float market capitalization	0.00	-0.01**	0.00	0.00
R ²	0.02	0.01	0.00	0.00

Notes: The research dataset encompasses 339 companies, excluding entities within the financial sector companies and investment trusts, that are listed on Borsa Istanbul. The timeframe of the study spans from 2016 to 2022, with an annual frequency of data collection. Results pertaining to the complete dataset are articulated in columns (1) and (3). For columns (2) and (4), companies associated with Koç Holding, Sabancı Holding, Anadolu Group, Oyak Group, and foreign companies were excluded from the analysis. Significance levels are denoted as follows: *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 5 shows the relationship between the stock price performance and RPTs. While the relationships predominantly appear negative, aligning with expectations, they lack statistical significance.

Table 5. The Relationship Between the Stock Price Performance and RPTs

Dependent Variable: Stock price performance				
	Fixed Effects		Random Effects	
PANEL A	(1)	(2)	(3)	(4)
Receivables from RP / total assets	-1.01	-0.28	-0.35	-0.28
Logarithm of free float market capitalization	-1.16***	-0.21***	-0.18***	-0.20***
R ²	0.43	0.25	0.04	0.04
PANEL B				
Debts to RP / total assets	-0.14	-0.43	-0.39	-0.42
Logarithm of free float market capitalization	-1.15***	-0.21***	-0.19***	-0.21***
R ²	0.43	0.25	0.04	0.04
PANEL C				
Trade receivables from RP / total trade receivables	-0.17	-0.12	-0.12	-0.12
Logarithm of free float market capitalization	-1.15***	-0.21***	-0.18***	-0.21***
R ²	0.43	0.24	0.04	0.04
PANEL D				
Other receivables from related parties / total assets	-0.34	-0.23	-0.34	-0.24
Logarithm of free float market capitalization	-0.18***	-0.21***	-0.18***	-0.20***
R ²	0.24	0.25	0.04	0.04
PANEL E				
Trade debt to RP / total trade debt	0.03	-0.15	-0.13	-0.16
Logarithm of free float market capitalization	-1.15***	-0.21***	-0.18***	-0.20***
R ²	0.43	0.25	0.04	0.04

Notes: The research dataset encompasses 339 companies, excluding entities within the financial sector companies and investment trusts, that are listed on Borsa Istanbul. The timeframe of the study spans from 2016 to 2022, with an annual frequency of data collection. Results pertaining to the complete dataset are articulated in columns (1) and (3). For columns (2) and (4), companies associated with Koç Holding, Sabancı Holding, Anadolu Group, Oyak Group, and foreign companies were excluded from the analysis. Significance levels are denoted as follows: *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 6 explores the relation between the dividend payout ratio (DPR) and RPTs. A positive relationship is observed between DPR and trade receivables from related parties, potentially attributable to the related party's intent to settle trade debts using received dividends. Conversely, a negative correlation is found between other receivables and DPR, indicating a preference by the related party to extract cash through loans rather than through dividend distribution. The explanatory powers of these models are notably weak.

Table 6. The Relationship Between the Dividend Payout Ratio and RPTs

Dependent Variable: Dividend payout ratio				
	Fixed Effects		Random Effects	
PANEL A	(1)	(2)	(3)	(4)
Receivables from RP / total assets	-0.07	-0.14	0.04	-0.11
Logarithm of free float market capitalization	-0.03	0.04***	0.04***	0.03***
R2	0.34	0.03	0.01	0.01
PANEL B				
Debts to RP / total assets	0.05	-0.01	-0.06	-0.07
Logarithm of free float market capitalization	-0.03	0.04***	0.04***	0.03***
R2	0.34	0.03	0.01	0.01
PANEL C				
Trade receivables from RP / total trade receivables	0.12**	0.02	0.12**	0.02
Logarithm of free float market capitalization	0.05***	0.04***	0.04***	0.03***
R2	0.03	0.03	0.02	0.01
PANEL D				
Other receivables from related parties / total assets	-0.31	-0.43**	-0.27	-0.38*
Logarithm of free float market capitalization	0.05***	0.04***	0.04***	0.03***
R2	0.03	0.04	0.01	0.01
PANEL E				
Trade debt to RP / total trade debt	0.09	0.05	0.09	0.06
Logarithm of free float market capitalization	0.05***	0.04***	0.04***	0.03***
R2	0.03	0.03	0.01	0.01

Notes: The research dataset encompasses 339 companies, excluding entities within the financial sector companies and investment trusts, that are listed on Borsa Istanbul. The timeframe of the study spans from 2016 to 2022, with an annual frequency of data collection. Results pertaining to the complete dataset are articulated in columns (1) and (3). For columns (2) and (4), companies associated with Koç Holding, Sabancı Holding, Anadolu Group, Oyak Group, and foreign companies were excluded from the analysis. Significance levels are denoted as follows: *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Finally, Table 7 presents the regression analysis results assessing the impact on Tobin's Q (TQ). In PANEL A, the influence of Receivables from RP / Total Assets (RRP/TA) on TQ is negatively characterized. PANEL B observes a positive impact of Debts to RP / Total Assets on Tobin's Q. PANEL C indicates negative relationship with Trade Receivables from RP / Trade Receivables (TRRP/TR). PANEL D suggests a negative impact of Other Receivables from Related Parties / Total Assets (ORRP/TA), while PANEL E demonstrates a positive and statistically significant effect of Trade Debt to RP / Trade Debt (TLRP/TL) on TQ. Consequently, it is discerned that debts to related parties positively influence company valuation, whereas receivables from related parties exert a negative effect. Nonetheless, given the models' low overall explanatory power, it is imperative to consider that additional factors may influence these relationships.

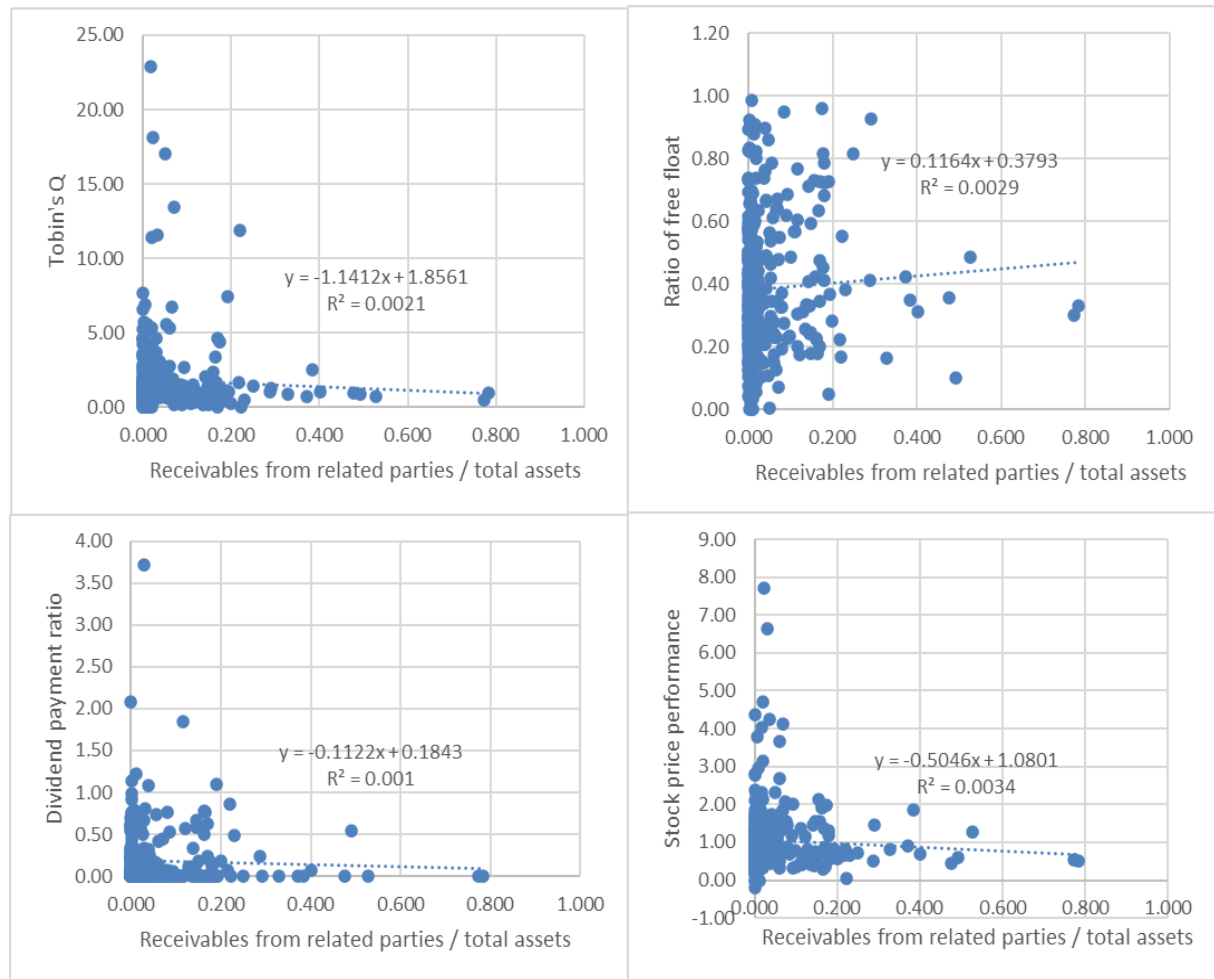
Table 7. The Relationship Between Tobin's Q Ratio and RPTs

Dependent Variable: Tobin's Q				
	Fixed Effects		Random Effects	
PANEL A	(1)	(2)	(3)	(4)
Receivables from RP / total assets	-1.04*	-1.16**	-1.15*	-1.33***
Logarithm of free float market capitalization	-0.12***	-0.07*	-0.02	0.06
R ²	0.07	0.08	0.00	0.01
PANEL B				
Debts to RP / total assets	2.10***	2.23***	2.35***	2.50***
Logarithm of free float market capitalization	-0.10**	-0.04	-0.01	0.07*
R ²	0.07	0.09	0.01	0.02
PANEL C				
Trade receivables from RP / total trade receivables	0.07	-0.43*	0.04	-0.46*
Logarithm of free float market capitalization	-0.12***	-0.07*	-0.03	0.05
R ²	0.06	0.08	0.00	0.00
PANEL D				
Other receivables from related parties / total assets	-1.73**	-1.19*	-1.86**	-1.43**
Logarithm of free float market capitalization	-0.12***	-0.07	-0.01	0.06
R ²	0.07	0.09	0.00	0.00
PANEL E				
Trade debt to RP / total trade debt	0.95***	0.38	0.91***	0.27
Logarithm of free float market capitalization	-0.12***	-0.07*	0.02	0.18***
R ²	0.07	0.08	0.00	0.02

Notes: The research dataset encompasses 339 companies, excluding entities within the financial sector companies and investment trusts, that are listed on Borsa Istanbul. The timeframe of the study spans from 2016 to 2022, with an annual frequency of data collection. Results pertaining to the complete dataset are articulated in columns (1) and (3). For columns (2) and (4), companies associated with Koç Holding, Sabancı Holding, Anadolu Group, Oyak Group, and foreign companies were excluded from the analysis. Significance levels are denoted as follows: *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

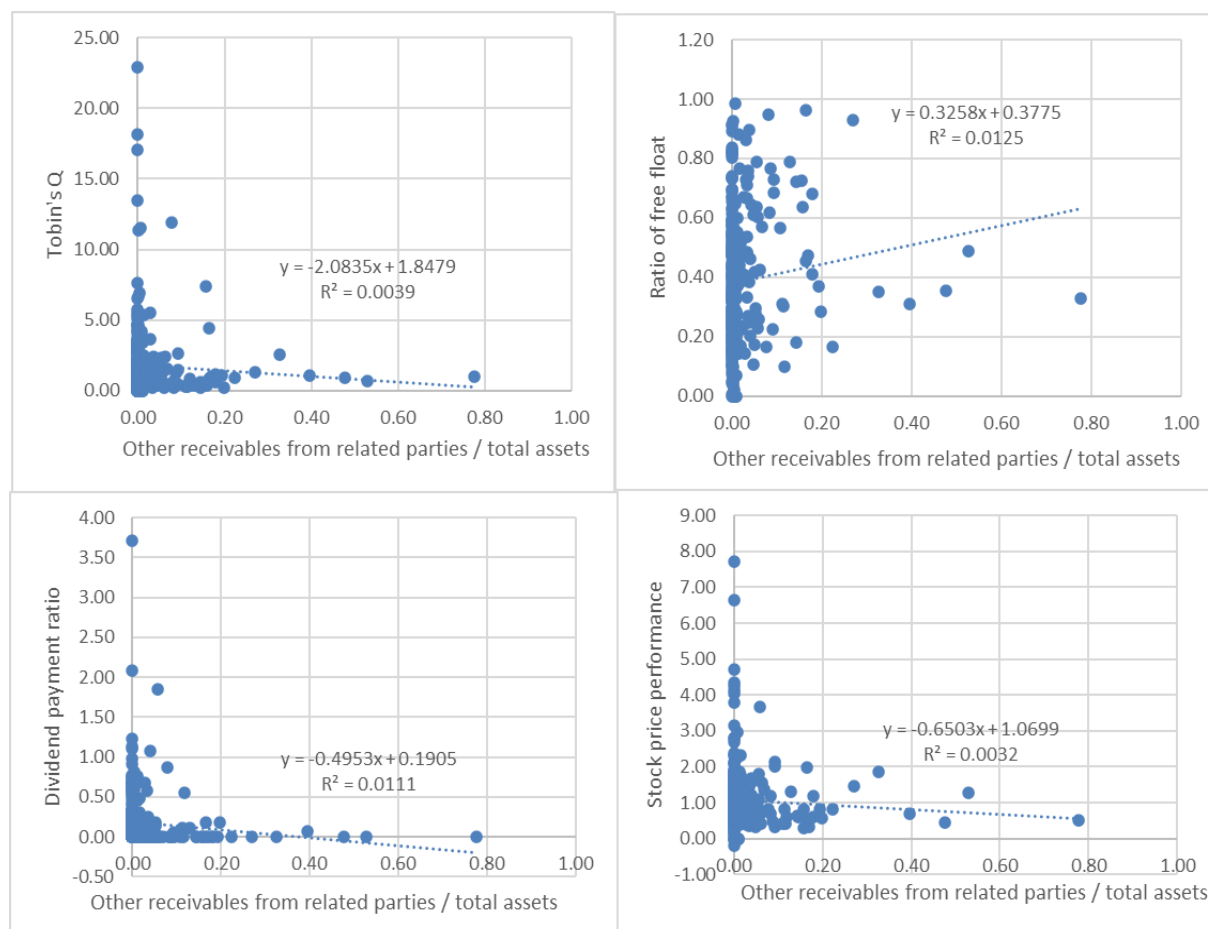
To understand the relationship of RPTs with other variables in the study, a seven-year average of data from the period 2016-2022 was calculated for each company. The data derived within the study are depicted in Figure 2, 3, and 4. Figure 2 indicates that receivables from related parties are inversely related to Tobin's Q, the dividend payout ratio and stock price performance, while showing a positive relationship with the free float ratio. Companies with receivables from related parties tend to have lower valuations, reduced dividend payout ratios, and diminished stock price performance. An increase in RPTs is observed in companies with a higher free float ratio, supporting the hypothesis that investors holding publicly traded shares incur agency costs. However, the graphical representations exhibit only a slight slope, indicating weak explanatory power.

Figure 2. Relationship Between Receivables from Related Parties and Depended Variables in the Study



Notes: The research dataset encompasses 339 companies, excluding entities within the financial sector companies and investment trusts, that are listed on Borsa Istanbul. For the chart creation, the average of the year-end values for each company was calculated over the period 2016-2022.

While companies with high institutional standards may conduct sales through holding companies, such as Koç Holding's subsidiaries Ford Otosan, Tofaş, and Türk Traktör, which exhibit significant levels of RPTs, the presence of international partnerships and jointly developed control mechanisms in these companies can mitigate agency cost risks. Additionally, receivables from related parties may arise from non-trade activities like financial lending. Lending by a company to a related entity poses challenges in controlling and potential agency costs due to the difficulty in determining fair interest rates and the uncertainty of the related company's risk level. Hence, non-trade related party receivables are becoming increasingly significant. Figure 3 presents the relationship between non-trade receivables from related parties and the study's variables, showing similar directional relationships as in Figure 2 but with greater explanatory power and steeper slopes, albeit still limited.

Figure 3. Relationship between other Receivables from Related Parties and Depended Variables in the Study

Notes: The research dataset encompasses 339 companies, excluding entities within the financial sector companies and investment trusts, that are listed on Borsa Istanbul. For the chart creation, the average of the year-end values for each company was calculated over the period 2016-2022.

Debts to related parties may take the form of commercial obligations or financial borrowings to fulfill capital needs. Financial debts, unlike commercial debts, are less significant due to fixed interest rates, with associated risks borne by the related party, not the company. The analysis thus focuses on how total debts to related parties influence other variables, as demonstrated in Figure 4.

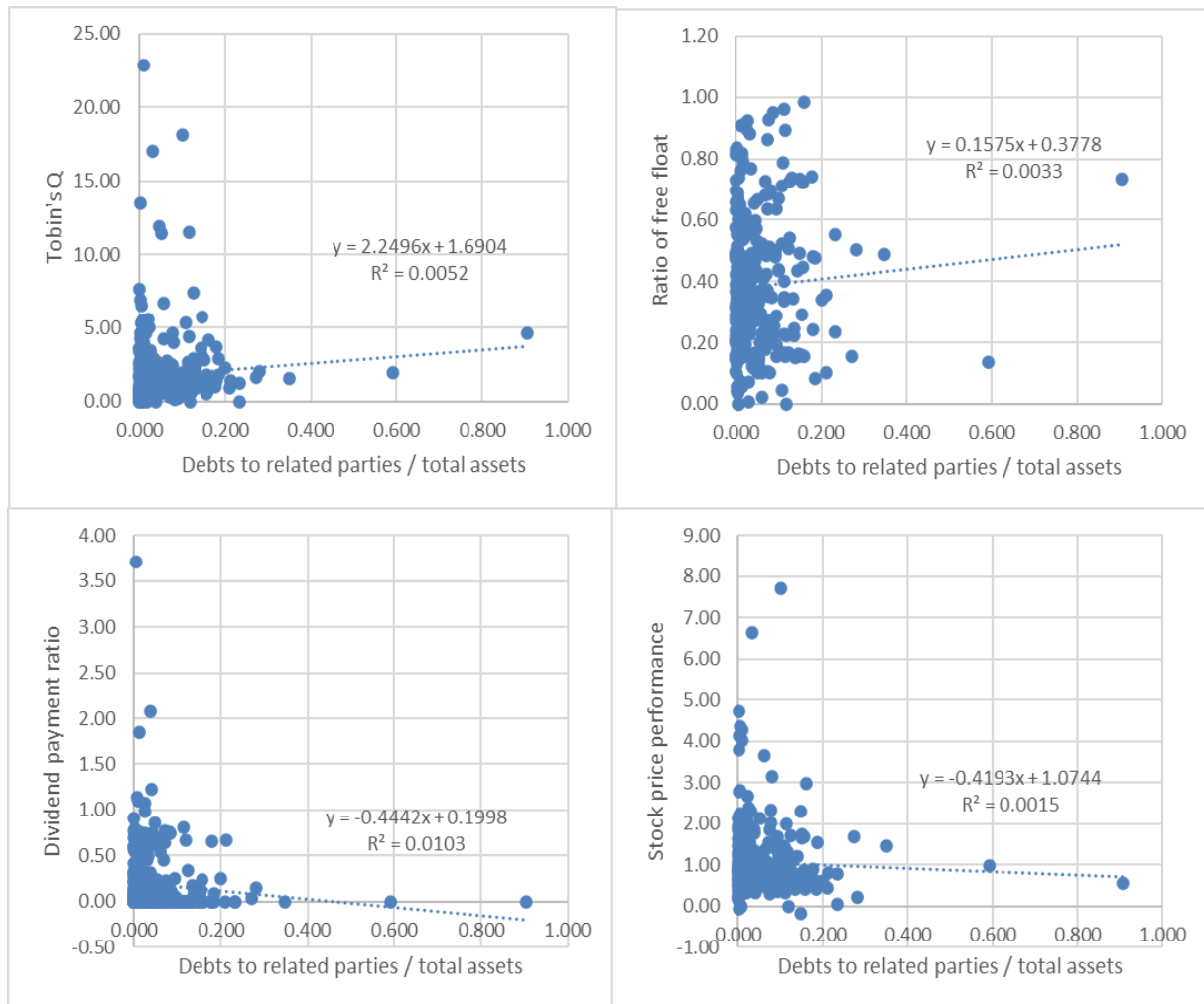
Surprisingly, a positive correlation exists between Tobin's Q ratio and debts to related parties, possibly due to companies with borrowing needs from related parties having lower book values. Interestingly, the market does not perceive debts to related parties as detrimental. An increase in the free float ratio is associated with higher debts to related parties, defying initial expectations. This anomaly could be explained by a reduced tendency of the controlling shareholder to finance the company as the free float expands, or it might indicate that loans from related parties signal an upcoming capital increase. Therefore, a higher free float ratio could lead to less participation by the controlling shareholder in the capital increase, explaining the positive correlation between the free float ratio and debts to related parties.

Conversely, a negative correlation is identified between the dividend payout ratio and debts to related parties. When the related party possesses receivables from the company, it is expected that the

related party would prioritize settling debts over distributing dividends. Furthermore, if a company's borrowing from a related party is due to an insufficient capital structure, a decrease in the dividend payout ratio is deemed justifiable. Lastly, a negative link is established between stock performance and debts to related parties, which may be attributed to companies with related party debts having weaker capital structures or experiencing losses from such transactions, suggesting the presence agency costs.

It is crucial to recognize the limited explanatory power of the equations employed in these analyses.

Figure 4. Relationship Between Debts to Related Parties and Depended Variables in the Study



Notes: The research dataset encompasses 339 companies, excluding entities within the financial sector companies and investment trusts, that are listed on Borsa Istanbul. For the chart creation, the average of the year-end values for each company was calculated over the period 2016-2022.

Table 8 summarizes the statistically significant relationships identified in the study. It reveals a positive relationship between debts to related parties and both the free float ratio and Tobin's Q ratio; a positive relationship between receivables from related parties and the free float ratio, and a negative relationship between receivables from related parties and Tobin's Q.

Table 8. Summary of Statistically Significant Relationships in The Research

	Receivables from Related Parties / Total Assets	Liabilities to Related Parties / Total Assets	Trade Receivables from Related Parties / Trade Receivables	Trade Liabilities to Related Parties / Trade Liabilities	Other Receivables from Related Parties / Total Assets
Free Float Ratio		+		+	+
Stock Price Performance					
Dividend Payout Ratio			+		-
Tobin's Q Ratio	-	+	-	+	-

5. CONCLUSION

This study aims to inform stock market investors about the significance of RPTs. The research examined the relationship between transactions with related parties and the free float ratio, stock price performance, dividend payout ratio, and Tobin's Q for companies listed in Borsa Istanbul.

The findings indicate a positive relationship between the free float ratio and RPTs, including both receivables from and debts to related parties. This suggests that an increase in the free float ratio may alter the alignment between the interests of controlling shareholders and the company. RPTs offer a means for controlling shareholders to utilize company resources for their own benefit, increasing the risk of agency costs for public shareholders. The positive link between the free float ratio and RPTs contrasts with the results reported by Khalili and Mazraeh (2016), which may be due to differences in capital market structures and the representation efficiency of publicly traded shares across countries.

The analysis of the relation between stock performance and RPTs shows a negative trend, though it is not statistically significant. The complexity of identifying this relationship is compounded by numerous factors influencing stock returns and the historical occurrence of RPTs in similar companies, which may have previously influenced stock prices. However, the negative relation supports the notion that RPTs may contribute to agency costs. Notably, other studies in the literature have also highlighted the adverse relationship between RPTs and stock returns (Gordon et al., 2006; Habib et al., 2021; Ryu, 2018).

The research results indicate a negative relationship between the dividend payout ratio and RPTs. When controlling shareholders can improperly transfer funds from the company through procurement or other means, their incentive to distribute dividends on behalf of the company decreases. This negative association between RPTs and dividend distribution increases the likelihood of agency costs. Conversely, a positive relation was identified only between trade receivables from related parties and dividend distribution, which may be due to the related party's intent to use the dividends received to settle its debts. The study's findings align with the existing literature (Sari et al., 2017).

Finally, a positive relation exists between debts to related parties and Tobin's Q ratio, and a negative relation is noted between receivables from related parties and Tobin's Q ratio. When companies extend loans to related parties, they assume the associated risk, whereas borrowing shifts the risk to other entities within the related party. Considering the shift in risk, the impact on market pricing appears consistent with research findings. The literature presents diverse findings regarding the influence of RPTs on firm valuation (Bona-Sánchez et al., 2017; Djankov et al., 2008; Elkelish, 2017; Gordon et al., 2006).

It is important to comment that although some research findings are statistically significant, the overall explanatory power of the equations is limited. This limitation may stem from the influence of numerous factors that cannot be included in the study and the variable effects of RPTs across different companies. For instance, RPTs in ethically managed companies may not be detrimental, whereas in firms governed by controlling shareholders who disregard ethical standards, the situation differs markedly. The challenge of conducting meaningful comparisons arises from the limited implementation of RPTs in numerous companies, coupled with a left-skewed distribution that tends toward the lower end.

In conclusion, this study highlights that RPTs can negatively impact public shareholders in certain companies. Therefore, investors should carefully analyze RPTs and incorporate them into their investment decisions. Given these potential risks, it is crucial for regulatory authorities to enhance oversight and impose restrictions on such transactions. Moreover, when RPTs receive regulatory approval, safeguarding the interests of public shareholders should remain a priority. However, it is important to recognize that many of the relationships examined in this study exhibit modest coefficients, and the explanatory power of RPTs on performance metrics is limited. Future research could provide deeper insights by conducting detailed case studies on company-specific RPTs.

Ethics Committee approval was not required for this study.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors declare that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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National Unemployment Rate Forecast with Google Trends

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Abstract

The significant economic recession and ongoing COVID-19 pandemic are impacting various sectors. The decrease in employment, one of the main consequences of this economic stagnation, is felt intensely in Türkiye. The concern that today's unemployment problem will be experienced more intensely in the future brings to the fore studies on unemployment forecasting. To date, unemployment forecasting studies have received extensive coverage in the literature. This study aims to make more successful forecasts of unemployment data by using Google Trends (GT), which is frequently used in different fields today. Four GT-based variables were incorporated into traditional forecasting methods, including ARIMA, ARIMAX, and VAR models. The VAR GT3 model, which integrates GT data with annual inflation, provided the best forecasting performance among all tested models. The findings indicate that models incorporating GT data derived from various keywords yield more successful results than traditional models.

Keywords: *Unemployment, Google Trends, VAR, ARIMA, ARIMAX.*



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1. INTRODUCTION

In recent years, the lack of employment opportunities in developing countries has been one of the biggest problems. Unemployment has become more deeply felt due to the global economic slowdown and the ongoing Covid-19 pandemic. However, perceived unemployment may vary according to the socioeconomic conditions of each country. At this point, dissatisfaction with past performance and concern about the future increase the interest of researchers and policymakers in studies on unemployment forecasts.

It is recognized that economic crises and structural changes mainly cause unemployment. In addition to these factors, demographic factors such as education, population growth, and migration also play a role as determinants of unemployment. In Türkiye, a significant migration issue that has been significantly impacted due to the conflict in Syria and Afghanistan, asylum seekers have negatively impacted the unemployment problem. Consequently, accurate unemployment prediction plays a pivotal role in shaping effective policy responses.

Predictive models can benefit by incorporating indicators reflecting individuals' job-search behavior or attitudes, potentially boosting forecast accuracy. For many years, variables such as individual behavior and attitudes have been measured through surveys, which are primary data methods. However, like many macroeconomic indicators, there may be delays in the publication of the unemployment rate indicators. Moreover, considering the reluctance of time-conscious individuals to fill out questionnaires, electronic data is expected to address this gap significantly.

Using web-based data derived from keyword searches has compelled researchers to contemplate maximizing its efficiency. To support this concept, there is a demand for up-to-date data to facilitate real-time forecasts of the unemployment rate (Fondeur & Karame, 2013). Today, the widespread use of the Internet and the proliferation of non-traditional data environments such as smartphones, smart sensors, digital media, Google, and web-based data sources have made it easier to obtain data on most of the everyday activities of companies and individuals. The electronic footprints left by individuals due to their Internet searches provide valuable information to researchers (Jun & Park, 2016). The digital data obtained through these unconscious footprints are inherently unbiased (Abraham et al., 2018; Ayyoubzadeh et al., 2020; Santillana et al., 2015), accurate (Han et al., 2012; Park et al., 2017; Santillana et al., 2015; Wilcoxson et al., 2020), and beneficial (Wu & Brynjolfsson, 2015; Vosen & Schmidt, 2011). They also offer more extensive, frequent, and current data than the more commonly employed surveys, typically subject to publication delays (Mulero & Garcia-Hiernaux, 2023). Roughly speaking, an unemployed person's unconscious disclosure of this situation by entering job search sites provides an indicator that can be used in unemployment forecasting. In short, the information collected from the Internet is crucial in providing information about the behavior of individuals on the Internet.

Google, one of the most significant search engines, provides users with such search statistics free of charge through its Google Trends (GT) tool. Google handles over 92 percent of all online searches worldwide (Lee, 2015). These statistics can be accessed by specifying the keywords related to the topic of interest and the period in which the words were searched. GT is one of the most widely used tools in applied economics literature among non-traditional data sources. (Cebrián & Domenech, 2023; Suhoy, 2009).

While online tools like Google offer a wealth of data, how can we put this to practical use? By tapping into the data from GT, we aim to see if it can help predict unemployment trends. This paper explores using Google Trends data to improve unemployment forecasting in Türkiye. Türkiye is a fascinating case to analyze because of its sharp rise in unemployment due to inflation and migration. Additionally, the occurrence of illegal migration impacts the accuracy of unemployment statistics. To provide a comprehensive approach to Turkish unemployment, we use simple exponential smoothing (SES), autoregressive moving average (ARMA), ARMA with explanatory variables (ARMAX), and vector autoregressive (VAR) models and also introduce Google searches for *job offers*, *jobs* as explanatory variables.

The paper is organized as follows: Section 2 provides a comprehensive literature review on utilizing GT as predictors, specifically focusing on its applications in predicting unemployment. Section 3 delves into the details of the data used in our analysis, particularly emphasizing the generation process of GT queries. The model and methodology used in our study are also presented in Section 3. Empirical Results are presented in Section 4. In Section 5, we compare the forecasting results of the proposed models across various combinations of GT data. Finally, the paper concludes with a discussion and presents some conclusive remarks.

2. LITERATURE REVIEW

GT data has attracted significant attention from researchers recently due to its ability to categorize Big Data sources according to time intervals, geographical locations, topics, and search terms. As more and more daily activities take place online, people inadvertently reveal their inclinations on these matters through their Internet searches (Belej, 2022; Blazquez & Domenech, 2018; Einav & Levin, 2014; Knipe et al., 2021; Rotter et al., 2021; Sherman-Morris et al., 2011; Yeh et al., 2018). Over the past two decades or so, studies in various fields have sought to demonstrate that models utilizing Internet-based search data can enhance prediction accuracy. In these studies, researchers aim to leverage unconventional data sources to forecast social, economic, or psychological behaviors and trends. Hassani and Silva (2015) explored the utilization of these data types across various fields.

In many forecasting studies, Internet-based data are included in the models as explanatory variables to improve forecasting performance. Mulero and Garcia-Hiernaux (2023) emphasize that

Google Trends data enable nowcasting models to provide more accurate forecasts than traditional indicators. Cebrián and Domenech (2023) investigate whether GT data can be reliable.

Internet-based data are now also integrated into many unemployment forecasting studies (Adu et al., 2023; Anvik & Gjølstad, 2010; Choi & Varian, 2012; D'Amuri & Marcucci, 2010; McLaren & Shanbhogue, 2011; Simionescu, 2020; Simionescu & Cifuentes-Faura, 2022a; Simionescu & Zimmermann, 2017). Unemployment is an important indicator for governments and researchers, especially considering the challenging situation in the Turkish labor market. This indicator is highly affected by migration from Syria and other countries in the region, the ongoing effects of the COVID-19 pandemic, and the economic slowdown.

The existing literature reveals that the number of studies focusing on Türkiye needs to be increased. Chadwick and Şengül (2015) categorized Google Trends (GT) data within the framework of a prediction model built using principal component analysis. The study demonstrates its superiority over other models in terms of performance by considering GT data and non-agricultural unemployment rates in its estimation model. Similarly, Bolivar et al. (2019) also tried to improve forecasting performance by using GT data on terms such as 'finding a job,' 'unemployment benefits,' and 'unemployment insurance.' The authors integrate variables such as production index, electricity consumption, capacity utilization rate, and unemployment benefit claims into their model. It is revealed that the model using GT data produces superior results compared to the models without GT data. In Şentürk (2022), where the addition of GT data to the forecasting model is advocated, the unemployment rate in Türkiye is estimated. The forecast accuracy is compared with ARIMA and ARIMAX methods.

The idea that using Google Trends (GT) data in forecasting models can significantly enhance predictive accuracy has been supported by many studies. In order to investigate whether this result is affected by the different economic structures of countries, studies conducted for many different countries, such as Fondeur and Karame (2013) in France, Adu et al. (2023) in Ghana, Askitas and Zimmermann (2009) in Germany, D'Amuri (2009) and Naccarato et al. (2018) in Italy, Anvik and Gjølstad (2010) in Norway and Mihaela (2020) in Romania are reviewed. As a result of this review, it was concluded that the use of GT data will improve the forecasting performance. Vicente et al. (2015), Gonzalez-Fernandez and Gonzalez-Velasco (2018), and Simionescu and Cifuentes-Faura (2022a, 2022b) found similar results in Spain. The studies conducted by D'Amuri and Marcucci (2010) and Ettredge et al., (2005) for the United States also support using GT data. A similar conclusion was reached in the studies conducted by Chadwick and Şengül (2015) and Şentürk (2022) for Türkiye.

The main difference in the studies examined is that the GT data are generated with keywords selected in the national language. Focusing on Spain, Gonzalez-Fernandez and Gonzalez-Velasco (2018), Mulero and Garcia-Hiernaux (2023), Simionescu and Cifuentes-Faura (2022a), Simionescu and Cifuentes-Faura (2022b), and Vicente et al. (2015) have used time series of job search queries from

Google Trends to predict unemployment. Simionescu and Cifuentes-Faura (2022a, 2022b) identified that the top keywords for job searches in Spain are “ofertas de empleo” (job vacancies), “ofertas de trabajo” (job offers), and “desempleo” (unemployment). Vicente et al. (2015) and Gonzalez-Fernandez and Gonzalez-Velasco (2018) incorporated some of these keywords to illustrate that forecasts relying on models using Google search data outperformed alternative forecasting methods for the Spanish unemployment rate. In Mulero and Garcia-Hiernaux’ (2023) paper, keywords are selected according to a different criteria procedure. They categorized the search terms into four groups: (i) queries related to leading job search platforms (such as Infojobs, Jobday, LinkedIn, etc.); (ii) searches linked to Spanish unemployment centers, whether online or physical, public or private (e.g., Employment office, SEPE, Randstad, etc.); (iii) queries related to standard job search terms (e.g., Job offers, How to Find a Job, How to Find Work, etc.); and finally, (iv) searches directly related to companies that generate the most employment in Spain (e.g., working at Inditex, Carrefour employment, Santander job opportunities).

Mihaela (2020) explained and estimated Romania's regional unemployment at the county level for 2004-2018. In addition, the Granger causality relationship between unemployment and other indicators was investigated. The findings of the study indicate that the indicators collected through Google Trends can improve the unemployment rate forecasts in Romania.

In conclusion, a detailed evaluation of the studies in the literature shows that GT data impact the success of unemployment rate forecasting models, but the forecasting accuracy depends on the keywords chosen.

3. DATA AND METHODOLOGY

This section details the data used in the unemployment estimation model and the assumptions regarding using GT data.

3.1. Data-Google Trends

In recent years, researchers have begun to use GT to measure indicators such as social behavior, attitudes, tastes, and preferences, which are difficult to measure. This preference also has some important advantages. Firstly, GT data is cost-effective and reliable. In addition, GT data eliminates the problem of data bias, as it is derived from Internet searches that the user unconsciously discloses. In addition, GT does not have the disadvantages of traditional survey measurement. These disadvantages include participant reluctance, the idea of wasting time, and laziness. The advantages of using GT data have been demonstrated in many studies (Belej, 2022; Blazquez & Domenech, 2018; Einav & Levin, 2014; Knipe et al., 2021; Rotter et al., 2021; Sherman-Morris et al., 2011; Yeh et al., 2018). When data on human and company activities are analyzed correctly, it will help reveal trends and behaviors (Blazquez & Domenech, 2018). Collecting information with GT data also has some disadvantages. While GT searches may occasionally yield unrelated results, they may also fail to capture the entirety of the relevant search (Anvik & Gjelstad, 2010). Choosing the right keywords related to the phenomenon

to be researched is very important. Several studies (Askitaş & Zimmermann, 2009; Simionescu & Cifuentes-Faura, 2022a) try to overcome this criticism by creating various scenarios in the research model.

GT index takes values on a scale between 0 and 100. GT is a trending index that measures how often a keyword is searched over time relative to the total search volume. The more popular the keyword is in the selected period and region, the higher it gets ranked. GT takes a zero value for queries with a low search volume and ignores repetitive searches performed by the same machine over a very short period. Searching for multiple keywords and filtering out queries with apostrophes and special characters is possible.

This study uses monthly, seasonally adjusted unemployment data (ages 15–64), the annual inflation rate, and four different GT search datasets (Jan. 2005–May 2023) to develop an unemployment forecasting model. The rationale for using inflation as an independent variable to understand unemployment is anchored on the Phillips curve. Empirical studies such as Karahan and Uslu (2018), Atgür (2020), Kırca and Canbay (2020), and Nar (2021) have shown that the Phillips Curve is valid in the Turkish context, with evidence suggesting a negative causality from inflation to unemployment. These findings highlight the relevance of inflation as a key variable in understanding and forecasting unemployment trends in Türkiye. Typically, inflation rate data becomes available more swiftly than unemployment statistics, which could make it a valuable, timely indicator for forecasting unemployment trends. Search frequency data from GT has been analyzed using four approaches (Mulero & Garcia-Hiernaux, 2023). The approaches taken for GT are given in Table 1¹.

Table 1. Definitions of Different GT Variables

Variables	Definition	Keywords
GT1	Unemployment rate + job postings	İşsizlik oranı+iş ilanları
GT2	Popular job search websites in Türkiye	İşbul net +Toptalent.co + Yenibiriş +Eleman online +Eleman net +Kariyer net
GT3	Turkish Employment Agency (state-sponsored job search platform)	İşkur+ Türkiye İş kurumu
GT4	Creating a CV + Reference letter + Interview techniques + Job application examples	CV oluşturma +Referans mektubu+Mülakat teknikleri+İş başvurusu örnekleri

¹ Although the keywords listed in Table 1 are in Turkish, they were intentionally preserved in their original form, as the study focuses on the Turkish labor market and reflects the actual search behavior of Turkish Internet users. Translating them into English would distort the nature of the data collected from Google Trends. Similar approaches have been taken in other country-specific studies (e.g., Mulero & Garcia-Hiernaux, 2023; Simionescu & Cifuentes-Faura, 2022a for Spain), where keywords were selected in the native language to ensure representativeness.

GT1 is frequently used in the literature, including the unemployment rate and the search terms for job vacancies. GT2 contains the names of the most used job posting websites in Türkiye. GT3 gives the search frequency of the government's official job search site, while GT4 includes search terms that are researched before a job search, especially for new graduates, and are more future-oriented. GT4 gives the number of searches for search terms such as creating CVs, requesting letters of reference, interview techniques, and job application examples.

Figure 1 shows the time path graphs of the unemployment and inflation rates, while Figure 2 shows the time path of Google search data for the unemployment.

Figure 1. Time Path of the Unemployment Rate and Inflation Rate

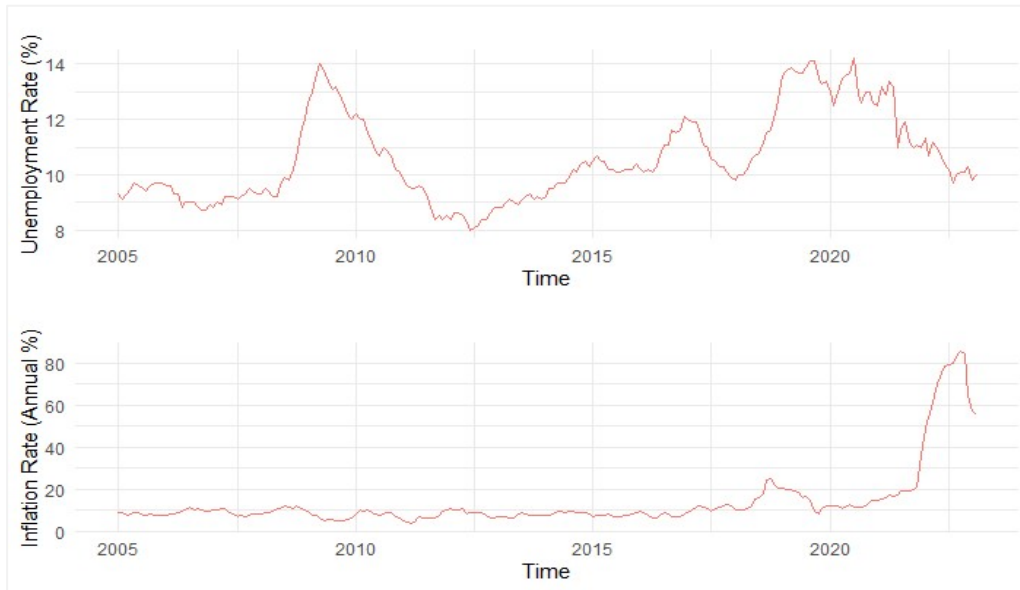
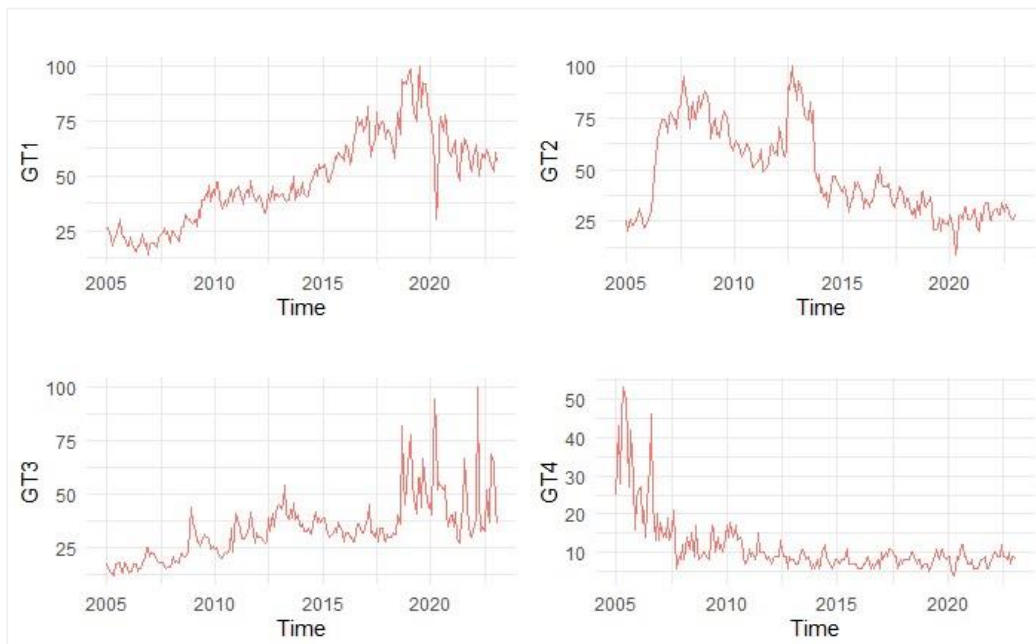


Figure 2. Time Path of Google Search Data for Unemployment



3.2. Methodology

This study considers two approaches for building a forecasting model: (1) univariate and (2) multivariate models. The univariate models used are the random walk process, ARMA, ARMAX, and SES models. In addition, VAR models are considered multivariate models.

3.2.1. Random Walk Model

Suppose that ε_t is a discrete-time purely random process with mean μ and variance σ_ε^2 . A process Y_t is said to be a random walk if

$$Y_t = Y_{t-1} + \varepsilon_t$$

The random walk process is a non-stationary process. In a time series with a random walk process, future values occur randomly without depending on previous values. In such a case, predicting future values by looking at past values is impossible. However, some studies indicate that the random walk process is superior to many methods in time series forecasting (Moosa & Burns, 2014). This study considers the random walk process a benchmark model (Pesaran et al., 2009). A random walk model forecast value is defined as

$$\hat{Y}_{n+i} = Y_n, i = 1, 2, \dots, h.$$

3.2.2. Simple Exponential Smoothing (SES)

Exponential smoothing (ES) is the name given to a general class of forecasting procedures that rely on simple updating equations to calculate forecasts. The most basic form introduced is simple exponential smoothing (SES), which should only be used for non-seasonal time series showing no systematic trend. Many time series that arise in practice do contain a trend or seasonal pattern, but these effects can be measured and removed to produce a stationary series for which simple ES is appropriate (Gardner Jr., 1985).

$$\hat{Y}_t = aY_t + (1 - a)\hat{Y}_{t-1}$$

Here, a is the smoothing coefficient, taking values between $0 \leq a \leq 1$. Determining a is an optimization problem commonly obtained by grid search (Hyndman & Athanasopoulos, 2018).

3.2.3. Autoregressive Moving Average (ARMA)

ARMA models are among the most frequently used econometric methods for analyzing and forecasting economic time series. According to Balli and Elsamadisy (2012), the Box-Jenkins methodology is regarded as an effective prediction technique, especially for single-variable time series.

The ARMA model for a stationary time series is generally:

$$Y_t = \mu + \varepsilon_t + \sum_{i=1}^p \phi_i Y_{t-i} + \sum_{i=1}^q \theta_i \varepsilon_{t-i}$$

ϵ_t is the white noise process, ϕ_i and θ_i are the coefficients of the autoregressive and moving average processes, respectively.

3.2.4. Autoregressive Moving Average with Explanatory Variables (ARMAX)

The ARMAX model is an extended version of the ARMA model. Unlike ARMA, exogenous (explanatory) variables are added to the model. Thanks to the added exogenous variables, the explanatory power of the model for the dependent variable increases. The mathematical representation of the ARMAX model is as follows:

$$Y_t = \mu + \epsilon_t + \sum_{i=1}^p \phi_i Y_{t-i} + \sum_{i=1}^q \theta_i \epsilon_{t-i} + \beta X_t$$

Here, X_t is the explanatory variable.

3.2.5. VAR Model

The VAR model can be considered a multivariate form of the ARMA model. Since it is a multivariate system, it is frequently used in time series analyses. In addition, unlike the ARMA model, since it is a system with more than one equation, the model's explanatory power may be higher in some cases.

Generally, VAR models is given as:

$$y_t = v + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + u_t$$

Where y_t is the variable vector, A_i 's is the coefficient matrix, and u_t is the error vector.

4. EMPIRICAL RESULTS

The stationarity structure of the time series was examined prior to the empirical analysis to ensure statistically significant results from the ARMA and VAR models. Analyses with non-stationary series may be misleading due to the spurious regression problem. The Augmented Dickey-Fuller (ADF) test proposed by Dickey and Fuller (1981) is widely used to test whether the series has a unit root. However, Perron (1989) pointed out that the ADF test gives erroneous results, and the null hypothesis of unit root is not rejected in case of a break in the series. Therefore, Zivot and Andrews (1992), Perron (1997), and Vogelsang and Perron (1998) propose unit root tests that allow structural breaks to be identified endogenously from the data. The results of the unit root test are presented in Table 2.

Table 2. Unit Root Test Results

Variables	ADF Level	Break Point Unit root test (Vogelsang and Perron, 1998) Level	First Difference
ump	-2.239725 (0.193)	-2.49 (0.905)	-13.45904 (< 0.01)
inf	0.115863 (0.9663)	-8.38 (< 0.01)	Breakpoints 2020:11
gt1	-1.750679 (0.4043)	-4.22 (0.093)	2014:05
gt2	-2.114395 (0.2393)	-4.31 (0.072)	2013:07
gt3	-2.490993 (0.1191)	-7.68 (< 0.01)	2018:06
gt4	-4.221675 (0.0008)		

Note: Both trend and break features are taken as constant terms only. The break type is an additive outlier. The break selection method is the minimized Dickey-Fuller t statistic. The appropriate lag length is chosen using SIC for a maximum of 12 lags. Values in parentheses are p-values corresponding to the test statistics. Null Hypothesis: Serie has a unit root.

According to the unit root test results, the unemployment rate is the first difference stationary. Inflation, GT1, GT2, and GT3 are stationary at levels under break. The breakpoints that disrupt the stationarity structure of the series are given in Table 2. GT4 is a level stationary time series. Due to the unit root test results, the first-order difference of the unemployment series is used in the ARMA, ARMAX, and VAR models.

On the other hand, for the series that are stationary under the break, dummy variables are used for the dates of the breakpoint in the models. After these specifications, the models were estimated, and out-of-sample forecast values were obtained. For the calculation of the predictive performance of the models, the data set is divided into two parts: train and test. 75% of the dataset (163 observations) is used for model prediction, and the remaining 25% (55 observations) is used as test data for the fit of the forecast model. 2005:01 to 2018:07 is the train data set, and 2018:08 to 2023:02 is the test data set.

Numerous criteria have been put forward throughout history to assess forecast accuracy, sparking debates about their appropriate application. Root Mean Square Error (RMSE) is a standard yet scale-dependent measure, making it unsuitable for comparing models with different variables or frequencies. In this study, we used the Symmetric Mean Absolute Percentage Error (sMAPE) and Mean Absolute Scaled Error (MASE), which are better for diverse datasets. sMAPE is frequently used for its scale-independence and interpretability, while MASE mitigates potential issues from using sMAPE. The corresponding formulas are as follows:

$$SMAPE = \frac{2}{h} \sum_{t=1}^h \frac{2|Y_t - \hat{Y}_t|}{|Y_t| + |\hat{Y}_t|} \times 100$$

$$MASE = \frac{1}{g} \frac{\sum_{t=1}^h |Y_t - \hat{Y}_t|}{\frac{1}{n-m} \sum_{t=m+1}^n |Y_t - Y_{t-m}|}$$

Where g is the number of out-of-period predictions, \hat{Y}_t is the out-of-period prediction values, m is the frequency of the data, n is the total number of observations. In the literature, many researchers have suggested using "relative" *MASE* (*RelMASE*) and "relative" *sMAPE* (*RelMAPE*) values instead of using *MASE* and *MAPE* values alone (Fildes, 1992; Ahlburg, 1992; Hyndman & Koehler, 2006). In order to calculate these criteria, it is necessary to calculate the *MAPE* and *MAPE* values of a simple but effective method as a performance indicator (benchmark). This study considers the Random Walk Model (RW) as a benchmark. After selecting the Random Walk Model as the performance benchmark, $RelMAPE = sMAPE/sMAPE_{RW}$ and $RelMASE = MASE/MASE_{RW}$. After calculating the relative criteria, *OWA* criterion is calculated by taking the overall weighted average of the "relative" *MASE* and "relative" *sMAPE* criteria (Ağaslan & Gayaker, 2020).

Table 3. Comparison of Forecasting Performance

Models	sMAPE	MASE	RealsMAPE	RealMASE	OWA	Success Rate (%)
Random Walk	13.85677	4.58519	1	1	1	0
ARMA	16.85470	5.46424	1.21635	1.19172	1.20403	-20.40
ARMA_GT1	12.89188	4.28972	0.93037	0.93556	0.93296	6.70
ARMA_GT2	16.98718	5.50243	1.22591	1.20004	1.21298	-21.30
ARMA_GT3	16.20020	5.27857	1.16912	1.15122	1.16017	-16.02
ARMA_GT4	16.78194	5.44869	1.21110	1.18832	1.19971	-19.97
SES	13.85683	4.58521	1.00000	1.00000	1.00000	0.00
VAR	11.63288	3.89768	0.83951	0.85006	0.84478	15.52
VAR_GT1	10.89739	3.66358	0.78643	0.79900	0.79272	20.73
VAR_GT2	11.78902	3.94669	0.85078	0.86075	0.85576	14.42
VAR_GT3	10.61869	3.57825	0.76632	0.78039	0.77336	22.66
VAR_GT4	10.72192	3.61067	0.77377	0.78746	0.78062	21.94

Table 3 shows that the VAR_GT3 model exhibits the best forecasting performance. In this model, "İşkur+Turkish Employment Agency" searches are included as annual inflation and Google Trends variables. The results show that using GT data to forecast the unemployment rate improves the forecasting performance. This finding aligns with previous studies such as Chadwick and Şengül (2015) and Bolivar et al. (2019), demonstrating that integrating GT data enhances the accuracy of unemployment forecasting models. However, in univariate models, ARMA_GT1 again shows the best forecasting performance. This model is obtained using the Google Trends variable with the key term "Unemployment rate + job vacancies" in addition to the lags of the unemployment rate itself.

Similarly, Şentürk (2022) also reported that using GT variables in ARIMA and ARIMAX models significantly improves forecast accuracy for unemployment in Türkiye. Figure 3 shows out of

sample forecast and actual data comparison. Figure 4 shows the out-of-sample forecast values of the VAR_GT3 model, which has the best forecasting performance.

Figure 3. Out of Sample (Ex-ante) Forecast and Actual Data

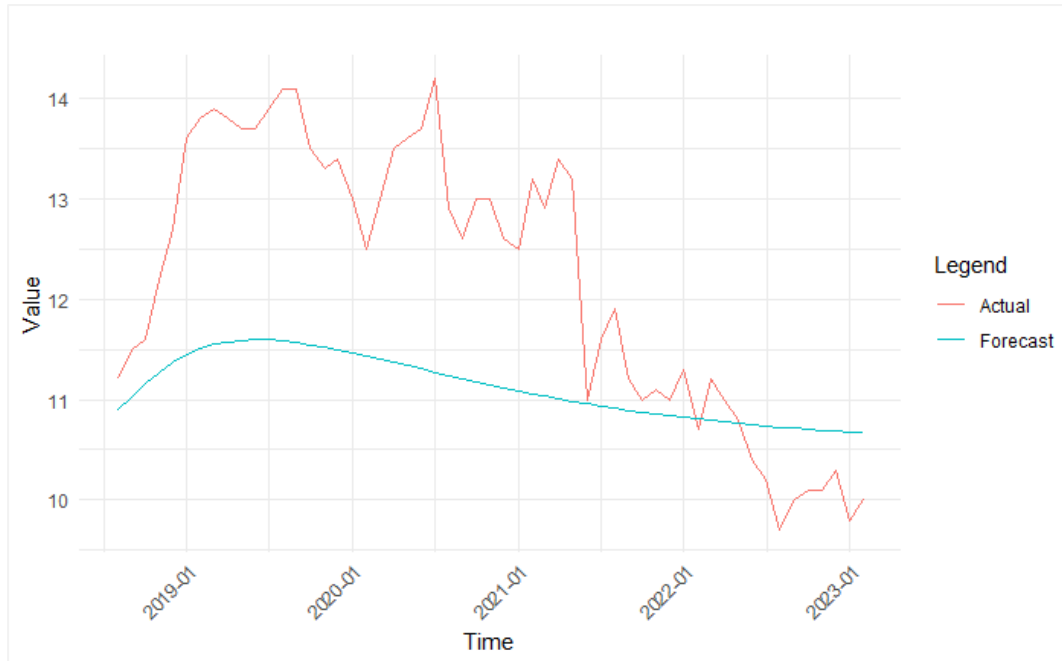
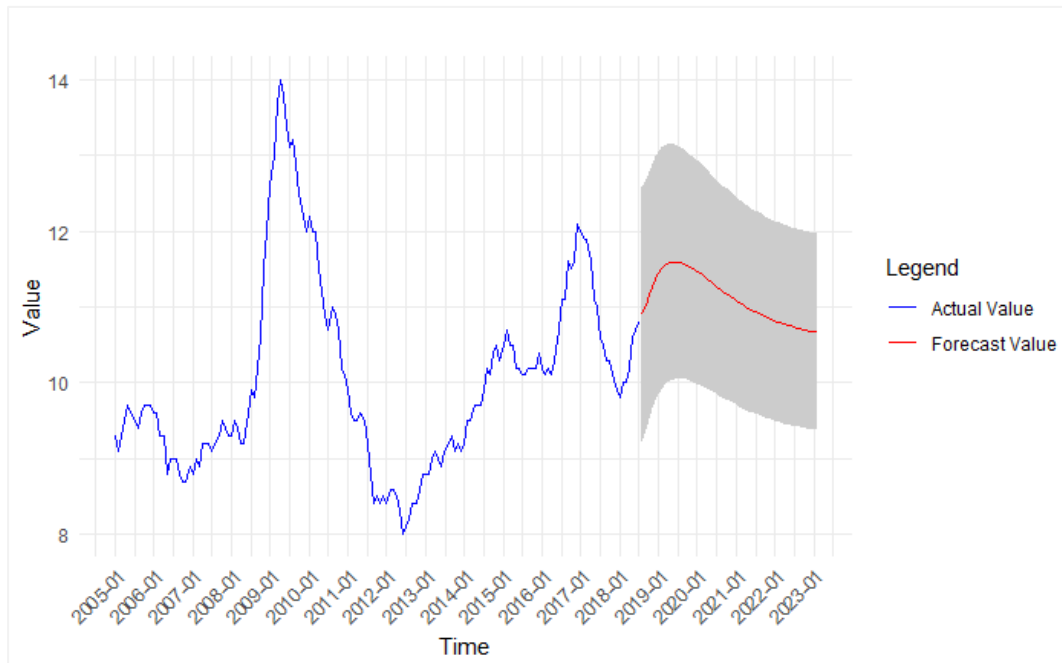


Figure 4. Actual and Out-of-Sample Forecasts with Confidence Intervals



The model results show that the models augmented with Google Trends data generally have better forecasting performance than the traditional models. The findings of this study are consistent with global literature, including Gonzalez-Fernandez and Gonzalez-Velasco (2018) for Spain and Naccarato et al. (2018) for Italy, both of which emphasize the superiority of GT-enhanced models in unemployment

forecasting. In particular, the VAR_GT3 model with the annual inflation rate and search terms associated with the Turkish Employment Agency performs the best compared to the other models. This suggests that individuals' interest in state-sponsored job search platforms may be an important indicator for predicting changes in the unemployment rate. Such findings align with studies like Kırca and Canbay's (2020) and Nar (2021), highlighting the utility of inflation and unemployment causality relationships in forecasting labor market dynamics.

Moreover, the ARMA_GT1 model with Google Trends data performs best in univariate models. This model includes the key term "Unemployment rate+job openings" related to the unemployment rate. This shows that critical terms related to unemployment can be crucial in improving unemployment forecasts.

5. CONCLUSION

Economic crises, the COVID-19 pandemic, and recent waves of migration have led to a significant drop in employment, causing public concern. Türkiye faces one of Europe's highest unemployment rates, which has become a priority socioeconomic issue for the country.

This study investigates whether using Google Trends to forecast Türkiye's unemployment rate will improve the forecasting performance. For this purpose, we use seasonally adjusted unemployment rate, inflation, and four different Google Trends data between January 2005 and May 2023. The study is based on two approaches: (1) univariate models, including the random walk process, ARMA frameworks, and simple exponential smoothing techniques, and (2) multivariate models, represented by the vector autoregressive (VAR) configurations.

According to the results, the VAR_GT3 model demonstrates the highest forecasting performance. This model incorporates the annual inflation rate along with GT3, which represents Google Trends search queries related to the *Turkish Employment Agency*. The inclusion of Google Trends variables significantly enhances the accuracy of unemployment rate forecasting. In contrast, among the univariate models, ARMA_GT1 yields the best performance. This model utilizes GT1, a Google Trends variable reflecting search activity on “*unemployment rate*” and “*job postings*”, alongside the lags of the unemployment rate itself.

These findings underscore the predictive power of modern tools like Google Trends in the current digital era. Predictive models built by incorporating real-time search data into traditional models are crucial for researchers to achieve more reliable forecasting results. The superior performance of models incorporating this data type, such as VAR_GT3 and ARMA_GT1, suggests that public interest and concern - reflected in their search behavior - can predict larger economic patterns. This enhances our technical approach to forecasting and highlights the importance of considering public sentiment and behavior in economic forecasting. It is an important step in combining traditional economic metrics with data sources from the digital age.

These results hold great importance for professionals and policymakers. The impact of key terms related to unemployment, particularly on popular online platforms like Google, is essential for enhancing unemployment forecasts. As industries and policymakers try to predict job market trends, these new data sources and analysis methods can be the key to accurate and up-to-date economic forecasts.

Ethics Committee approval was not required for this study.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors declare that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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The Mediating Role of Country Brand Equity in the Effect of Country of Origin Image on Word of Mouth Marketing: A Study on Turkish TV Series in Morocco

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Abstract

Turkish TV series have recently become more widespread and popular in the international arena, especially in the Balkan and Middle Eastern countries. Turkish TV series, which have a wide audience in the Arab geography, are met with great interest especially in the Kingdom of Morocco. Within the scope of this study, the reasons and tendencies of Moroccan people, who are among the audience of Turkish TV series, to watch Turkish TV series were investigated. In addition, the effect of country of origin image (COI) on country brand equity (CBE) and word-of-mouth marketing (WOM) was analyzed and the mediating role of country brand equity in this effect was examined. In the context of literature, the historical development of the Turkish TV series sector is discussed by touching on the historical relationship between Türkiye and Morocco, and the similarities in terms of culture and belief. The study was carried out in the cities of Casablanca, Fez, Marrakesh and Meknes, which are among the most populous cities of the Kingdom of Morocco. Quantitative methods were used in the research and data was collected with a survey form obtained from 250 people using the easy sample method. Among the data obtained in the study, demographic characteristics, perspectives on Turkish TV series, reasons for watching TV series, criticisms about TV series, desire to buy products in TV series and perspectives on Türkiye were analyzed using frequency analysis using SPSS program. The effect of COI on WOM and the mediating role of country brand equity in this effect were analyzed by measurement and structural model with the help of SmartPLS 4.0 program. As a result of the study, it was seen that the COI had a statistically significant effect on brand equity and WOM. In addition, a mediating role of country brand equity was found in this effect.

Keywords: *Country of Origin, Country Brand Equity, Word of Mouth Marketing, Morocco, Turkish TV Series, Intercultural Communication.*



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1. INTRODUCTION

An important factor in people's product evaluations is national origin. The country of origin of a product signals the quality of that product and influences perceived risk and purchasing behavior (Papadopoulos & Heslop, 2003). Country image is defined as the sum of the ideas, impressions and beliefs that people living in a particular place have about a country (Kotler et al., 1993). Therefore, it shapes people's behavior (Kim & Yim, 2022; Magnusson et al., 2022). For comprehending the value of brands, brand equity structure has been presented in the literature (Aaker, 1991; Keller, 1993). Country brand equity, which is considered a conceptual extension of brand equity, refers to the value of country brands (Zeugner-Roth et al., 2008). Therefore, a country's country brand represents a “relational”, in other words, intangible asset (Veloutsou et al., 2013). The country of origin of the brand is a driving force in determining the brand image, perceived quality, brand loyalty, and brand awareness (Magnusson et al., 2022; Lee et al., 2020). In this context, Turkish TV series take their place in literature as an important factor in the image of a country (Özarslan, 2020; Kaptan & Algan, 2023; Hancığaz & Hülür, 2024).

TV series and movies can affect the thoughts and behaviors of the audience in the country where they are broadcast and encourage the audience to live and live standards in the TV series. In addition, Turkish TV series are effective communication tool in promoting Turkish culture, customs, traditions and tourism (Cengiz & Çakın, 2022). Word of mouth marketing (WOM) is a communication effort that takes place between two people without commercial concerns or any self-interest (Taylor et al., 2012). There are studies in the literature on the connection between brand equity and word of mouth marketing (WOM) marketing (Latif et al., 2019; Mukerjee, 2018; Sofiane, 2019; Yazgan et al., 2014). In a study conducted to determine the effect of the brand equity on the WOM communication variable; research indicates that brand equity positively influences and significantly contributes to positive WOM communication (Odabaşoğlu et al., 2022). Another study stated that brand image has a moderate and positive effect on WOM communication carried out online (Urmak & Dayanç Kıyat, 2021). There are also studies on the effect of the country-of-origin on brand equity. In these studies, it was concluded that country of origin effects have a positive effect on consumer brand equity. (Aaker, 1991; Kim & Chung, 1997; Yoo & Donthu, 2001; Lin & Kao, 2004; Jaffe & Nebenzahl, 2006; Pappu et al. 2006; Mohd Yasin et al. 2007; Ngan et al., 2020).

The aim of the article is to examine the effect of country of origin image on country brand equity and WOM and to analyze the mediating role of country brand equity in this effect. In addition, to examine the tendencies of Moroccan people towards Turkish TV series and products, to reveal the reasons for their preference of Turkish TV series and products and the aspects they criticize in the series. There are studies in the literature that measure the effect of country of origin image on country brand equity. It has been noticed that the studies that examine the effect of country of origin and brand equity on word of mouth marketing are limited. Considering the limited number of studies on the interaction

between the country of origin and WOM, it is expected that the study conducted will have a significant effect in terms of providing insight when it is simultaneously included in the marketing strategies related to the country, product, company or brand that will be in the market. In addition, no study has been found that examines the mediating role of the country brand equity in the effect of the country of origin image on word of mouth marketing. In this context, the study is considered original. Another original area of the study is that the application area of this model designed for Turkish origin products and brand equity is Morocco. Research on country brand equity continues to be added to the marketing literature (Zeugner-Roth et al., 2008; Pappu & Quester, 2010; Bose et al., 2020).

Overall, this study aims to contribute to the existing literature on country brand equity and addresses the fact that consumer perceptions in the global market can be manipulated through TV series. As a result of this situation, the study is considered important in terms of providing clues and guidance to companies operating in international trade in determining strategies. TV series export, which has an important place in foreign trade, is an effective international marketing area in the promotion of countries and products. Therefore, this study aims to raise awareness by emphasizing the importance of TV series and film exports. In addition to all these, it is thought that it will also guide researchers who want to work in this field. In this context, the first part of the article consists of a conceptual framework and covers the perception of country brand equity, COI, Turkish TV series exports and WOM. The second part provides the purpose, scope and method of the study, data analysis, findings and comments.

2. CONCEPTUAL FRAMEWORK

2.1. Country Brand Equity and Country of Origin Effect

The concept of brand equity is considered a concept used not only on companies or individuals, but also on countries. A country's branding depends on its success in these areas. In a global context, a country's perception of its image and reputation has an important place in country branding. In his study, Anholt (2003) emphasized that the implementation of brand strategies, approaches and methods for countries gives strength to global economic prosperity and country development. According to Anholt, the concept of country brand equity is evaluated as a set of perceptions of people about a country in terms of its political, commercial, cultural, tourist attraction, investment potential and workforce infrastructure features. Mariutti and Giraldi (2020) argue that country brand equity has expanded both in theory and practice, but there is little work on conceptualization. On top of that, they propose a multidimensional framework by including the "reputation" dimension in the concept of country brand equity.

Compared to products from other countries, the feeling of trust that Japanese brands give to the person and the perception of longevity in terms of functionality are seen as the reasons for preference. The perception of low quality and use of cheap materials towards Chinese products creates a discouraging effect that causes a lack of trust in this country's products and makes people worry about

choosing them. Therefore, the perception of a country's brand, which has a strong influence that makes a difference in certain commercial areas, not only affects the purchasing decision process of consumers, but also reflects on the country's performance in the field of exports for its interests (Yıldız, 2017). Countries, in people's perception; They can be divided into multiple groups in terms of brand equity, technological superiority, product design and quality. People may associate the perceptions they attribute to a brand or product with different product groups in the same country. Attitudes attributed to a particular country can also be shaped by people's backgrounds, such as the degree of similarity with that country, cultural, psychological and demographic characteristics. Country of origin; It is expressed as a reputation, an animated picture, formed in the minds of consumers based on a country's image, political and economic history, and national characteristics (Nagashima, 1970).

From a marketing perspective, the country name can have the same power and influence as the brand name and can also contribute to the perceived value of the product. As a result of the reputational perspective, products of a country with a positive image in people's minds are more popular and preferred than products of a country with a negative image (Petra & Diamantopoulos, 2008). Brand equity may be defined as the perception formed in consumers' minds and affects their purchasing decisions (Ural & Perk, 2012). A study by Mohd Yasin et al. (2007) found that the concept of country of origin impacts brand equity, according to the analysis of survey results obtained via e-mail from companies operating in Malaysia. In the studies of Parkvithee and Miranda (2012), it was observed that a brand image with a strong value can replace a country image with a weak value. A meta-analysis study concluded that country of origin image is effective in brand evaluations by consumers (Oduro et al., 2024). Another study conducted on Algerian consumers regarding mobile phones concluded that the perception of country of origin has a direct impact on brand equity dimensions (Djafer & Adjila, 2024).

2.2 Turkish TV Series Industry and Product Placement in the Perspective of Popular Culture

Understanding of popular culture; It consists of products and systems known, recognized and shared by people and is produced and consumed for commercial purposes. The most distinctive feature of this understanding is that it is produced to be sold in the market. Culture industries, which produce the concept of popular culture, create demand for products by creating meaning, images and a consumable pleasure based on these on the capitalist system through a commercial good. In the understanding of popular culture conveyed through mass media, television series and movies are mass media that quickly penetrate people's worlds, influence their thoughts, enable them to take stances on certain issues, manage their perceptions, and have the effect of creating images related to people, places, etc. (Yılmaz & Yılmaz, 2010). Turkish TV series attract all audiences from seven to seventy; In some cases, it can create effects such as different image, personality, style, lifestyle, and arouse different emotions, causing emulation behavior and, as a result, increasing devotion to popular culture. Popular culture, which has become widespread as a result of increased devotion, can also cause a cultural

transformation and a change in consumption patterns (Sucu, 2011). Local TV series broadcast in foreign countries help to spread the understanding of popular culture and to recognize that region in different geographies as a result of visually influencing the audience with the location and location features (Sakallı, 2014).

Many global and national factors have contributed to the rise of Turkish television as a transnational media industry in the last thirty years. The transnationalization of the Turkish television industry, which began in the late 1990s, continues to be successful with Turkish television series exported to more than 150 countries. Turkish television is a tremendous area of cultural production in its historical past (Kaptan & Algan, 2023). Turkish TV series gained momentum especially after 2006 and were exported to many countries, especially the Balkans and the Middle East. After 2010, Türkiye became the largest exporting country in the TV series industry after the USA (United States of America) (Öztürk & Atik, 2016; Uğurlu, 2018). Turkish TV series viewers in Middle Eastern countries approach Turkish TV series with great interest in order to find traces of their own cultural history. The success of Turkish TV series in various aspects such as location, setting and actors is among the main reasons for this intense interest. Another reason is the presence of an Islamic culture with similar lifestyles and beliefs as the audience. Thanks to the TV series, the culture of the Turks has increased its popularity in the Middle Eastern countries and stimulated tourist visits to the country (Ökmen & Göksu, 2019). The concept of product placement, advanced as an alternative to traditional advertisements, is a marketing communication tool. According to DeLorme and Reid (1999), the purpose of this communication tool is to influence the subconscious of the audience and allow the message to be easily received by the receiver (Yıldırım, 2018). Since the actors on the screens have a great influence on the general audience, companies have chosen to appeal to people by taking advantage of this influence for years. Many trendy products have become widespread by being reflected on people's screens. Companies that are aware of this situation have started to take advantage of this marketing communication and use the "product placement" strategy. It is known that this marketing communication increases awareness of brands and provides benefits in image formation (Bozkurt, 2008).

Cultural proximity theory put forward by Straubhaar (1991); This is because viewers are more interested in television productions that they find close to their own lifestyle and culture. This concept was revealed in a study on why Turkish TV series are admired in the Middle East and North African countries, known as the MENA region with the use of English (Berg, 2017). Within the scope of the study, the fact that the actors in the series are more similar to Arabs than European, American or Far Eastern actors, the fact that the plot takes place in a modern Muslim society, the overlap in terms of social relations, similar beliefs and lifestyles cause Turkish TV series to be met with admiration and interest in this region. has happened. Another striking result of the study is the cultural blending situation. As a result of the adoption of the modern understanding of Islam in society, there are differences in the role of women in society compared to the countries of the Mena region. Adopting

modern Islam, a blended image of eastern and western lifestyles, increases the interest in Turkish TV series. The roles of female actors, who take on different roles, especially compared to the countries in the Mena region, are met with interest by female audiences. Therefore, Turkish TV series that reflect modern Muslim culture blended with cultural closeness and east-west synthesis attract more attention than other countries. Another reason why Turkish TV series attract attention in the study is that people who are popular with the audience take part in the TV series. In addition, the fact that the series take place in attractive and luxurious places and lead to a luxurious lifestyle and consumption is another important result of the series attracting attention (Şentürk et al., 2017).

Doğanay and Aktaş (2021) examined television series, which are seen as the biggest entertainment and communication tool, within the scope of production. In their study, Armağan and Gürsoy (2011) aimed to contribute to the development of international scale by examining the concepts of country of origin and consumer ethnocentrism and finding common factors between them. In their study, Başgöze and Kazancı (2014) investigated the factors that affect people's attitudes, brand image and purchasing tendency towards product placement and advertising strategies. As a result, it has been found that people have positive attitudes towards the product placements they encounter in TV series, people have a positive brand image, and people's tendency to purchase the product increases. In their study, in another study, the attitudes of young consumers towards product placements in movies and TV series were examined and divided into categories (Kırcova & Köse, 2017). In a study examining consumers' perceptions of product placement strategies in Turkish TV series watched in Azerbaijan; Six dimensions were revealed: perceived benefit dimension, purchasing effect dimension, cultural promotion dimension, tourism effect dimension, general promotion effect dimension and viewing reason dimension. Participants stated that in the Turkish TV series they watched, they remembered actor clothes, venue furniture and mobile devices in terms of products, and Istanbul in terms of city (Gümüş, 2018). In the study conducted in Bosnia-Herzegovina, Jordan and Kyrgyzstan, the perception levels of Turkish people and Türkiye created by Turkish TV series on individuals were measured. As a result, it was found that the perceptions of Turkish TV series viewers about the personality traits of Turkish people, life in Türkiye, Türkiye's power and Türkiye's active role were effective on their desire to establish close relations with Türkiye (Hancıgaz & Hülür, 2024).

2.3. Country Image and WOM

It is stated that the image created by a country's historical facts and events, traditions and cultures, economic maturity, products and services, technology and industrialization are effective in consumers' brand preference and purchasing decision process (Bannister & Saunders, 2001). The image of the country; It states that consumers' comments formed as a result of their experiences are shaped by the opinions of opinion leaders in society and the guiding influence of mass media (Shimp, 1984). In individuals' purchasing behavior, the people around them, such as their spouses, friends, relatives, and people they take as role models and trust, influence the decision-making process. While individuals

share their positive or negative opinions with other individuals, they inevitably spread their thoughts through WOM (Karaca, 2010). Positive WOM; It takes place in the form of transferring the advisory status of the companies to another person. This allows the company to reduce costs in promotional activities and increase company profits due to attracting a new customer portfolio (Derbaix & Vanhamme, 2003). This marketing activity directly relates to people's value, judgment and quality perceptions. It is indicated that the positive nature of WOM is directly related to perceptions (Hartline & Jones, 1996). A study conducted in America examined how consumers perceived Chinese-made automobiles and its reflections on their purchasing behavior. Within the scope of the study, the effects of product quality, country's image, ethnicity and ethnocentrism on product evaluation and purchase intention were measured. It has been concluded that product quality affects purchasing, while other variables do not affect purchasing (Chinen & Sun, 2011). The concept of country of origin, which is thought to play an active role in shaping consumer perception, plays an active role in shaping the consumer's perception of the country where the product is produced. There are perceptions formed due to some generalizations, such as the deliciousness of Italian pizza, the perfectionism of German cars, and the technological superiority of Japanese electrical products (Mohd Yasin et al., 2007). In a study conducted on a motorcycle brand in Bandung, it was revealed that country of origin, e-wom, and brand trust variables affect people's purchase intention (Hasanawi et al., 2024). Koçan and Yıldız (2020) found correlation between consumption emotions such as gladness and arousal, WOM communication, loyalty and satisfaction in the TV series industry. It has been determined that a positive correlation exists between arousal, WOM communication, loyalty and satisfaction. In a study based on the automotive industry, where the effects of brand, price and COI on product evaluation and purchasing were revealed, it was found that Japan country image is more than France (İzmir, 2016). Doan et al., (2024) concluded in their study that altruism, perceived value and brand equity significantly affect e-wom.

2.4. Model and Hypotheses of the Research

A positive brand image generally results in positive brand equity (Yoo & Donthu, 2001; Lin & Kao, 2004; Jaffe & Nebenzahl, 2006; Pappu et al., 2007). When the studies are examined, country image has a positive and significant effect on perceived quality, brand awareness, brand loyalty and brand associations (Ngan et al., 2020). Country of origin image has a positive and significant effect on brand loyalty variable (Kim & Chung, 1997; Paswan et al., 2003; Pappu et al., 2007; Shahin et al., 2012; Saydan, 2013; Panda & Misra, 2014; Septyanti & Hananto, 2017). Country of origin image is effective in creating associations in people's minds (Aaker, 1991). As a result of this call, product quality perception can be affected (Klein et al., 1998; Haubl & Elrod, 1999; Verlegh & Steenkamp, 1999; Norouzi & Hosienabadi, 2011, Murtiasih et al., 2014; Kim & Chao, 2018). Similarly, there is a positive relationship between the country of origin image and brand awareness (Nath Sanyal & Datta, 2011; Murtiasih et al., 2014; Chiu & Ho, 2015; Kim & Chao, 2018). Generally speaking, when people do not

have information about the product, they refer to the country of origin (Lusk et al., 2006). Considering all these studies, the following assumptions were made in this research:

H₁: COI affects the country brand loyalty dimension of country brand equity in a positive and significant way.

H₂: COI positively and significantly affects the country brand quality dimension of country brand equity.

H₃: COI positively and significantly affects the country brand awareness dimension of country brand equity.

When the studies are examined, it can be said that there is a positive relationship between the country of origin image and word of mouth marketing. It is assumed that the country of origin affects celebrity endorsement and e-wom purchase intention (Halim & Keni, 2021). Li and Li (2024) assume in their studies that there is a substitutive relationship between the country of origin and WOM. If the brands have a positive and strong brand equity, the likelihood of expressing positive opinions about that brand and recommending it to others will increase to this extent (Seo & Park, 2018; Chakraborty & Bhat, 2018; Ahmad & Guzmán, 2021). Therefore, examining the relationship between word of mouth marketing and brand equity will benefit stakeholders in creating a marketing strategy for the target audience in the short term. In this way, it will allow for a permanent perception in the consumer's mind and more efficient future strategy plans (Keller, 1993). Based on all these assumptions, the mediating role of brand equity in the effect of country of origin on word of mouth marketing has been wondered and it has been noticed that there is no study on this subject in the literature. The hypotheses prepared by taking into account the assumptions in the studies are as follows:

H₄: COI affects WOM positively and significantly.

H₅: The country brand loyalty dimension of country brand equity affects WOM positively and significantly.

H₆: The country brand quality dimension of country brand equity affects WOM positively and significantly.

H₇: The country brand awareness dimension of country brand equity affects WOM positively and significantly.

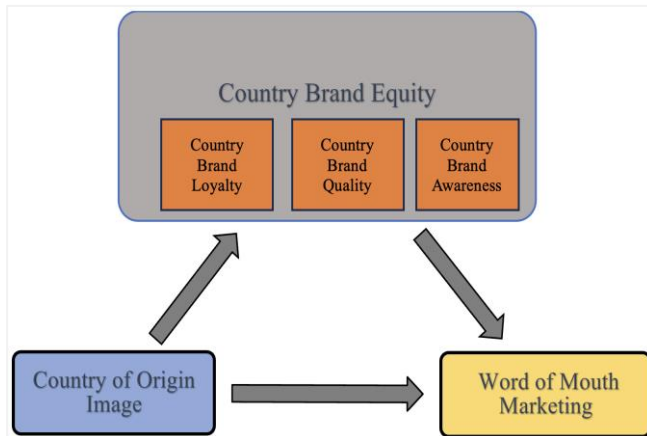
H₈: The country brand loyalty dimension of country brand equity has a mediating role between COI and WOM.

H₉: The country brand quality dimension of country brand equity has a mediating role between COI and WOM

H₁₀: The country brand awareness dimension of country brand equity has a mediating role between COI and WOM.

The research model was created based on the variables used in the studies examined as a result of the literature review. The model established in accordance with the purpose of the research is presented in Figure 1.

Figure 1. Research Model



3. METHOD

Purpose of the research; to determine the perceptions of the Moroccan people towards Turkish and Turkish origin products by revealing their perspectives and tendencies regarding Turkish TV series, to analyze the effect of the COI on the country equity and WOM in the eyes of the Moroccan people, and to analyze the mediating role of the country brand equity in this effect. For this purpose, the study has been carried out in the cities of Casablanca, Fes, Marrakesh and Meknes, which are the most populous cities of the Kingdom of Morocco. Data was collected with a face-to-face survey form from 250 people determined by easy sampling method. In determining the sample size for the study, the rule that there should be 5 times or more participants than the statements in the survey form was taken as basis (Hair et al., 2019). At the same time, as another method to determine the sample size, the number of participants was determined based on the fact that the ratio of the number of items to the number of participants was considered to be between 3-6 people for each item (Cattell, 1978).

The survey form was first prepared in Turkish and then translated into Arabic under the supervision of an expert. In the first part of the survey form, statements regarding demographic information are included. In the second part; people were presented with statements such as which Turkish TV series they watch, the reasons for watching Turkish TV series, and the aspects they criticize. In the third section, statements about country brand equity, country of origin and positive WOM prepared using a 5-point Likert scale are included. Expressions created using the Likert scale were adapted from scales that have been used in many studies so far and whose validity and reliability have been tested. Country brand equity scale was measured by the scale used in Zeugner-Roth et al. (2008) study. The

COI scale, which consists of seven single dimensions, was adapted from the scale used in the study of Mohd Yasin et al. (2007). The positive WOM scale, which consists of six statements and one sub-dimension, was adapted from the scale used in the study of Goyette et al. (2010). Data were collected between 20 - 30 December 2023. The analysis of the data obtained was subjected to frequency analysis with the SPSS program. In addition, with the help of SmartPLS 4.0, the reliability, validity and discriminant validity analyzes of the measurement model were conducted. Variable explanation rate (R^2) and effect size (f^2) values were calculated using the PLS algorithm. Linearity analysis and path analysis were applied to the structural model. In order to determine the significance level of the path diagram that gives the path coefficients, 5000 subsamples were taken from the sampling using bootstrap (resampling) and t values were found. PLSPredict analysis was applied to calculate the Q^2 value for model predictive power. Structural equation modeling comes in two forms: variance and covariance (Garson, 2016). Variance-based PLS-SEM works successfully in cases where the normality assumption is not met without specifying an assumption regarding the data distribution (Hair et al., 2017). Considering these situations and the fact that the data do not have a normal distribution, PLS-SEM was preferred in the structural equation modeling established in the research.

3.1. Data Analysis and Findings

Descriptive statistics of the demographic information about the participants and the Turkish TV series trend are given in Table 1 and Table 2.

Table 1. Socio-Demographic Distribution

		n	%
Gender	Female	146	58.4
	Male	104	41.6
Age	18-25	136	54.4
	26-35	38	15.2
	36-45	25	10.0
	46-55	28	11.2
	56-65	23	9.2
Civil Status	Married	70	28.0
	Single	180	72.0
Education level	Secondary School Graduate	3	1.2
	High School Graduate	93	37.2
	Associate Degree Graduate	11	4.4
	Bachelor's Degree	120	48.0
	Master's Degree	22	8.8
	PhD	1	0.4
Job	Civil Servant	17	6.8
	Employee	39	15.6
	Tradesman	14	5.6
	Self-Employment	6	2.4
	Private Sector	15	6.0
	Housewife	4	1.6
	Student	151	60.4
	Other	4	1.6
	Total	250	100.0

As can be seen from Table 1, most of the participants in the study are women. In addition to this, the age range of the study participants is mostly young and middle age. It is known that there is a high concentration of single people as a result of the greater participation of the young audience. Based on this situation, the education level is mostly at the undergraduate level and students are excluded from Table 1 as a professional group.

Table 2. Trends of Moroccan People Towards Türkiye and Turkish TV Series

		n	%
Have you ever visited Türkiye?	Yes	17	6.8
	No	233	93.2
How many Turkish TV series do you follow?	1-2 TV Series	124	49.6
	3-4 TV Series	59	23.6
	5 and more TV Series	65	26.0
	None	2	0.8
After watching Turkish TV series, have you ever wanted to buy the products in the series?	Yes	174	69.6
	No	76	30.4
Have you ever bought a product you saw in the TV series after watching Turkish TV series?	Yes	68	27.2
	No	182	72.8
Have you ever wanted to go to Türkiye after watching Turkish TV series?	Yes	216	86.4
	No	34	13.6
Did you want to live in Türkiye after watching Turkish TV series?	Yes	151	60.4
	No	99	39.6
Total		250	100.0

When the expressions created to reveal the tendencies towards Turkish TV series were examined, it was seen that the majority followed at least one Turkish TV series even though they did not visit Türkiye. In line with the response given regarding the formation of purchasing desires for the products in Turkish TV series, it is stated that this desire is formed in the majority. At the point of turning the purchasing desire into action, some of them realized it, but the majority could not. It has been concluded that after watching Turkish TV series, most participants have a desire to go to Türkiye and even a desire to live in Türkiye.

As can be seen from Table 3, the most watched TV series is "Diriliş Ertuğrul". It was followed by the TV series "Kurtlar Vadisi" and "Aşk-ı Memnu", respectively. As a result of the answers given to the statements asked to learn the reasons for watching these series, it is seen that the most marked statement is "because I find it close to my own culture". Then comes the phrase "Because I love Türkiye and the Turks." In the previous section, it is concluded that the answers given to the desire to go to Türkiye and live in Türkiye are parallel to the participation in this statement. In terms of criticism of Turkish TV series, the phrase "Normalizing and encouraging extramarital relationships" was the most marked, and it is highly possible to comment that the formation of such an impression from the eyes of a country close to Turkish culture could be an indication that extramarital relationships have become very common in Turkish TV series. It seems that the most memorable products in Turkish TV series are

clothes and furniture. As a result of this situation, although Moroccan people are close to Turkish beliefs and culture, different lifestyle of Türkiye compared to Morocco can be remarkable, and it can be interpreted that clothes and furniture can be memorable, perhaps due to emulation or attraction.

Table 3. The Most Watched TV Series in the Kingdom of Morocco, Reasons for Watching, Criticisms and Memorable Product Groups

		n	%
Please mark which of the Turkish TV series below you watch. (You can mark more than one)	Ihlamlar Altında	4	0.5
	Kaybolan Yıllar	98	11.9
	Muhteşem Yüzyıl	14	1.7
	Gümüş	2	0.2
	Aşk-ı Memnu	132	16.0
	Beni Affet	10	1.2
	Kara Sevda	118	14.3
	Siyah Beyaz Aşk	69	8.4
	Kurtlar Vadisi	149	18.1
	Fatmagül'ün Suçu Ne	8	1.0
	Oğlum İçin	19	2.3
	Diriliş Ertuğrul	171	20.7
	Yaprak Dökümü	31	3.8
	Total	825	100.0
What is your reason for watching Turkish TV series? (You can mark more than one)	Because I find it close to my own culture	106	27.7
	Because I love Turks and Türkiye	104	27.2
	Because I find it to be of high-quality production.	87	22.8
	Because I found the actors successful	85	22.3
	Total	382	100.0
What aspects of Turkish TV series do you criticize? (You can mark more than one)	Too many violent incidents	49	11.5
	Encouraging young people to have bad friendships	90	21.2
	Normalizing and encouraging extramarital affairs	155	36.5
	Encouraging people to commit crimes	58	13.6
	There is nothing I criticize	73	17.2
	Total	425	100.0
Which products do you remember most from the Turkish TV series you watched? (You can mark more than one)	Mobile Phones	52	6.5
	Furniture	166	20.9
	White Goods	69	8.7
	Electronic Small Appliances	18	2.3
	Automobiles	98	12.3
	Clothes	189	23.7
	Shoes	96	12.1
	Bags And Accessories	108	13.6
	Total	796	100.0

Note: It exceeds the sample number n because it contains multiple answer questions

3.2. Structural Equation Modeling with Partial Least Squares - Measurement Model Testing (PLS-SEM)

Before starting the structural model analysis, conditions such as reliability and validity of the structures within the scope of the study must be met. In the study to examine the reliability and validity conditions; Internal consistency reliability, convergent validity and discriminant validity were evaluated. Internal consistency reliability, cronbach's alpha value and composite reliability (CR) coefficient value were examined. In convergent validity, the values assigned to the factors and the AVE, that is, explained variance values, were examined. Factor loading ≥ 0.70 ; cronbach's alpha and composite reliability (CR) coefficients ≥ 0.70 ; average variance explained (AVE) values are expected to be ≥ 0.50 (Hair et al., 2022). The measurement model table created for reliability and validity is given in Table 4.

Table 4. Measurement Model Results

Variable	Expression	Factor Loading	Cronbach's Alfa	CR	AVE
Country of Origin Image	COI1	0.752	0.892	0.918	0.651
	COI2	0.763			
	COI3	0.761			
	COI4	0.643			
Country Brand Equity	Country Brand Loyalty	CBVP1	0.807	0.715	0.535
		CBVP2	0.892		
	Country Brand Quality	CBVP3	0.715	0.647	0.739
		CBVP4	0.647		
	Country Brand Awareness	CBVP5	0.593	0.593	0.699
		CBVP6	0.807		
		CBVP7	0.892		
		CBVP8	0.715		
Positive Word of Mouth Marketing		WMM1	0.708	0.807	0.632
		WMM2	0.769		
		WMM3	0.831		
		WMM4	0.790		
		WMM5	0.870		
		WMM6	0.862		

Hair et al. (2022) state that any statements with a factor loading below 0.40 in the measurement model need to be eliminated from the model. They recommend that expressions with factor loads between 0.40 and 0.70 be removed from the measurement model by checking the AVE or CR coefficient values and if they are below the threshold value. After examining the AVE and CR values of 3 variables belonging to the COI scale with factor loadings below 0.40, it was decided to remove them from the measurement model. Although the factor load of the COI4 expression is 0.643, it was decided to keep the expressions in the measurement model because the AVE (0.651) value is over 0.50 and the CR (0.918) value is over 0.70 again, although the factor load of the CBVP4 statement regarding country brand quality, which is the sub-dimension of brand equity, is 0.647, the expressions are not included in the measurement model because the AVE (0.739) value is over 0.50 and the CR (0.850) value is over 0.70. It was decided to stay. Likewise, although the factor loads of the CBVP5 expression regarding

country brand awareness, which is the sub-dimension of country brand equity, is 0.593, the expressions are not valid because the AVE (0.699) value is over 0.50 and the CR (0.821) value is over 0.70. It was decided to remain in the measurement model.

When the values in Table 4 are examined, it can be said that reliability regarding internal consistency is ensured. CR coefficients; It is seen that the values are between 0.918 and 0.821. As for Cronbach's Alpha values, values between 0.60 and 0.70 are considered acceptable, values between 0.70 and 0.80 are considered good, and values above 0.90 are considered excellent reliability. In addition, values in the range of 0.60 and 0.80 are considered medium reliability, and values in the range 0.80 and 1.00 are considered high reliability (Gallais et al., 2017; Kılıç, 2016). When the values in Table 4 are examined, factor loadings are between 0.593 and 0.892; Since the AVE coefficients are between 0.535 and 0.739, it can be seen that the convergent validity assumption is met.

For the determination of discriminant validity; cross loads, the criterion recommended by Fornell and Larcker (1981) and HTMT values given were used as criteria by Henseler et al. (2016). When the cross-loading table was examined, it was seen that there was no overlapping expression between the expressions measuring the research variables. Fornell and Larcker (1981) discriminant validity results are presented in Table 5, and discriminant validity results of HTMT coefficients are presented in Table 6.

Table 5. Discriminant Validity (Fornell and Larcker Values)

	Word of Mouth Marketing	COI	Country Brand Loyalty	Country Brand Quality	Country Brand Awareness
Word of Mouth Marketing	0.807				
Country of Origin Image	0.607	0.732			
Country Brand Loyalty	0.586	0.507	0.860		
Country Brand Quality	0.333	0.410	0.412	0.836	
Country Brand Awareness	0.536	0.484	0.421	0.248	0.795

According to Fornell and Larcker (1981), the square root of the average explained variance values (AVE) of the structures included in the research should be higher than the correlation coefficients between the structures included in the research. In other words, the square root values of the AVE coefficient must be greater than the other structures in its columns and rows. The values expressed in bold color in Table 5 are given as the square root values of the AVE coefficient, and the other coefficients are given as the correlation values between the variables. When the values in Table 5 are examined, it is seen that the square root of the AVE value of each structure is greater than the correlation coefficients with other structures.

Table 6. Discriminant Validity (HTMT Values)

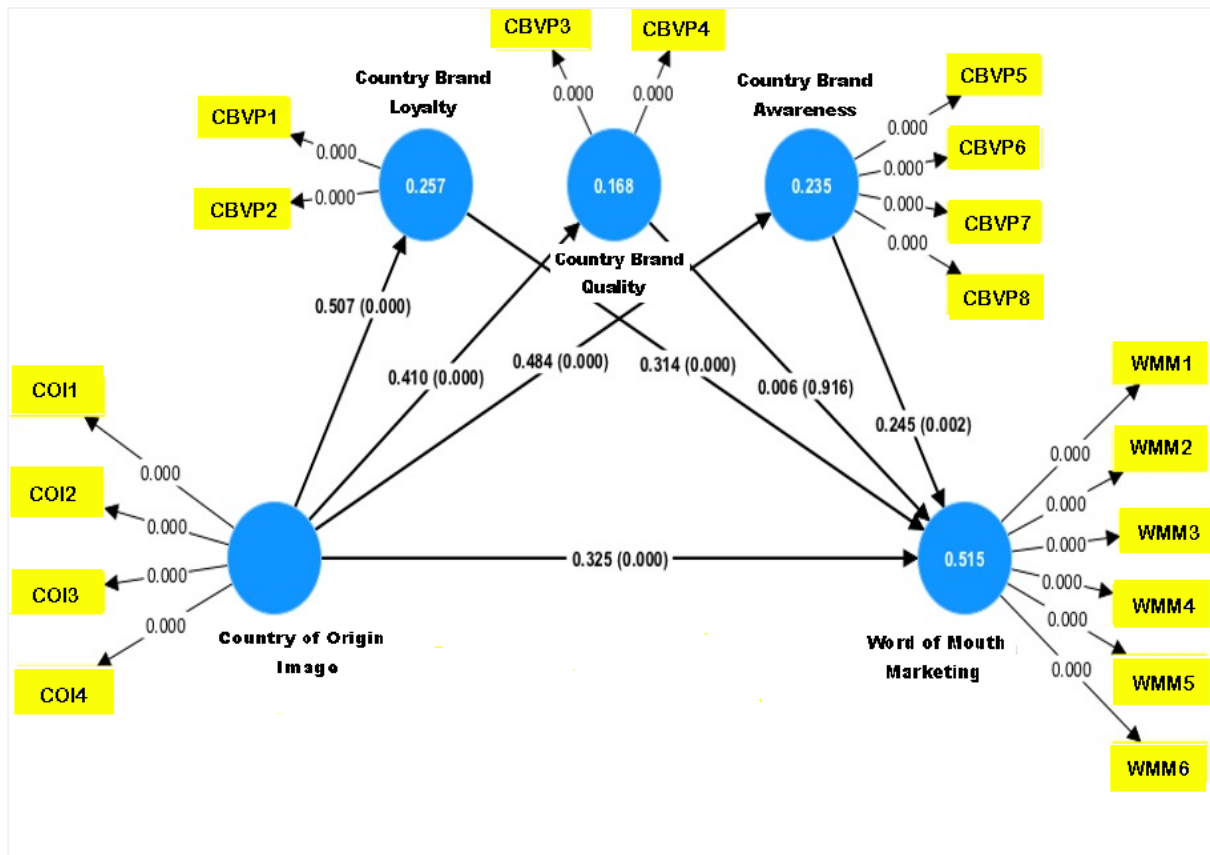
	Word of Mouth Marketing	Country of Origin Image	Country Brand Loyalty	Country Brand Quality	Country Brand Awareness
Word of Mouth Marketing					
Country of Origin Image	0.720				
Country Brand Loyalty	0.770	0.719			
Country Brand Quality	0.438	0.599	0.626		
Country Brand Awareness	0.612	0.583	0.570	0.319	

Henseler et al. (2016), HTMT (Heterotrait-Monotrait) is stated as the ratio of the average of the correlations of the expressions of all variables in the research to the geometric averages of the correlations of the expressions of the same variable. When the HTMT coefficients in Table 6 are examined, it is seen that each value is below the threshold value. Thus, discriminant validity conditions are met.

3.2.1. Testing the Structural Model and Results

The structural equation model established for hypothesis testing is shown in Figure 2.

Figure 2. Structural Equation Model



Partial least squares path analysis was used in the research model test. The data was analyzed with the SmartPLS 4 statistical program (Yıldız, 2021). Regarding the research model; PLS algorithm

to calculate linearity values, path coefficients, R^2 values giving the explanation ratio and f^2 values giving the effect size; PLSpredict analysis was also used to calculate the Q^2 value for predictive power. In order to measure the significance levels of PLS path coefficients, t values were found by taking 5000 subsamples from the sample with the resampling method. Regarding the research results; VIF, R^2 , f^2 and Q^2 values are given in Table 7, and research model impact coefficients are given in Tables 8 and 9.

Table 7. Research Model Coefficients

Variables		VIF	R^2	f^2	Q^2
Country of Origin Image	Country Brand Loyalty	1.000	0.257	0.345	0.251
Country of Origin Image	Country Brand Quality	1.000	0.168	0.202	0.156
Country of Origin Image	Country Brand Awareness	1.000	0.234	0.306	0.223
Country of Origin Image	Word of Mouth Marketing	1.623	0.516	0.135	0.360
Country Brand Loyalty		1.520		0.135	
Country Brand Quality		1.289		0.000	
Country Brand Awareness		1.381		0.089	

When we look at the VIF (Variance Inflation Factor) values, which measure the linearity between variables, there are results below 5, which is considered a threshold value. As a result, it appears that there is no linearity problem between the variables (Hair et al., 2022). When we look at the R^2 values of the model, it is calculated that the brand loyalty dimension of the country's brand equity is explained by 25%, the brand quality dimension by 16%, and the brand awareness dimension by 23%. Additionally, the explanation rate for the WOM variable was found to be 51%. The f^2 value calculated as the effect size coefficient; Values of 0.02 and above are low; medium with a value of 0.15 and above; values of 0.35 and above are considered high (Cohen, 1988). When the f^2 coefficients are examined as the effect size on the WOM variable; It has been determined that the country brand quality and country brand awareness dimensions have a low effect, while the COI and country brand loyalty dimensions have a medium level effect. On country brand equity dimensions; It was found that the COI had a medium or even high effect. In cases where the Q^2 predictive power value coefficients calculated for endogenous variables are greater than zero, the research model is said to have predictive power (Hair et al., 2022). When the Q^2 coefficient values in Table 7 are examined, it can be interpreted that they are greater than zero and therefore the model has predictive power. Direct effect coefficients are given in Table 8, and indirect effect coefficients are given in Table 9.

Table 8. Research Model Direct Effect Coefficients

		Standardized β	Standard Deviation	t value	p value
H ₁	Country of Origin Image → Country Brand Loyalty	0.507	0.046	11.028	0.000
H ₂	Country of Origin Image → Country Brand Quality	0.410	0.076	5.403	0.000
H ₃	Country of Origin Image → Country Brand Awareness	0.484	0.054	8.895	0.000
H ₄	Country of Origin Image → Word of Mouth Marketing	0.325	0.064	5.093	0.000
H ₅	Country Brand Loyalty → Word of Mouth Marketing	0.314	0.062	5.038	0.000
H ₆	Country Brand Quality → Word of Mouth Marketing	0.006	0.062	0.105	0.916
H ₇	Country Brand Awareness → Word of Mouth Marketing	0.245	0.078	3.147	0.002

• The effects of the COI variable ($\beta=0.507$; $p<0.05$) on the country brand loyalty dimension are statistically positive and significant, and the effects of the COI variable ($\beta=0.410$; $p<0.05$) on the country brand quality variable. It was concluded that the effects of the COI variable ($\beta=0.484$; $p<0.05$) on the country brand awareness dimension were statistically positive and significant.

• On the WOM variable; The effects of the COI variable ($\beta=0.325$; $p<0.05$), country brand loyalty dimension ($\beta=0.314$; $p<0.05$) and country brand awareness dimension ($\beta=0.245$; $p<0.05$) were statistically significant. It was concluded that it was positive and significant, while the country brand quality dimension was not statistically significant ($p>0.05$).

In line with the findings, it was seen that hypotheses numbered 1, 2, 3, 4, 5, 7 were supported, while hypothesis number 6 was not supported.

Table 9. Research Model Indirect Effect Coefficients

		Standardized β	Standard Deviation	t value	p value
H ₈	Country of Origin Image → Country Brand Loyalty → Word of Mouth Marketing	0.159	0.033	4.771	0.000
H ₉	Country of Origin Image → Country Brand Quality → Word of Mouth Marketing	0.003	0.026	0.102	0.919
H ₁₀	Country of Origin Image → Country Brand Awareness → Word of Mouth Marketing	0.119	0.041	2.917	0.004

It can be seen that the indirect effects of country brand awareness ($\beta=0.119$; $p<0.05$) and country brand loyalty ($\beta=0.159$; $p<0.05$) dimensions on the WOM variable through the COI variable. It is seen that the effect of the country brand quality dimension is statistically significant ($p>0.05$). Regarding the results, it was seen that hypotheses 8 and 10 were supported, while hypothesis 9 was not supported.

Zhao et al. (2010), the existence of a mediating effect is considered as the existence of a mediating effect if the independent variables have significant (indirect effects) effects on the mediator

variables and the mediator variables have significant effects on the dependent variables. Based on this situation, a mediation effect can be mentioned if the effect of the COI on the country brand awareness and country brand loyalty dimensions is significant, and the effect of the country brand awareness and country brand loyalty dimensions on the WOM variable is significant.

The types of mediation effects detected were also decided in line with the decision tree (Zhao et al., 2010; Yıldız, 2021).

- Since it has a significant indirect effect on the COI → Country brand awareness → WOM path, it has a significant direct effect on the COI → WOM path, and the path coefficients are positive, the country brand awareness dimension is the COI variable. It has an integral partial mediating role between the WOM variable.

- Since it has an important indirect effect on the COI → Country brand loyalty → WOM path, It has a significant direct effect on the COI → WOM path, and the path coefficients are positive, the country brand loyalty dimension is the COI variable. It has an integral partial mediating role between the WOM variable.

4. CONCLUSION

Within the scope of the study, the attitudes and tendencies of the Moroccan people towards Turkish TV series, which are met with great interest in the Kingdom of Morocco, were investigated. The reasons for watching Turkish TV series and the issues they criticized while watching them were examined. Their desire to go to Türkiye or live in Türkiye after watching the series was mentioned. It was also examined whether the products in the series were memorable and whether they created a purchasing desire and behavior in people. In addition to all these, the effects of COI and country brand equity on WOM and the mediating role of country brand equity in this effect were examined and statistically analyzed. Although the majority of the participants had never been to Türkiye before, they stated that they wanted to come to Türkiye and live here due to the effect of the series. Morocco's similarity to Turkish culture in terms of its cultural characteristics and the sympathy of the people living there towards Türkiye and the Turkish people play a major role in the preference of Turkish TV series. The participants stated that the products in the series stimulated a purchasing desire in them. It was observed that the most watched series were love and action, drama and political themed series, and that the furniture and clothes in these series were remembered more than other products. Although participants find Turkish TV series to be of good quality, they criticize them for encouraging young people to have bad friendships and normalizing extramarital affairs.

The intensity of positive and negative emotions that occur in people after watching a series can lead them to certain behaviors. Some of these behaviors may be related to people's demand for products. A person may be interested in the products used in a series by a celebrity whom they consider a role model, like, find close to their own culture, and admire, and this may arouse certain feelings in the

person and cause them to want to buy it. Or, by sending messages to people's subconscious through product placements in series, certain emotions can be triggered and awareness of that product or brand can be created. As a result of the recent increase in demand for Turkish series abroad, Turkish series are among the top in the world in series exports. This situation contributes greatly to the country's economy and is also an important element in terms of promoting the country and attracting tourists. The Moroccan people, who find Turkish culture and beliefs close to their own culture and beliefs, express this situation with their sympathy for Turkish series.

It has been observed that Turkish TV series create an attractive effect and sense of identity in the countries where they are broadcast, which creates a soft power effect for Türkiye. Although they touch on different stories, TV series, which act as cultural ambassadors, convey Turkish culture. TV series are a media product that has an impact on people's thoughts. TV series, which are an important tool of popular culture, are also an important factor in terms of tourism. People get ideas about the places they will go thanks to the TV series they watch. For this reason, TV series are of great importance in creating a positive image (Hancıgaz & Hülür, 2024). In the study, it was found that the image of the country of origin has a positive and significant effect on brand loyalty, brand quality and brand awareness, which are expressed as country brand equity dimensions. The results found support the literature (Kim & Chung, 1997; Klein et al., 1998; Yoo & Donthu, 2001; Paswan et al., 2003; Pappu et al., 2007; Mohd Yasin et al., 2007; Norouzi & Hosienabadi, 2011; Murtiasih, et al., 2014; Shahin et al., 2012; Saydan, 2013; Panda & Misra, 2014; Septyanti & Hananto, 2017; Ngan et al., 2020; Djafer & Adjila, 2024). In the study prepared based on the relationship between country of origin and word of mouth marketing and purchase intention (Halim & Keni, 2021), it was found that country of origin is effective on word of mouth marketing. In addition, brand awareness and brand loyalty were found to have a positive and significant effect on word of mouth marketing. This finding supports the literature (Seo & Park, 2018; Chakraborty & Bhat, 2018; Ahmad & Guzmán, 2021). Perceived quality was found to have no significant effect on word-of-mouth marketing. This may be related to the country of application, time, sample variety and size. When indirect effects were examined; the indirect effects of country brand awareness and country brand loyalty dimensions on word-of-mouth marketing variable through the country of origin image variable were found to be significant. As a result of the significant indirect effect, complementary partial mediation type was encountered. It was found that the mediating effect of country brand quality between country of origin and word-of-mouth marketing was insignificant.

When the study is evaluated in general, it is concluded that Turkish TV series have a significant impact on the country's image, and the studies in the literature support this (Özarslan, 2020, Kaptan & Algan, 2023; Hancıgaz & Hülür, 2024). It can be interpreted that the Moroccan people approach Türkiye and Turkish TV series with sympathy in line with their own culture and beliefs, and this situation is reflected in the brand equity of the country. The fact that clothing and furniture attract attention

especially among the product groups in the TV series may be a clue for companies that will open up to the international market in this field. As a result of the Moroccan people who love Turks and Türkiye wanting to go to Türkiye after watching Turkish TV series, it can be interpreted that this type of TV series export sector can also have a significant impact on the promotion of the country and the revitalization of tourism in the country in terms of attracting people to the country. It can be said that the TV series export sector is an important marketing strategy in terms of product marketing and recall as a result of the desire to buy the products in the series after watching the TV series. While the criticism of Turkish TV series by the Moroccan people and their encouragement of extramarital affairs are normalized, the fact that such a comment is made by people close to Turkish culture and beliefs can also be considered as an issue that needs to be emphasized. The study was conducted in a single country (Morocco), at a specific time, and with a specific number of samples related to the series. Therefore, the results are limited to a single country. Future studies can be conducted in different countries and the results can be compared. The research can be applied to developed, developing, and underdeveloped countries and discussed across regions. The model can be expanded by adding dimensions that include nationalism and patriotism, such as ethnocentrism, to the research model. In addition, country reputation can be included in the model. In addition to all these, studies can be conducted on certain categorized product groups and the results of easy product, popular product, and luxury product groups can be discussed among themselves. The scope and interpretation of the study can also be expanded with qualitative analyses such as surveys or interviews with the help of an interpreter. According to the results obtained here, strategic information can be provided to companies that will enter international markets. It can shed light on the foreign policies to be followed regarding Türkiye.

Ethics committee approval for the study was obtained from the Afyon Kocatepe University Ethics Committee on December 20, 2023, with document number 234763.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors affirm that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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Does Nepotism Trigger Quiet Quitting? A Research on Local Governments

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Abstract

The concept of quiet quitting, which denotes a cognitive and/or emotional, if not physical, detachment, has recently become one of the most frequently studied topics in organizational psychology. The term refers to performing only the tasks stipulated in job description with minimum organizational commitment and not going beyond that. Due to the detrimental effect of quiet quitting on both individual and organizational performance, it is crucial to study the phenomenon in depth. By referring to the organizational justice perspective, the study is designed to determine whether one of the negative employee experiences, nepotism, in local governments trigger quiet quitting. The main assumption of the research is that nepotism deteriorates the sense of justice, which leads employees to quit quietly. Structured questionnaires were administered to 259 local government workers in Adana. The results suggest that exposure to nepotism triggers quiet quitting in local governments where preferential treatments are allegedly pervasive. The study is expected to guide managers in establishing effective human resources practices in such institutions.

Keywords: *Quiet quitting, nepotism, organizational justice, local governments.*

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1. INTRODUCTION

Scholarly debates on burnout and burnout-like concepts have intensified in recent years, largely following the COVID-19 pandemic. One of these concepts being discussed is *quiet quitting*. The term refers to performing only the tasks specified in the job description and not going beyond that (Formica & Sfodera, 2022). In a sense, workers do not literally quit their job, but rather, minimize their effort with a continuance commitment. The phenomenon has been linked '*hustle culture*' that ignores work-life balance, strives for continuous high performance, and ignores personal needs (Hamouche et al., 2023). Others have suggested various individual and work-related factors that may trigger quitting quietly (Mahand & Caldwell, 2023; Öztürk et al., 2023). Regardless of its motive, quiet quitting can have a detrimental effect on individuals' performance and therefore organizations' (Liu-Lastres et al., 2024; Karrani et al., 2023).

Taking an organizational justice perspective, nepotism may be one possible cause of quiet quitting among employees. When employees perceive that family ties rather than merit influence decisions about hiring, promotions, and rewards, it erodes their belief in fairness and equality within the workplace (Hudson et al., 2019). This perception of injustice can diminish employee motivation and commitment, as individuals who work hard and demonstrate competence feel undervalued and overlooked (Sidani & Thornberry, 2013; Serenko, 2024). Consequently, these employees may resort to quiet quitting, where they fulfill only the minimum requirements of their job, withdrawing their engagement and enthusiasm for going above and beyond. This passive response to nepotism reflects a disillusionment towards organization's values, ultimately deteriorating the overall morale of the workforce.

The current research sets out to evaluate the relationship between nepotism and quiet quitting in local governments. The main assumption of the study is that the intricate dance between nepotism and quiet quitting was choreographed on the organizational justice stage. Unlike previous, this study is among the first to examine nepotism as a potential predictor of quiet quitting. Thus, the study adds substantially to our understanding of the mechanisms that lead to quiet quitting. Studying nepotism in local governments, which is one of the most typical workplaces for nepotism to occur, makes the study even more intriguing.

As this article will explore, the perception of nepotism can corrode the bedrock of meritocracy, leading to a silent withdrawal of employee engagement and effort (Anand et al., 2023; Boy & Sürmeli, 2023)- a phenomenon now colloquially known as *quiet quitting*. By examining the multifaceted layers of this relationship, we aim to not only understand the impact of nepotism on individual and collective morale but also to offer insights into the mechanisms by which organizational justice might be upheld to prevent the insidious effects of such workplace dynamics. It is through this lens that the study will dissect and discuss the potential pathways to foster a more equitable work environment.

2. THEORETICAL BACKGROUND

2.1. Quiet Quitting

Quiet Quitting is a concept that has emerged in both psychological and self-help literature, emphasizing the importance of perseverance and resilience in the face of challenges. The term implies a phenomenon where employees do not formally resign from their positions but disengage from going above and beyond their job requirements (Formica & Sfodera, 2022). Essentially, quiet quitters do the minimum required work and refrain from extra efforts that exceed their job descriptions. Quiet quitting highlights the growing importance employees place on work-life balance. It reflects a shift away from the glorification of overwork and towards a more sustainable approach to employment, where personal time and well-being are prioritized (Mahand & Caldwell, 2023).

Hamouche et al. (2023) suggest that quiet quitting evolved as a reaction against the hustle culture that demands constant superior performance in working life. The Covid-19 pandemic brought into question the meaning of life once more, which made the concept even more visible (Ratnatunga, 2022). This turbulent period, in a sense, has been a wake-up call for workers to take back control of their lives. Consequently, employees have made it a priority to achieve a work-life balance by spending less time at work (Lee et al., 2023; Gabelaia & Bagociunaite, 2022). From this perspective, quiet quitting can be seen as a coping mechanism for preserving mental health. It underscores the significant impact that job stress and burnout can have on individuals, pushing them to set boundaries to protect their mental well-being (Wu & Wei, 2024).

Beyond cultural trends or individual well-being, there may be other factors compelling individuals to quit quietly. The perception of organizational injustice may be one of the factors mentioned. Hamouche et al. (2023) argued that to fully understand the phenomenon, organizational justice perspective must be employed, since it can be a reaction to unfair practices. Similarly, Arar et al. (2023) and Wicker & Van Hein (2023) proposed that injustice in the workplace can lead to unintended consequences such as quiet quitting. Anand et al. (2023) reported that discrimination that might lead to a sense of unfairness inside the organization can be the catalyst for quiet quitting. As noted by Esen (2023), unfair practices may cause employees to stop making efforts, leading to withdrawals.

This new fashion but old phenomenon (Wu & Wei, 2024) is significant because it serves as an indicator of employee satisfaction, engagement, and evolving attitudes towards work-life balance (Pevec, 2023). It encourages both individuals and organizations to rethink and potentially reshape the future of work to be more fulfilling, balanced, and sustainable. In a sense, it challenges traditional notions of success and productivity in the workplace. On a broader scale, the widespread occurrence of quiet quitting reflects changing societal values regarding work, personal fulfillment, and the role of employment in one's life. It has implications for labor market dynamics, employee retention strategies, and economic productivity.

2.2. Nepotism

The practice of nepotistic human resources practices is prevalent in both public and private institutions. The term refers to granting favors based on family or friendship ties, rather than on merit (Padgett & Morris, 2005; Vveinhardt & Sroka, 2020). Cambridge Dictionary (2024) defines the term as *“the act of using power or influence to get good jobs or unfair advantages for family members”*. There are several ways in which this phenomenon manifests itself, including the appointment of relatives to key positions without an objective assessment of their qualifications (Safina, 2015). This creates an environment where personal connections outweigh professional competence (Büte, 2011).

A variety of organizational practices, decisions, and outcomes can be affected by nepotism, including personnel decisions, pay, and rule enforcement (Schmid & Sender, 2021; Spranger et al., 2012). This phenomenon poses a serious threat to fair competition and meritocracy, which in turn erodes organizational culture as a whole (Bünyamin, 2023). In situations where individuals are granted preferential treatment based on family ties rather than their qualifications or abilities, equal opportunities are undermined (Jaskiewicz et al., 2013). Due to these reasons, managers and employees consider nepotism negatively, believing it has negative effects on employee outcomes, such as reducing innovation and increasing turnover intentions (Jain et al., 2022).

Although nepotism has a negative connotation, there are certain forms in which it is acceptable or even valued (Burhan et al., 2020). Vveinhardt & Bendaraviciene (2022) suggest that nepotism can be beneficial for certain organizational forms, and social connections may help employees to gain a better attitude toward their jobs and perform better. Nepotistic practices in such forms have resulted in shorter learning curves, greater loyalty, lower risks, and lower turnover, meeting peak needs, maximizing performance, and maintaining commitment over time (Vinton, 1998). A similar claim is made by Gibb Dyer Jr. (2006) that nepotism can be a significant competitive advantage for family businesses.

The prevalence of nepotism is higher in societies with strong traditional ties and relationships (Aktan, 2021, p.16). In such societies, public institutions such as local governments are particularly prone to such practices, where political relations have a stronghold (Sezik, 2020). This can be attributed to deeply ingrained cultural values that emphasize group loyalty, economic strategies for ensuring family stability, the strategic use of social capital, and the historical normalization of nepotism. For instance, Putnam (1993) suggests that in societies with limited economic opportunities, securing jobs for relatives within local governments can be perceived as a way to ensure economic security and stability for one's family. Rothstein & Teorell (2008), on the other hand, asserted that in social environments where governance systems lack transparency and accountability, nepotism tends to thrive. Finally, Alesina and Giuliano (2010) explore the historical roots of family ties and their impact on economic outcomes, suggesting that in societies with strong familial networks, nepotism is not merely a modern phenomenon but a historically rooted practice that is considered normative and even virtuous.

This study examines the phenomenon, quiet quitting, through the lens of organizational justice. The theory postulates that employees' behavior can be influenced by their perception of fairness and justice in their workplace (Greenberg, 1990). Through the lens of reciprocity, fairness, and compatibility, the theory can offer insight into an organization's culture's impact on employees' attitudes and behaviors, quiet quitting in particular (Hamouche et al., 2023). Based on the fact that nepotism weakens the perception of organizational justice (Mijs, 2016; Hudson et al., 2019) the study proposes that such practices in the public sector may lead to quiet quitting. The following hypothesis is therefore proposed to be tested in this study:

H1: The nepotistic practices that public sector workers are exposed to lead them to quit quietly.

3. METHODOLOGY

3.1. Research Design

This research adopts a quantitative approach to investigate the relationship between nepotism and quiet quitting among local government workers in Adana, Turkey. The study was conducted following the ethical guidelines provided by the Ethical Committee of Munzur University (2024/02-01). Artificial intelligence tools were used to improve spelling and grammar in some sections. By doing this, the content flow has been intended to be improved.

A total of 259 participants were selected using stratified random sampling to ensure representation across different departments and levels of seniority within the local government workforce. Participants were informed that their participation was entirely voluntary and that they could withdraw at any stage of the study without any consequences. Table 1 (on the next page) summarizes the demographic characteristics of the participants.

The data were collected through structured questionnaires, meticulously designed to measure perceptions of nepotism and quiet quitting. The questionnaire comprised two main sections: the first part assessed respondents' perceptions of nepotism using a validated scale by Asunakutlu and Avcı (2010) which includes items on *hiring (NRS)*, *promotion decisions (NPR)*, and *the general fairness of workplace procedures (NWP)*. The second part of the questionnaire measured quiet quitting behaviors, adapted from the scale developed by Savaş and Turan (2023) focusing on reduced effort, disengagement from work tasks, and a lack of initiative beyond the basic job requirements. Participants were asked to complete the questionnaire in their natural work environment for their convenience. Each questionnaire was accompanied by an informed consent form, which highlighted the study's purpose, the anonymity and confidentiality of the responses, and the voluntary nature of participation.

Table 1. Demographic Characteristics of Participants

(n= 259)		Frequency(f)	Percentage (%)
Gender	Male	157	60.6
	Female	102	39.4
Age	18-24	12	4.6
	25-30	83	32.0
	31-40	112	43.2
	41-50	40	15.4
	51 and more	12	4.6
Education	High school	179	69.1
	Associate degree	36	13.9
	Bachelor	38	14.7
	Post-graduate	6	2.3
Managerial Role	Low-level	2	0.8
	Mid-level	8	3.1
	Top-level	29	11.2
	None	220	84.9
Tenure (Year)	1-5	141	54.4
	6-10	82	31.7
	11-15	24	9.3
	16-20	9	3.5
	More than 20 years	3	1.2
Total Work Experience	1-5	33	12.7
	6-10	84	32.4
	11-15	98	37.8
	16-20	35	13.5
	More than 20 years	9	3.5

Upon collection, the data were coded and entered SPSS V24.0 for analysis. Descriptive statistics were used to profile the sample characteristics. The relationship between perceived nepotism and quiet quitting behaviors was analyzed using Pearson's correlation coefficient to determine the strength and direction of the association. Further, regression analysis was conducted to explore the impact of nepotism on quiet quitting, controlling for potential confounding variables such as age, gender, tenure, and managerial role.

4. ANALYSIS & RESULTS

In the analysis section of our study, a stepwise procedure was undertaken to ensure the integrity and robustness of the findings regarding the relationship between variables to be tested. Initially, a comprehensive data check was conducted to identify and address any missing values or outliers. Following this, the internal consistency and validity of the measurement instruments were tested through

Exploratory Factor Analysis (EFA) and Cronbach's Alpha, confirming their reliability for our research purposes. An overview of the factor loadings and Cronbach's alpha values of the measurement tools can be found in Table 2.

Table 2. Factor Structure & Internal Validity of the Measurement Instruments

Item	Factor Loadings	Cronbach's Alpha
QQ1	0.454	0.770
QQ2	0.763	
QQ3	0.621	
QQ4	0.760	
QQ5	0.683	
QQ6	0.627	
QQ7	0.528	
QQ8	0.726	
QQ9	0.544	
QQ10	0.482	
QQ11	0.656	
QQ12	0.674	
QQ13	0.699	
QQ14	0.712	
QQ15	0.597	
QQ16	0.510	
NPR1	0.553	0.794
NPR2	0.772	
NPR3	0.782	
NPR4	0.827	
NPR5	0.761	
NWP1	0.812	0.885
NWP2	0.813	
NWP3	0.687	
NWP4	0.805	
NWP5	0.795	
NWP6	0.888	
NRS1	0.849	0.826
NRS2	0.876	
NRS3	0.860	

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 6 iterations.

Across all instruments, reliability scores ranged between 0.770 and 0.885, which meets the recommended level of 0.70. Principle component analysis with varimax rotation was employed to

perform factor analysis. In preparation for EFA, the Kaiser-Meyer-Olkin (KMO) was determined to be 0.897, indicating adequate sampling adequacy for the analysis. Bartlett's Test of Sphericity yielded significant results at the 0.05 level, substantiating the appropriateness of factor analysis for the dataset under consideration. A total of four components (*QQ*, *NPR*, *NWP*, *NRS*) with eigenvalues greater than 1.00 were yielded from the analysis. These components account for 68.42% of the total variance. Factor loadings ranged between 0.454 and 0.888 and there were no items with a cross-loading higher than 0.40.

Following validation and internal consistency assessments on the measurement instruments used, correlation and regression analyses were performed to investigate the dynamics between nepotism and quiet quitting. The table below provides a summary of the Pearson correlation coefficients among variables.

Table 3. Pearson's Correlation Matrix

N (Overall)	1	0.908**	0.952**	0.866**	0.473**
NPR (Promotion)		1	0.770**	0.688**	0.472**
NWP (Procedures)			1	0.785**	0.433**
NRS (Recruitments)				1	0.463**
QQ					1

**Correlation is significant at the 0.01 level (2-tailed)

The Pearson correlation analysis revealed a significant moderate positive correlation between overall nepotism and quiet quitting, with a coefficient of 0.473. This suggests that higher levels of perceived nepotism within an organization are associated with increased tendencies towards quiet quitting among employees. Further analysis into the sub-dimensions of nepotism provided nuanced insights. Specifically, the nepotism-promotions relationship (NPR) and quiet quitting exhibited an identical correlation coefficient of 0.472, indicating a significant moderate positive relationship. This was closely followed by the nepotism-recruitment (NRS) and quiet quitting correlation, which stood at 0.463, suggesting a similar strength and direction of association. The nepotism-working procedures (NWP) dimension demonstrated a slightly lower but still significant moderate positive correlation with quiet quitting at 0.433.

Subsequently, a regression analysis was performed to ascertain the predictive power of nepotism on the propensity for quiet quitting among employees. A summary of the regression model is given in Table 4.

Table 4. Regression Model Towards the Relationship Between Nepotism and Quiet Quitting

Dependent Variable: Quiet Quitting					
	β	Std. Error	Beta	t	Sig.
Nepotism	0.232	0.036	0.373	6.435	.000
R= 0.488	R Square= 0.239	Adjusted R Square= 0.235	Std. Error of the Estimate= 0.3882		

Results suggest a positive but moderate relationship between nepotism and quiet quitting ($\beta=0.232$ $p=0.000$), indicating that as nepotism increases, there is a corresponding moderate increase in the likelihood or intensity of quiet quitting. The significance of this coefficient affirms nepotism's role in influencing quiet quitting behaviors. R Square value was estimated as ($R^2=0.239$). This means that approximately 23.9% of the variation in quiet quitting can be explained by nepotism. This leaves a significant portion (76.1%) of the variation in quiet quitting explained by factors not included in this model. Given these results, it is evident that there is a positive relationship between nepotism and quiet quitting, with nepotism explaining a significant but not overwhelming portion of the variance in quiet quitting.

5. DISCUSSION

This study investigates how nepotism influences quiet quitting in local governments and reveals a significant positive correlation between the examined variables. The research findings align well with the study by Nimmi et al. (2024) that suggests nepotism among superiors made some of the employees quit quietly. Similarly, the study conducted by Georgiadou et al. (2025) also found that perceptions of organizational injustice and psychological contract breaches trigger quiet quitting. In particular, it was noted that unfair practices such as nepotism reduce employee motivation and weaken organizational commitment, thereby increasing quiet quitting.

In discussing the findings of our study, which revealed a positive correlation between nepotism and quiet quitting among employees working in local governments, it is crucial to delve into the underlying mechanisms that may facilitate this relationship, particularly through the lens of organizational justice and the unique context of public sector employment. Organizational justice, which pertains to employees' perceptions of fairness in their workplace, plays a pivotal role in shaping employee attitudes and behaviors (Marzucco et al., 2014; Akram et al, 2020). In the context of local governments, where expectations of impartiality and meritocracy are particularly high (Mulaphong, 2023), nepotism can significantly undermine perceptions of fairness (Burhan, et al., 2020). When employees perceive that job assignments, promotions, or rewards are distributed not on the basis of merit but rather familial or personal connections, it can lead to a sense of injustice (Bünyamin, 2023). This perception of unfairness is likely to erode trust in the organization, diminish employee morale, and possibly increase intentions to engage in quiet quitting as a form of silent protest against the perceived inequities.

Incorporating the mentioned aspects, it's important to acknowledge the unique employment dynamics within the public sector that contribute to the phenomenon of quiet quitting rather than outright job resignation. Public sector jobs often provide benefits and security that are not as readily available in the private sector, such as comprehensive health benefits, pension plans, and job stability (Reichard & Schröter, 2021; Acheampong, 2021). These attractive features can lead to a situation where employees, despite feeling disillusioned or unfairly treated due to nepotism, choose not to leave their positions outright. Instead, they may engage in quiet quitting, minimizing their effort and engagement without formally resigning. This decision reflects a rational choice to retain the tangible benefits of public sector employment while internally withdrawing from active and enthusiastic participation in the workplace.

The reluctance to leave, fueled by the unique offerings of public sector employment, emphasizes the importance of addressing nepotism and fostering a fair work environment. Public employees' decision to stay but disengage highlights a critical issue: while the security of public sector jobs can act as a safety net, it can also trap employees in an environment where they feel their only recourse is to quietly quit. These dynamic poses significant challenges for public sector organizations, as it affects not only individual well-being but also organizational effectiveness and public service delivery.

6. CONCLUSION

This research has scrutinized the complex dynamics between nepotism and quiet quitting within local governments, revealing a moderate positive correlation between these variables. The findings highlight the potential detrimental impacts of nepotism on organizational morale and productivity, suggesting that nepotism could be a significant factor contributing to employees' disengagement and quiet quitting. By showing how nepotism violates the psychological contract between public sector employees and their employers, which is rooted in meritocracy and equity, the study contributes to theoretical understanding.

Unfortunately, understanding the actual impact of nepotism in the public sector proves more challenging than in the private sector. This is because, in the public domain, employees rarely resign outright when faced with nepotism due to the benefits provided by such institutions; instead, they tend to reduce their effort, adopting a behavior known as quiet quitting. Therefore, it becomes imperative for local governments to take proactive steps to combat nepotism maintaining public trust and integrity. Ensuring that all employees feel valued, recognized, and fairly treated can mitigate the inclination toward quiet quitting. Initiatives could include developing and enforcing clear policies against nepotism, creating more transparent and merit-based processes for promotions and rewards, and fostering an organizational culture that values equity and inclusiveness.

It is important to acknowledge the limitations of this research, particularly its reliance on cross-sectional data, which restricts the ability to infer causality. Future studies employing longitudinal designs are recommended to further elucidate the nature of this relationship, offering more definitive

insights into the long-term effects of nepotism on employee behavior and organizational health. Future research could also explore the mediation effect of organizational justice on this relationship. It would be insightful to examine how different dimensions of organizational justice, such as distributive, procedural, and interactional justice, specifically influence the relationship between nepotism and quiet quitting. Additionally, investigating the role of individual differences, such as personality traits and work values, in moderating the impact of nepotism on quiet quitting could offer a more comprehensive understanding of when and why nepotism leads to such disengagement behaviors.

Ethics committee approval for the study was obtained from Munzur University Ethics Committee on March 5, 2024, with document number 2024/2-1.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors affirm that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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The Role of the Psychological Contract in the Relationship Between Career Adjustment Ability and the Perception of Employability

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Abstract

The concept of employability has been more focused on in recent years. The concept of perceived employability expresses individuals' control over their lives and careers. Career adaptability means a hierarchical and multidimensional construct, including resources of control, concern, confidence, and curiosity. Employability is a sense of career adaptability in the context of individuals' social construct of managing career transitions. A mutually positive interaction between employability, psychological capital, and subjective well-being can exist. Using Savickas's career construction theory, the current study investigated the relationship between employability and career adaptability and the intermediary effect of the psychological contract. Based on these results, career adaptation ability positively affects psychological contract, and psychological contract affects employability perception; also, based on the results that career adaptation ability positively affects employability perception, this relationship can occur through psychological capital.

Keywords: *Employability, Career Adjustment Ability, Psychological Contract.*

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1. INTRODUCTION

The concept of employability has been more focused on in recent years. Employability reflects the skills that enable people to find a suitable job in the area where they are educated. Employability has different dimensions, including individual and institutional employability (Fugate et al., 2004). For individual employability, the skills, competencies, and expectations of the graduates are included, and for organizational employability, the market conditions of the organizational and market employment conditions are considered (González-Romá et al., 2016). Considering the different employability dimensions, career goals and decisions at the individual level should be appropriate for sectoral requirements and macro career planning (Teychenne et al., 2019; Andresen et al., 2022).

The concept of perceived employability expresses the control of individuals over their own lives and careers (Marler et al., 2002; De Cuyper et al., 2011; Coetzee & Engelbrecht, 2020). Psychological factors are essential in forming individual-level employability perception (Broeck et al., 2014). In other words, an individual with low employability may see himself as having high employability (De Cuyper et al., 2011). The level of perceived employability at the individual level is also related to macro factors far beyond individual factors (Wittekind et al., 2010; Atitsogbe et al., 2019). It is necessary to consider many external factors, especially national and international economic factors, the current labor market conditions, and government decisions.

Personal adaptability is a psycho-social dimension of the employability concept, including optimism, openness, the propensity to learn, generalized self-efficacy, and internal (Fugate et al., 2004). Career adaptability is a part of the career construction system, helping individuals to have synergy through overcoming vocational issues (Savickas, 2013). According to Savickas (2013), career adaptability is a hierarchical and multidimensional construct that includes resources of control, concern, confidence, and curiosity. These resources are derived from specific attitudes, behaviors, and competencies of career construction (Savickas & Porfeli, 2012). These four adaptive resources constitute the career construct theory for vocational situations (Santra & Giri, 2019). In this context, career adaptability is a psychological resource individuals use to deal with career development, career change, and other career challenges (Chen et al., 2018).

The psychological contract refers to an individual's beliefs about an exchange relationship and has recently attracted considerable attention. Scholars have argued that psychological contracts reflect expectations, promises, and obligations (Rousseau et al., 2018; Mensah, 2019). The psychological contract between employers and organizations is dynamic and includes mutual promises and responsibilities of the respective parties (Rousseau, 1995).

This study aims to test the psychological contract's role in the influence of career adaptability on the perception of adaptability. In this way, in the future career perceptions of individuals, the

importance of the harmony between the perceptions of the future positions that they are as successful and the variables affecting this perception and the level of corporate employability will be emphasized.

2. CONCEPTUAL FRAMEWORK

2.1. Employability

Employability refers to an individual's ability to secure and maintain employment aligned with their skills and competencies (Rothwell et al., 2008). It encompasses internal factors such as personal skills and academic performance (Monteiro et al., 2020) and external factors like labor market conditions and employer demand (Rothwell et al., 2009). Perceived employability is a subjective assessment influenced by macroeconomic factors, industry trends, and individual attributes (De Cuyper et al., 2011; Atitsogbe et al., 2019). Higher perceived employability enhances career confidence and adaptability (Berntson et al., 2010). Within higher education, employability is linked to competency development and career preparedness (Jackson & Tomlinson, 2020), aligning with the changing nature of work (Pool & Sewell, 2007). In recent years, government policies, employment structures, and HR strategies have increasingly emphasized the importance of employability as a critical aspect of career success (Rajan, 1997; de Guzman & Choi, 2013).

Employability is also a psycho-social construct with individual characteristics (Fugate et al., 2004), encompassing self-perceived employability and environmental influences (De Cuyper et al., 2011). Self-perceived employability reflects an individual's confidence in obtaining and retaining employment, influenced by external factors such as market demand and institutional reputation (Rothwell et al., 2008; Atitsogbe et al., 2019). Universities play a crucial role in developing students' employability skills, as seen in the emphasis on graduate employment rates as a measure of institutional performance (Tomlinson, 2007; de Vos et al., 2011; Brown et al., 2022).

2.2. Career Adaptability

Career adaptability, rooted in career construction theory (Savickas, 2013), is a multidimensional construct comprising concern, control, curiosity, and confidence (Savickas & Porfeli, 2012). It enables individuals to navigate career transitions and uncertainties (Johnston, 2018; Ng et al., 2020). Career adaptability has been linked to self-efficacy, emotional regulation, and resilience, which help individuals respond to labor market fluctuations (Rudolph et al., 2017; Bimrose & Hearne, 2012). Career adaptability is an essential factor in employability, as it facilitates proactive career behaviors and enhances career development (de Guzman & Choi, 2013; Monteiro et al., 2022).

Career adaptability is particularly relevant in modern career structures, where employees frequently change jobs due to economic or organizational shifts (Nota et al., 2012). Adaptability resources serve as self-regulatory mechanisms that enable individuals to maintain employability in dynamic work environments (Sou et al., 2022). Higher adaptability enhances perceived employability by equipping individuals with the necessary career self-management competencies (Guan et al., 2013;

Rudolph et al., 2017). The increasing complexity of career transitions necessitates the continuous development of adaptability skills to maintain a competitive edge in the labor market (Sou et al., 2022; Chen et al., 2018).

2.3. Psychological Contract

The psychological contract represents an individual's beliefs about mutual obligations in an employment relationship (Rousseau, 1995). It encompasses transactional (economic) and relational (emotional) components (Kaya & Karatepe, 2020). Perceived breaches in the psychological contract can negatively impact job satisfaction, engagement, and commitment (Coyle-Shapiro et al., 2019). Conversely, fulfilling psychological contract expectations strengthens organizational commitment and employee performance (Bal et al., 2013). In employability research, the psychological contract mediates the relationship between career adaptability and employment outcomes as organizations increasingly emphasize self-directed career management (De Cuyper et al., 2011; Scholarios et al., 2008).

The psychological contract shapes employees' expectations and responses to career challenges. When employees perceive that their employers fulfill their promises, they demonstrate higher engagement and adaptability, enhancing employability (Lam & de Campos, 2015). Psychological contract fulfillment also supports career well-being, as employees feel more secure and valued in their organizations (Soares & Mosquera, 2019). However, breaches in the psychological contract can undermine career adaptability by reducing employees' willingness to invest in professional development (Bal et al., 2008; Coyle-Shapiro et al., 2019).

2.4. The Role of Psychological Contract in Career Adaptability and Employability Relationship

Employability frameworks integrate adaptability, career identity, and social capital as interrelated dimensions (Fugate et al., 2004). Career adaptability is a critical resource for career adjustment, facilitating career transitions, and developing employability skills (McArdle et al., 2007; Matilda & Neena, 2016). Psychological contract fulfillment strengthens this relationship by reinforcing individuals' confidence in career self-management (Lam & de Campos, 2015). Empirical studies confirm that career adjustment ability positively influences employability outcomes, with psychological contracts as a key intermediary (Coetzee et al., 2015; Monteiro et al., 2019). Organizations can enhance career adaptability through supportive policies, fostering sustainable employability (Scholarios et al., 2008; Ito & Brotheridge, 2005).

Studies indicate that psychological contract dynamics significantly influence career adaptability and employability. Employees who perceive intense psychological contract fulfillment exhibit higher career resilience and proactive job-seeking behavior (Ebere & Onuoha, 2022). Career adaptability is crucial for employees to perform effectively in their workplace and ensure career well-being (Akkermans et al., 2018; Ferreira, 2019). Adaptable employees are more competent and efficient,

benefiting from progressive employability strategies that facilitate career growth and stability (Wang, 2013; Safavi & Bouzari, 2019).

This study examines the mediating role of the psychological contract in the relationship between career adaptability and perceived employability, contributing to research on career self-management and labor market integration. Understanding this relationship is crucial for developing strategies that enhance employability through career adaptability interventions and psychological contract management.

The research model and hypotheses are given below. This study aims to test the psychological contract's role in influencing career adaptability and the perception of adaptability.

Hypotheses

H1: Career adaptation ability affects psychological contracts positively.

H2: Career adaptability ability positively affects the perception of employability.

H3: Psychological contract positively affects the perception of employability.

H4: Psychological contract has an intermediary effect on the relationship between career adaptation ability and employability perception.

3. METHODOLOGY

3.1. The Sample of the Research and the Scales Used

The universe of the research is composed of university students. In the study, with 320 participants, 168 were women (52.5%), and 152 participants (47.5) were men. The distribution of the participants according to the departments is as follows: approximately 16% consists of business administration, 55% consists of human resources, 15% consists of public relations, and 14% consists of banking and insurance departments. Why was the sample selected only from specific departments (business, human resources, public relations, banking, and insurance)? The survey technique was used for the research. The first part of the survey contains demographic information, while the second part contains statements related to three separate scales.

In the study, three separate scales were used to measure the dimensions.

Career adaptation ability scale: Savickas and Porfeli (2012) developed four sub-dimensions and 24 expressions. Later, Maggiori et al. developed a 12-item version. Three separate groups adapted it into a short version. This study uses a short version of 12 items: 1,2,3. The size of the questions of interest is 4,5,6. Questions of control size are 7, 8, and 9. Questions about the size of curiosity are 10, 10, 12. The scale measures the size of trust in the questions.

Rothwell and Arnold (2007) used an 11-item employability perception scale with two sub-dimensions. This scale includes four intra-organizational statements and seven non-organizational statements.

Psychological contract scale: Developed by Millward and Hopkins (1998) and then a short version by Grimmer and Oddy (2007), a short form consisting of 2 sub-dimensions and 17 expressions was used. The first ten expressions measure transactional expressions and seven-count relational expressions.

All scales used a 5-point Likert type measurement tool (1= I am afraid I have to disagree at All, 2= I Agree Very Little, 3= I Agree on a Little, 4= I Quite Agree, I Agree, I Completely Agree).

3.2. Methods

This study investigates the effect of psychological contracts' mediating role on the impact of career adaptation ability on employability perception. The data collected by the convenience sampling method were analyzed using statistical analysis programs. Descriptive statistics, reliability analysis, correlation analysis, explanatory and confirmatory factor analysis, and structural equation modeling analysis were used to test whether there is an intermediary relationship in the research.

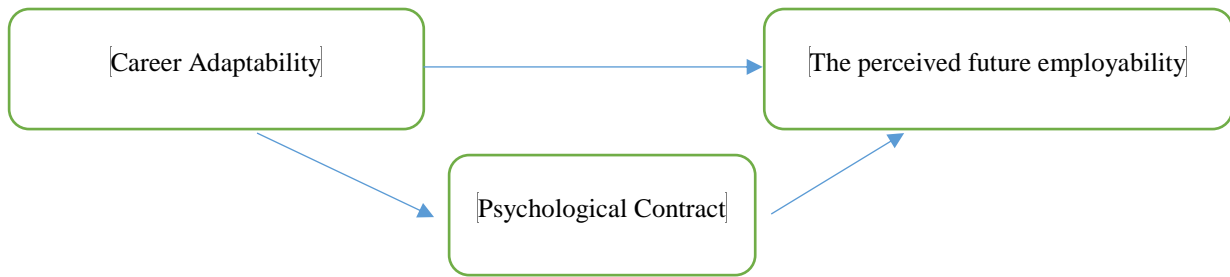
3.3. Data Collection and Analysis

The perceived future employability scale consists of 24 items and six dimensions developed by Gunawan et al. (2019) and adapted to Turkish by Alkın et al. (2020). The sub-dimensions consist of future skills, experiences, communication networks, personal characteristics, knowledge of the labor market, and the educational institution's reputation. The answers were collected using a 6-point Likert rating (1. strongly disagree, six. Strongly agree).

The career adjustment ability scale consists of 24 items and four sub-dimensions, including resources of concern, curiosity, control, and confidence. It was developed by Savickas and Profeli (2012) and adapted to Turkish by Kanten (2012). The sub-dimensions are anxiety, control, curiosity, and trust. The answers were collected using the 5th Likert degree (1. strongly disagree, 5. strongly agree). The Cronbach's reliability for the original scale was 0.91.

The psychological contract scale consists of 24 items and four sub-dimensions developed by Luthans et al. (2007) and adapted to Turkish by Çetin and Basım (2012). optimism,' size 1*, 9, 11*, 14, 18, 19; 'psychological endurance, ' size 5, 7, 8*, 10, 13, 22; 'hope' size 2, 6, 12, 17, 20, 24; 'self-sufficiency' size 3, 4, 15, 16, 21, 23 has been measured by item number. In the version adapted by Çetin and Basım (2012), expressions numbered 1, 8, and 11 were removed from the scale. The final version of the scale consists of 21 items.

Figure 1. Research Model



4. FINDINGS

4.1 Structure Validity

Explanatory factor analysis was performed to test the construct validity. All factors were included during this test, and natural factor resolution was applied (Bektaş, 2017). In light of the results obtained, it was concluded that the data were suitable for factor analysis. Confirmatory factor analysis was also used to determine the degree to which the variables observed in the study represent hidden variables (Hair et al., 2010). The two-stage method Anderson and Gerbing (1998) proposed was followed at this stage. This way, whether the model has sufficient compliance values is tested. The findings obtained are shown in Table 1.

Confirmatory factor analysis explains the suitability of the model with five index results. The results obtained from the five indices were $\Delta\chi^2/df=1.314$, GFI=0.84, CFI=0.74, RMSEA=0.051, and NFI=0.89, respectively. Thus, the values obtained remain within the limits of the accepted reference values regarding compliance statistics (Hair et al., 2010).

Table 1. Descriptive Factor Analysis

Factors	No of Items	Factor Load Interval	Variance Explained	Cronbach Alpha	
Career Adaptability	Concern	3	0.674-0.921	78.417	$\alpha=0.84$
	Control	3			
	Curiosity	3			
	Trust	3			
KMO=0.714; Barlett= (df=7) 4847.125; P<0.001					
Employability	Internal	4	0.689- 0.908	70.147	$\alpha = 0.88$
	External	7			
KMO=0.784; Barlett= (df=9) 745.458; P<0.001					
Psychological Contract	Transactional	10	0.561-0.874	64.540	$\alpha =0.93$
	Relational	7			
KMO=0.914; Barlett= (df=28) 3104.005; P<0.001					

The results of the consistency validity of the model are presented in Table 2. The table shows that all values are from 0.50 and gave statistically significant results. The convergence validity is used to see how the same structures combine or show high correlation (Hair et al., 2010). According to these results, convergent validity (convergence transmittance) is provided. Many studies examine Average Variance Extracted (AVE) and Composite Relativity values. Table 2 shows the results of both values. Both values are at an acceptable level.

Table 2. Results of the Consistency Validity

CONSTRUCT	ITEM	AVE	CR
Concern	3	0.76	0.87
Control	3	0.68	0.76
Curiosity	3	0.84	0.91
Trust	3	0.81	0.94
Internal	4	0.74	0.88
External	7	0.63	0.90
Transactional	10	0.75	0.93
Relational	7	0.69	0.89

Discriminant validity is expressed as the fact that the scale does not relate to other measurements considered different. Venkatraman's (1989) method was adopted in this study, and its validity was tested. In order to test the validity of Discriminant Validity, the square root of AVE values was taken and compared with the correlation between hidden variables. The scales chosen by the researcher correspond to hidden variables in the measurement model. Latent variables cannot be directly observed, which explains a theoretical structure by associating it with scale items. The fact that the square root of the AVE value is greater than the correlation value between the hidden variables shows that the Decoupling validity is ensured. The fact that these two values do not overlap shows that the model provides decomposition validity. It is shown in Table 3.

Table 3. Results regarding the discriminant validity

Test	Description	χ^2 Limited Model	χ^2 Free Model	Differences
1	PC-CAA	212.487	168.587	43.9
2	PC-PFE	145.358	134.269	11.089
3	CAA-PFE	78.691	40.129	38.562

Notes: All difference values are statistically significant at the significance level of $p < 0.05$. **PC:** Psychological Contract, **CA:** Career Adjustment Adaptability, **PFE:** The Perceived Future Employability

4.2. Common Method Variance Error

In this study, where the personal information of the participants was not requested, questions that would reflect their personal opinions were also avoided. In this way, it has been tried to prevent the standard method variance error. It is expressed as one of the measurement problems arising during data collection for more than one structure (Podsakoff et al., 2003). After completing the research, it was re-tested to determine whether the obtained data had standard method variance. In recent years, empirical research in psychology and organizational studies has given great importance to standard method variance. Richardson et al. (2009) Decipher the standard method variance as "the systematic error variance shared between variables measured and presented as a function of the same method and source." Systematic error variance can prevent the estimated relationships between criteria (Campbell & Fiske, 1959) and cause measurement bias. If there is a bias in the estimated relationship between two variables, the standard method can be considered a Deceptive (or third) variable that systematically

affects both essential variables. This situation may inflate, decrease, or eliminate the observed relationship between the relevant essential variables. In order to prevent this, the standard method variance values were checked.

4.3. Statistical and Correlation Decisions Between the Variables

Table 4 shows the correlation table between the variables and the statistical results, the mean and standard deviation, and the reliability coefficients in parentheses. Decency and reliability coefficients are given. When the relationships between variables are examined, it is seen that all variables have a positive effect Decently and are statistically significant. As a result of the Cronbach's alpha test conducted for reliability analysis, the alpha value of career adjustment ability was determined as $\alpha=.83$, $\alpha=.90$ for employability perception and psychological contract $\alpha=.85$

Table 4. Correlation Results

VARIABLES	AVG	Ss	1	2	3
Psychological Contract	2.87	1.02	(0.83)		
Career Adaptability	3.45	0.945	0.572	(0.90)	
Employability	3.14	0.912	0.415	0.438	(0.85)

Note: The correlations between the variables are high. This suggests the presence of an overlap (multicollinearity) issue among the scales.

4.4. Structural Equation Modeling Results of the Model

When conducting path analysis, it is tried to prove that the model exists by using confirmatory factor analysis compliance indices. It is seen that the compliance indices obtained as a result of the analyses are sufficient. The results corresponding to the reference values Hair (2010) determined are as follows: $\Delta\chi^2/df= 1.416$, GFI= 0.89, CFI= 0.90, NFI= 0.91, RMSEA= 0.47).

These results show that career adaptation ability significantly and positively affects psychological contracts from a statistical point of view ($\beta =0.512$; $t=3.405$; $p<0.001$). A similar effect is seen when decoupling the relationship between psychological capital and employability. Psychological capital has a statistically significant and positive effect on the perception of employability ($\beta =0.605$; $t=5.814$; $p<0.001$).

Our other hypothesis, the relationship between career adaptability ability and employability perception, has a significant and positive effect statistically ($\beta =0.402$; $t=5.018$; $p<0.001$) Decently. (Table 5)

In the analysis in which the mediation effect is tested, in order to understand whether there is a mediating effect, if there is a mediating effect at what level, the effect of career adjustment ability on employability perception, the relationship between career adjustment ability and employability perception is not as strong as in the first model when the psychological contract is included in the model ($\beta = 0.019$; $t=0.208$; $p<0.001$). In addition, there is a decrease in the beta coefficient between the first

and second models, which shows the effect on career adjustment ability and decency perception ($\beta_1=0.402$; $\beta_2=0.019$). According to this result, psychological capital has a full intermediary effect on the relationship between career adaptation ability and employability perception. According to the Sobel test result, it is statistically significant ($z=4.1962$; $p<0.001$). Similarly, in Table 5, when the Bootstrap sample size is calculated as 1000, this indirect effect is statistically significant ($p<0.01$) and confirms the above results (Effect=0.1874; Boot SE=0.0214; BOOTL99 CI=0.1225; BootUL99 CI=0.3974).

Table 5. Structural Equation Modeling Related to the Mediation Effect

Hypotheses	Standardized Coefficients (β)	R ²	Standardized R ²
CAA-PC	0.512***($t=3.405$)	0.14	
PC-PFE	0.605***($t=5.814$)	0.21	
CAA-PFE	0.402***($t=5.018$)	0.064	0.17
CAA-PFE (indirect)	0.019****($t=0.208$)	0.28	

* $p<0,05$; ** $p<0,01$; *** $p<0,001$; **** p : not significant

5. DISCUSSION

Employability has changed significantly in recent years, reflecting shifting employment structures and workforce expectations. The understanding of the employee who has been working at the same enterprise for a long time in the traditional understanding of employment has been replaced by candidates and employees who are constantly on the move and carry the values of Generation Y and Z. The new career approach, shaped following the new needs, imposes responsibility on individuals, organizations, and the state at the point of gaining and developing the employability skills of individuals. One of the ways to survive in sectors and organizations experiencing rapid change is explained within the framework of the concept of employability. Organizations no longer guarantee lifelong employment but offer opportunities for continuous professional growth, enabling employees to remain competitive in evolving labor markets. This requires individuals to proactively enhance their employability through skill acquisition, career adaptability, and professional networking.

The theoretical framework of employability has predominantly focused on individual capabilities. However, considering environmental factors such as the current economic conditions and organizational culture, the boundaries of employability have become different. Studies highlight that perceived employability significantly affects career progression and job security (De Cuyper et al., 2008; Potgieter & Coetzee, 2013; Gamboa et al., 2014). Organizations must invest in training programs, career development initiatives, and internal mobility opportunities to enhance employability, ensuring that employees can transition smoothly within and beyond their current roles. Higher education institutions also play a crucial role in equipping students with relevant skills and fostering adaptability through career-focused curricula and work-integrated learning experiences.

The findings confirm that career adaptability has a statistically significant and positive impact on the psychological contract. This outcome aligns with similar studies in literature (Haslberger &

Brewster, 2009; Chen, 2010; Gamboa et al., 2014; Deas & Coetzee, 2020; Lodi et al., 2020; Koveshnikov et al., 2022). Additionally, the psychological contract positively influences perceived employability, reinforcing the importance of mutual expectations and fulfillment between employees and employers (Scholarios et al., 2008; De Cuyper et al., 2011). Furthermore, the mediation effect of the psychological contract in the relationship between career adaptability and employability perception suggests that psychological contract fulfillment enhances career confidence and career progression (Guan et al., 2013; Sok et al., 2013; Dries et al., 2014; Coetzee et al., 2015).

6. CONCLUSION

This study underscores the significance of career adaptability in enhancing perceived employability, with the psychological contract playing a crucial mediating role (De Cuyper et al., 2011; Scholarios et al., 2008). The evolving nature of employment necessitates that individuals take proactive steps to manage their careers, while organizations and educational institutions must provide resources to support this adaptability (Fugate et al., 2004; Potgieter & Coetzee, 2013).

It is helpful to consider the concept of employability from the point of view of quality in higher education (Jackson & Tomlinson, 2020). Graduates' employment rates are also considered an indicator of success for higher education institutions (Brown et al., 2022). The variable of graduates' ability to get a full-time job within a certain period (for example, in the first year after graduation) can be used as a measurement method (Rothwell et al., 2008). In order to calculate this ratio effectively, the graduate information system must work very well. In this way, employability can be operationally seen as equivalent to having a full-time job after graduation; however, the actual process of employability should be considered together with studentship, and having a job is only an outcome (de Vos et al., 2011). Apart from this, the employability process can be measured with success indicators that have both individual and institutional aspects (Guilbert et al., 2016).

Among the factors that affect corporate employability are the reputation of the university, the type of instruction (formal, remote), the mobility of staff and graduates, the field of study, work experience (internships, part-time or full-time study), age, gender, and social class (Succi & Canovi, 2020). There is also a need for an independent organization to conduct an "employability audit" to continuously monitor universities' employability effectiveness (Gbadamosi et al., 2015). Graduate employment rates can also be tracked by improving employability (Tomlinson, 2007).

6.1. Practical Implications

The study's findings highlight the need for organizations and universities to actively foster career adaptability (Van der Heijde & Van der Heijden, 2006). Universities should integrate structured career management training, internships, and skill-based learning opportunities into their curricula to help students develop career resilience and adaptability (Pitan & Muller, 2019; Monteiro et al., 2020).

Career services must enhance employability by providing tailored guidance on industry trends, skill development, and career planning (Pool & Sewell, 2007).

From an organizational perspective, HR strategies should reinforce psychological contract fulfillment through clear communication, structured career pathways, and professional development initiatives (Coyle-Shapiro et al., 2019). Employers can implement mentorship programs, continuous learning opportunities, and career mobility strategies to strengthen the psychological contract (Bal et al., 2013). These efforts increase employee engagement, retention, and long-term employability (Coetzee & Engelbrecht, 2022).

6.2. Limitations and Future Research

Despite its contributions, this study has certain limitations. The sample primarily consists of university students, which may limit the applicability of findings to other workforce demographics (Berntson et al., 2010). Future research should extend the investigation to different employment sectors and cultural contexts (Andresen et al., 2022). Additionally, longitudinal studies are required to assess the long-term effects of psychological contract fulfillment on career adaptability and employability outcomes (Maree, 2017). Further exploration of specific organizational interventions to strengthen the psychological contract and support career adaptability would provide valuable insights for policymakers and HR practitioners (Ebere & Onuoha, 2022).

By addressing these limitations, future research can deepen the understanding of how career adaptability and psychological contract dynamics interact to shape employability in a rapidly evolving job market. Employability will become more critical and form the basis of individual and organizational career planning (Savickas, 2013).

Ethics Committee approval was not required for this study.

The author declares that the study was conducted in accordance with research and publication ethics.

The author confirms that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The author declares that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article.

The author affirms that the entire research process was conducted solely by them.

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Souls of Survival: COVID-19, Spirituality and Coping Outcomes Among Malaysia's Informal Workforce *

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Abstract

This study aims to examine how spirituality influenced coping outcomes among informal workers during the COVID-19 epidemic. The Sustainable Livelihood Approach (SLA) theory is used to comprehend how informal workers cope. 367 heads of households residing in Kuala Lumpur's government flats, generally called people's housing projects (PPRs), participated in the quantitative study. Using the multiple regression analysis and PROCESS, the study found a relationship between physical, financial, and social capital and coping outcomes. On another note, spirituality mediated the coping outcomes during hard times, except for natural and physical capital. Spirituality builds resilience and hopefulness, essential for good mental health within this group. This paper also presents the practical implications of government machinery in mitigating the epidemic's effects on informal workers, particularly in urban areas.

Keywords: *Informal Worker, Coping Outcomes, Sustainable Livelihood Approach, Spirituality.*

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1. INTRODUCTION

A religious gathering in Kuala Lumpur in early March 2020 shocked Malaysia with the highest cumulative COVID-19 cases in Southeast Asia (Edinur & Safuan, 2020). To curb the spread, a Movement Control Order (MCO) was enforced nationwide (Tan, 2020). The order was altering people's lives, economically and socially. The epidemic caused an economic and workforce market whammy, allowing for new working norms. Many lost their jobs due to the sluggish market. The COVID-19 epidemic also pushed an additional 88 to 115 million people into extreme poverty because of the global recession (World Bank, 2020).

In Malaysia, the absolute poverty rate has risen from 5.6% to 8.4%, while hardcore poverty has increased by 1% in Malaysia (Department of Statistic Malaysia Official Portal, 2021). The incidence of absolute poverty by state shows that Sabah recorded the highest poverty rate at 21.2% and Terengganu at 12.0%. Losing and reducing income and working hours are among the brutal strategies employers took to survive in the market; however, they hit hard on informal workers (Department of Statistic Malaysia Official Portal, 2021).

On another note, the Department of Statistics Malaysia reported that informal workers were the most susceptible during the epidemic (Department of Statistic Malaysia Official Portal, 2021). The International Labour Organization (ILO) defines informal workers as any work paying that is not registered, regulated, or protected under an existing legal or regulatory framework (Husmanns, 2003). Before the epidemic, the informal workers coped with daily challenges, such as struggling to provide sufficient necessities to their households. During the epidemic, these workers had difficulty surviving because the nature of their work did not support a work-from-home policy, leading to employment and financial loss.

Two billion informal workers have significantly reduced their capacity to earn a living and sustain their livelihood, resulting in an increasing poverty rate (International Labour Organization, 2020). Typically, informal workers have lower educational attainment, less income, and low economic opportunities (Komin et al., 2021). Furthermore, informal workers are not covered with the same social protection as formal employees. With less income earned, limited savings, and a lack of social security, informal workers struggle to sustain their livelihood, especially during the COVID-19 epidemic.

This situation may lead to increased depression and suicidal behaviour due to the job and financial loss. During the epidemic, suicide cases increased, particularly among B40 households (Borneo Post, 2021a). B40, also known as the bottom 40 percent of households, are the lower-income group in Malaysia, with a household income below RM4,849 per month. The COVID-19 epidemic was also causing secondary health problems such as psychological illness (Deng et al., 2023; Ibad et al., 2021; Wong et al., 2021).

From the positive psychology perspective, spirituality builds resilience and reduces hopelessness during challenging times (Waters et al., 2022; Barton & Miller, 2015). Spirituality can be characterised as understanding that human lives have meaning beyond ordinary daily living, with the physical requirements that motivate selfishness and aggressiveness (Spencer, 2012). According to African American studies, spiritual well-being has partially mediated culture-specific coping with the cost of living (Utsey et al., 2007). With these arguments, this paper selected spirituality as a mediator because of its applicability beyond religious beliefs across the plural societies in Malaysia.

Similarly, the increase in poverty may impact the attainment of the Sustainable Development Goals (SDGs). According to the SDGs Report 2021, extreme poverty increased in 2020 in sub-Saharan Africa and other countries. Even before the outbreaks, the globe was still battling to eradicate poverty by 2030. The epidemic impacted food security, intensified food insecurity and threatened SDG 2 (Zero Hunger). The global economy slowed, and the worldwide recession resulted in significant rises in unemployment in 2020, affecting SDG 8 (Decent Work and Economic Growth). As of late April 2021, the global mortality toll from COVID-19 had topped three million, posing a threat to SDG 3 (Good Health and Well-Being).

The death rates and decreases in life expectancy associated with COVID-19 are particularly pronounced among the most susceptible, poor, and marginalised communities. Hence, this paper is interested in investigating the relationship between coping outcomes among informal workers, mediated by spirituality in Kuala Lumpur, Malaysia, during the COVID-19 epidemic. The remainder of the study is restructured as follows: literature review, methodology of the study, results and discussions, and recommendations and conclusion.

2. LITERATURE REVIEW

The impact of the COVID-19 epidemic has harmed the economic, social, and health sectors in Malaysia. The mobility restrictions significantly impacted, such as increased employment losses and psychological implications, especially among informal workers. While the COVID-19 epidemic has pushed hard on the extremely poor, it keeps the policymakers busy formulating the best social protection schemes that help the whole nation.

2.1. The National Recovery Plan

The National Recovery Plan is a Malaysian government strategy to ease people's struggles with the economic shocks. The recovery plan consists of seven stimulus packages: PRIHATIN, PENJANA, Kita PRIHATIN, PERMAI, PEMERKASA, PEMERKASA Plus, and PEMULIH that involve RM530 billion for direct relief and financial support. Besides that, RM83 billion was set aside for fiscal spending, while RM447 billion was for non-fiscal spending (Ministry of Finance Malaysia, 2021).

Overall, all economic stimulus packages introduced by the government were projected to reduce the burden of impact on people (Farah Adillah, 2021; Borneo Post, 2021b; Chung, 2020; Zainal Abidin,

2021). However, Ming et al. (2021) stated that most of the government's allocation was not direct fiscal spending but funds derived from deferred payment through loan moratoriums, loan guarantees, loan facilities, and for individuals through Employees' Provident Funds (EPF) withdrawals. The EPF is a compulsory retirement savings and contribution plan for workers. The government also unveiled a wage subsidy scheme for qualified businesses, which did not extend to foreign workers, self-employed workers, or informal sector workers (Ming et al., 2021). Since informal workers do not have EPF contributions, they may have slipped through the cracks, especially among B40 households.

On a different note, the withdrawals from the EPF scheme invited a mixed response among citizens. Some perceived it as timely to meet the urgent cash flow of households badly affected by the movement control order (Kassim, 2021). Meanwhile, economists perceived it as a short-term solution and urged the government to consider alternatives to help the citizens rather than decreasing citizen pension savings (Ming et al., 2021). Although the support given to individuals and families was grossly insufficient in the case of informal workers, numerous studies have shown that they use five forms of capital: human, natural, physical, financial, and social to survive during trying times (Rahman et al., 2020; Ibrahim & Othman, 2020; Komin et al., 2021; Pitoyo et al., 2021; Yirga, 2021).

2.2. Sustainable Livelihood Approach

Informal workers employ various coping mechanisms to stay afloat. Based on the Sustainable Livelihood Approach (SLA) which introduced by Chambers and Conway (1992), the framework could be used as a tool for analysing and improving the lives of poor or marginalised persons. It is a participative method founded on the notion that all people have the abilities and assets to sustain their personal development. Most early SLA studies were rural-focused, including those developed by the United Kingdom's Department for International Development (DFID), which was concerned with the relationship between rural poverty and the environment (Farrington et al., 2002). Likewise, most SLA research focused on rural areas in Malaysia, while few studies applied SLA in urban areas (Ibrahim et al., 2018; Jamil et al., 2020). The dynamics of SLA allow the theory to be applied in both urban and rural settings. Hence, its adoption in this study is regarded as a tool for understanding the coping outcomes of the urban poor, particularly informal workers' survival using specific coping mechanisms.

The components of SLA include (1) vulnerability context, (2) livelihood assets, (3) policies, structures, and processes, (4) livelihood strategies, and (5) livelihood outcomes. However, this study adopts spirituality as a mediating variable to influence coping mechanisms and outcomes among informal workers.

The vulnerability context is defined as insecurity of an individual's or a household's well-being encountered because of the environment. Vulnerability has two aspects: the external environment, such as seasonality, critical trends and shocks; and then the internal environment, such as lack of skills (Serrat, 2008). Meanwhile, assets are the resources, stocks, claims, and access for individuals or households by

which to control and sustain their livelihoods. Assets can be described as five diverse types of capital: human, natural, physical, financial, and social capital. The definition of capital is portrayed in Table 1.

Table 1. Definition of Assets

Assets	Definition
Human Capital	Comprises the capabilities, experience, work skills, and good health that enable people to engage in various livelihood options and sustain their livelihood
Natural Capital	The stocks of natural resources that can be exploited to produce additional goods and services. For instance, land, soils, food production, water supply etc.
Physical Capital	The tools and equipment necessary to produce products and the basic infrastructure to sustain livelihoods such as housing, road and transportation, access information etc.
Financial Capital	People's financial resources to sustain their livelihood, such as cash, debts, savings, monetary assistance etc.
Social Capital	An individual's social support networks to sustain their livelihood. Relationship networks are essential to avoid economic shocks by relying on family, friends, and social helps during difficult times.

The processes refer to the regulations, policies, norms, and practices that determine how the structure operates. Due to the enforcement of mobility restrictions, the Malaysian government introduced many assistance programmes such as PRIHATIN, PENJANA, Kita PRIHATIN, PERMAI, PEMERKASA, PEMERKASA Plus, and PEMULIH. These forms of assistance could reduce the burden to informal workers during the COVID-19 epidemic (Zakaria et al., 2023; Nungsari et al., 2023).

Moreover, the research also adopted spirituality as a mediating variable influencing coping outcomes and mechanisms among informal workers. Spirituality is vital in assisting people in coping with stressful conditions. Likewise, from an Islamic perspective, Al-Quran and Al-Hadith also state the importance of spirituality in human beings (Sudi et al., 2018).

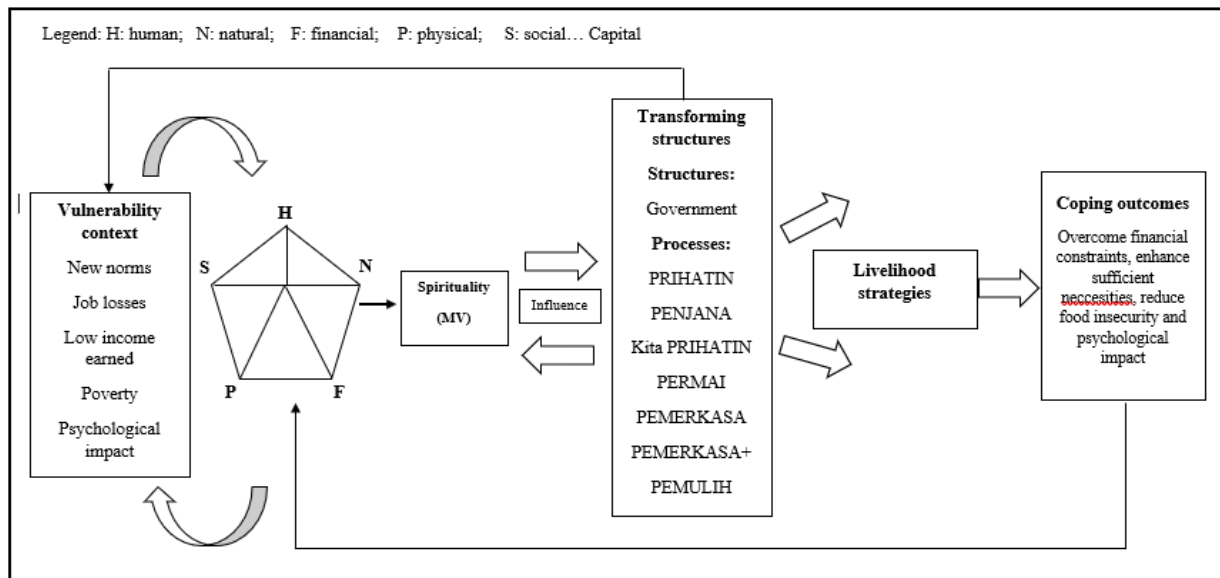
Some studies have discussed spirituality as a mediator variable on coping behaviours to build resilience and reduce hopelessness (Gülerce & Maraj, 2021). This is supported by Khairina et al. (2020) in that spirituality acts as a coping strategy during challenging times among Indonesian students. Numerous studies have been conducted on spirituality as a research topic because of its applicability to non-religious people (Gülerce & Maraj, 2021; Utsey et al., 2007). During the mobility restrictions, vulnerable groups such as lower-income people, informal workers and the elderly encountered many challenges sustaining their lives. Therefore, it was essential to have high spirituality to survive during the epidemic.

2.3. Development of conceptual framework

The model framework was developed based on the literature review and understanding of SLA theory. The conceptual framework proposed a direct relationship between new norms, employment losses, low income earned, and the psychological impact (vulnerability context) of the massive changes

during the outbreaks. The researchers discussed human, natural, physical, financial, and social capitals (assets) as coping mechanisms by the informal workers use to sustain their livelihood. This study also included measuring the transforming structures such as PRIHATIN, PENJANA, Kita PRIHATIN, PERMAI, PEMERKASA, PEMERKASA Plus, and PENJANA provided by the Malaysian government and NGOs, which directly for informal workers. Therefore, by relying on those five capitals, informal workers could achieve coping outcomes such as more income, boosted well-being, reduced vulnerability, improved food security, and recovered human dignity. Lastly, spirituality was a mediating variable between coping outcomes and livelihood strategies among the informal workers during the epidemic, as an accelerating agent to positive coping outcomes. The conceptual framework is portrayed in Figure 1.

Figure 1. Sustainable Livelihood Approach



Source: Department for International Development (1999)

2.4. Hypothesis Development

This study examines the relationship between key components of the theory of SLA and the coping outcomes of informal workers among B40 households in surviving the epidemic. Field Chambers and Conway (1992) state that a livelihood is the capabilities, assets, and other activities necessary for survival. Therefore, to augment a sustained livelihood during the outbreaks, informal workers developed various coping mechanisms based on human, natural, physical, financial, and social capital to achieve sustainable coping outcomes. These kinds of capital may improve well-being and reduce informal workers' burdens in enduring COVID-19. Meanwhile, spirituality is an essential element that all individuals need to adapt and to cope with stressful conditions. Many studies have examined the mediating effects on spirituality as increasing resilience and reducing hopelessness by being involved in social support and active coping to increase an individual's competence to survive during hard times

(Gülerce & Maraj, 2021; Reutter & Bigatti, 2014). Utsey et al. (2007) assert that spiritual well-being mediates the relationship between coping behaviours, such as social support and positive health outcomes. With the above arguments, hypothesis 1 was developed:

H1: There is a relationship between human, natural, physical, financial, and social capital and informal workers' coping outcomes during the COVID-19 epidemic, mediated by spirituality.

3. MATERIALS AND METHODS

An exploratory research design was used in this study to ensure that the study's objective could be met (George, 2021). An exploratory research design is conducted to investigate a problem that has not been fully characterised. Since the COVID-19 epidemic was a global phenomenon, the researchers explored the coping mechanisms informal workers use to sustain their livelihood. A cross-sectional survey was also developed to have sufficient time to collect data and determine outcomes (Setia, 2016). In this paper, the researchers used quantitative methods as primary data from data collected and interpreted numerical data using SPSS 26. Secondary data such as journals, websites, online newspapers, and reports have also been used to obtain additional information regarding coping mechanisms and government assistance.

Following the rule of thumb Krejcie and Morgan (1970), 367 heads of households of informal workers were needed to answer the questionnaires (N= 8,108). A cluster sampling technique was used in this study, which was to select a random sample of clusters from the population. Purposive sampling techniques were used to identify suitable respondents. The inclusion criteria used were 1) 18 years old and above, 2) living in government housing (PPRs) in the Bandar Tun Razak district, and 3) working in the informal sectors. In this study, the researchers divided the sample size by percentage from six PPRs in the Bandar Tun Razak district to provide a fair distribution, as portrayed in Table 2.

Table 2. PPRs in Bandar Tun Razak

District	PPR residential	Unit	Population (N)	Sample size (s)
Bandar Tun Razak	PPR Seri Malaysia	632	632	10% of 367 = 37
	PPR Desa Petaling	632	632	10% of 367 = 37
	PPR Raya Permai	1264	1264	20% of 367 = 73
	PPR Desa Tun Razak	1824	1824	20% of 367 = 73
	PPR Taman Mulia	912	912	20% of 367 = 73
	PPR Kg Muhibbah	2844	2844	20% of 367 = 73
Total			8108	367

Source: Field work

In developing the items, the researchers generated items for two variables; five were adapted from past studies. Among them were coping outcomes and physical capital by Yirga (2019) and financial capital by Thinagar et al. (2021), Komin et al. (2021), Azhar et al. (2020), and Sulaiman et al. (2011). Meanwhile, social capital items were adapted from the studies of Komin et al. (2021), Pitoyo et al.

(2021), and Chirombe et al. (2020). And lastly, items from DeLaney (2003) and Underwood and Teresi (2002) were accustomed to the spiritual variable.

The goodness of the data is crucial for conducting the validity and reliability test. The aim is to verify that the questionnaires are valid and reliable. The exploratory factor analysis (EFA) was performed to measure the validity of the items and for the reliability test by using Cronbach's Alpha to ensure the items used were reliable in measuring the study's validity. The EFA results revealed that only 9 of the 58 items were removed as the extraction value was below 0.4. The principal components showed seven components with eigenvalues exceeding 1, which was acceptable. They are the coping outcomes of informal workers (11.82%), human capital (6.63%), natural capital (3.87%), physical capital (3.23%), financial capital (4.19%), and social capital (6.87%) and one mediator variable, the spirituality of informal workers (26.85%). The total value of the seven components is 44.77% of the variance.

A reliability test was undertaken to reveal how free it is from random error, and one of the most critical issues is the scale's internal consistency. The results show that the coping outcomes indicated $\alpha=.791$; human capital, $\alpha=.726$; natural capital, $\alpha=.790$; physical capital, $\alpha=.650$; financial capital, $\alpha=.616$; social capital, $\alpha=.790$; and spirituality, $\alpha=.740$. Following Nunnally's (1978) rule of thumb, all attained values are acceptable. Table 3 presents the results of the reliability test.

Table 3. Cronbach's Alpha value

Variable	Number of items	Cronbach's Alpha	Reliability
Coping outcomes among informal workers	9	0.791	Yes
Human Capital	4	0.726	Yes
Natural Capital	5	0.790	Yes
Physical Capital	5	0.650	Acceptable
Financial Capital	8	0.616	Acceptable
Social Capital	7	0.790	Yes
Spirituality	11	0.740	Yes

This study was also granted ethical clearance from the university's Research Ethical Committee, reference no.: FERC/03/2022 (EMA737/16).

4. RESULTS AND DISCUSSION

4.1 Demographic Profile

The questionnaire was distributed to 367 respondents of PPR residents in Bandar Tun Razak district in Kuala Lumpur. The respondents are the head of the household. In this study, 89.1% of respondents were male, and 10.9% were female. Moreover, most respondents were aged between 41 and 50 (58.6%). In terms of ethnicity, most respondents were Malays (84.7%), followed by Indians (10.9%), Chinese (3.8%) and Others (0.5%). The highest level of education attained was high school, representing 78.7% of respondents. 89.1% of the respondents are married and had at least 3 to 4 children living with them. In addition, most respondents received RM4,849 or below for their monthly income.

All respondents in this study were the heads of households. Table 4 shows the respondents' demographic profile.

Table 4. Profile of Respondents

Variable	Profile of respondents	Frequency	Percentage (%)
Gender	Male	327	89.1
	Female	40	10.9
Age	18 – 30 years	5	1.4
	31 – 40 years	52	14.2
	41 – 50 years	215	58.6
	51 – 60 years	87	23.7
	61 years and above	8	2.2
Ethnic	Malay	311	84.7
	Chinese	13	3.8
	Indian	40	10.9
	Other	2	0.5
Religion	Islam	311	84.7
	Buddha	13	3.5
	Hindu	40	10.9
	Other	3	0.8
Education	Primary school	4	1.1
	Secondary school	55	15.0
	High school	289	78.7
	Diploma / Degree	19	5.2
Occupation	Self- Employed	367	100
Marital Status	Married	327	89.1
	Divorced	20	5.4
	Widowed	20	5.4
No of Children	0 – 2 children	100	27.2
	3 – 4 children	167	45.5
	More than 5 children	100	27.2
Monthly Household	RM 4849 and below	367	100
Role in the Household	Head of Household	367	100

4.2. Coping Mechanisms Based on Capitals

In determining the relationship between coping mechanisms and outcomes, this paper adapted the components of SLA as coping mechanisms, including human, natural, physical, financial, and social capital. The results reflected a significant influence of physical capital ($p < 0.05$, $p = 0.000$), financial capital ($p < 0.05$, $p = 0.000$), and social capital ($p < 0.05$, $p = 0.004$) on the coping outcomes of informal workers. However, human capital ($p < 0.05$, $p = 0.239$) and natural capital ($p < 0.05$, $p = 0.948$) did not have a significant influence on the coping outcomes of informal workers during the epidemic. Table 5 shows the results that measure the relationship between coping mechanisms and coping outcomes.

The finding on the physical assets was consistent with past studies (Ibrahim & Othman, 2020; Ncube et al., 2019). For example, Ncube et al. (2019) highlighted that female South African migrants leveraged their transportation, housing, and availability of information to survive in a foreign land. The Malaysian scenario Ibrahim and Othman (2020) identified that the B40 group actively used telecommunication, social media platforms, and transportation to get involved in the gig economy. In a similar vein, Yirga (2021) asserted that the poor engaged in business activities at their own houses,

which reduced their operational cost. These few examples underscore the importance of physical assets for the poor.

Another significant capital in this study was social capital, which was highly associated with adaptive coping mechanisms for attaining sustainable livelihoods. In urban Kenya, a strong social capital could be achieved through solid relationships with family, relatives, friends, and neighbours (Mpanje et al., 2022). These were important significant others who assisted them to survive stress and shocks. This is supported by another study that lower-income groups relied significantly on their family, friends, and neighbours, such as borrowing money and food donations during epidemics (Flanders et al., 2020). However, some studies stated that individuals below the poverty line might lack accessible resources to help others (Aldrich et al., 2021). Still, the outcomes of this study uncovered that people give whatever they have to help others during their time of need.

Notably, financial capital was deemed essential for the urban poor to sustain their lives during the outbreak of COVID-19. Despite personal savings, borrowing from significant others, such as friends and family members, was the method to sustain financially. Financial capital also partially relied on government assistance, which was straightforward fiscal aid. According to the respondents, financial aid helps significantly reduce the burden and reflects the government is awareness of the hardship the people face. This type of financial capital will be further discussed in the following section.

Table 5. The Multiple Linear Regression result

Model		Unstandardised Coefficients		Standardised Coefficients		Collinearity Statistics		
		B	Std. Error	Beta	t	Sig.	Tol.	VIF
1	(Constant)	3.988	0.259		15.377	0.000		
	Human Capital	-0.029	0.025	-0.057	-1.178	0.239	0.910	1.098
	Natural Capital	0.002	0.026	0.003	0.065	0.948	0.948	1.054
	Physical Capital	-0.237	0.033	-0.338	-7.154	0.000	0.941	1.062
	Financial Capital	0.318	0.046	0.327	6.940	0.000	0.944	1.059
	Social Capital	0.107	0.037	0.135	2.875	0.004	0.958	1.044

4.3. Assistance Received by the Poor

The data analysis continued with identifying the types of assistance received by the informal workers in analysis the elements of transforming structures. Two types of assistance were described: direct fiscal and indirect fiscal measures. In terms of direct fiscal measures, 74.4% were the recipients of the *Bantuan Sara Hidup* (BSH), or sustenance aid, followed by *Bantuan Prihatin Nasional* (BPN) (36%). Meanwhile, *Baitulmaal* aid, e-hailing incentives and *Bantuan Khas COVID-19* (BKC) were recorded at 12.8%, 11.2% and 10.1%, respectively. The *MySalam* incentive (insurance scheme) offered by the government was indicated by 6% of recipients, and finally, the *Geran Khas Prihatin* (GKP) was recorded at 2.5% of respondents.

The highest indirect fiscal aid the informal workers obtained was the food basket program (34.1%). Then, 28.6% enjoyed electricity discounts, and 4.1% declared for rental exemption. The other 6.8% cumulatively received assistance of free internet access through the *Jaringan Prihatin* Program, training for gig economy workers, and public transport discounts. Table 6 shows the findings on government aid for informal workers.

Based on these results, almost all had received aid from the government, whether from direct or indirect fiscal assistance. However, 6.8% had never been the recipient of such aid. The informal workers could, therefore, sustain their livelihoods briefly by utilising the government's assistance, which reflected lessening their financial constraints, food insecurity, and reduced livelihood susceptibility during the COVID-19 (Farah Adillah, 2021; Borneo Post, 2021b Chung, 2020; Zainal Abidin, 2021). On the same note, other countries such as India used similar strategies for their women domestic workers via aid programs such as *Pradhan Mantri Garib Kalyan* Package (PMGKP), *Pradhan Mantri Kisan Sammann Nidhi* (PM-Kisan), and other assistance to sustain their livelihoods during the lockdown (Sumalatha et al., 2021). Likewise, B40 households in Malaysia also relied on financial aid from the government to reduce their financial constraints and sustain their livelihoods marginally during this time (Flanders et al., 2020). Despite making loans from registered financial bodies, some poor in Thailand opted for personal loans through loan sharks since it was more flexible and received fast approval (Komin et al., 2021).

Table 6. Assistance Patterns for Informal Workers

Type	Assistance	Frequency	Percentage %
Direct Fiscal Measure	Bantuan Prihatin Nasional (BPN)	132	36.0
	Bantuan Sara Hidup (BSH)	273	74.4
	E-hailing Incentive	41	11.2
	Geran Khas Prihatin (GKP)	9	2.5
	MySalam Incentive	22	6.0
	Bantuan Khas COVID-19 (BKC)	37	10.1
	Other: Baitulmal	47	12.8
Indirect Fiscal Measure	Rental Exemption	15	4.1
	TNB discount electricity	105	28.6
	Free internet basis	7	1.9
	Training for Gig economy workers	4	1.1
	Public Transport subsidy (MY30)	3	0.8
	Social assistance from the government	0	0
	PEKA B40	4	1.1
	Food basket program	125	34.1
	Cashless incentives	0	0
	MyMedic@Wilayah	0	0
	Jaringan PRIHATIN Program	7	1.9

Source: Field work

4.4. The Role of Spirituality as a Mediator

Based on the foregoing analysis, the results showed that spirituality mediates between physical capital ($p < 0.05$, $p = 0.000$), financial capital ($p < 0.05$, $p = 0.000$), and social capital ($p < 0.05$, $p = 0.0395$) and coping outcomes. Meanwhile, spirituality did not mediate between human capital ($p < 0.05$, $p = 0.186$), natural capital ($p < 0.05$, $p = 0.4352$) and coping outcomes of informal workers. In summary, spirituality has partially mediated the relationship between coping mechanisms and outcomes among informal workers during the COVID-19 epidemic. Table 7 below illustrates the results of spirituality as a mediator using the Andrew F. Hayes (PROCESS) method (Hayes, 2017).

In this sense, spirituality provides resilience and hopefulness during stressful conditions (Halil & Özkapu, 2023; Gülerce & Maraj, 2021). The results concur with the previous studies stating that spirituality significantly mediates the individual's coping strategies and builds resilience during challenging times (Sadeghifard et al., 2020; Li et al., 2021). On the other hand, an earlier study supported the current findings by highlighting spirituality partially mediates the association between perceived stress and psychological well-being (Reutter & Bigatti, 2014). In this past study, spirituality appears to reduce perceived stress levels and psychological health, implying that spirituality may be related to both the stimulus and the response, more positive assessments of life pressures (stimulus) and less psychological distress (response/outcome).

Table 7. Spirituality mediating results

Variable	Effect	se	t	p	LLCI	ULCI
Coping outcomes and human capital*spirituality	0.0356	0.0269	1.3222	0.1869	-0.0173	0.0885
Coping outcome and natural capital*spirituality	-0.0255	0.0289	-0.7812	0.4352	-0.0793	0.0342
Coping outcomes and physical capital*spirituality	-0.2464	0.0344	-7.1712	0.000	-0.3139	-0.1788
Coping outcomes and financial capital*spirituality	0.3318	0.0478	6.9480	0.000	0.2379	0.4199
Coping outcomes and social capital*spirituality	0.0852	0.0413	2.0666	0.0395	0.0041	0.1664

Source: Field work

5. RECOMMENDATIONS & CONCLUSION

This study explored informal workers' coping mechanisms and outcomes during the COVID-19 epidemic. It showed that informal workers sustained their livelihoods using only three coping mechanisms (physical, financial and social capital). Meanwhile, human and natural capital were insignificant during the epidemic outbreak and lockdowns, perhaps due to a lack of information on online training available, having limited access to an internet connection or not owning a proper gadget to join the classes, resulting in being less interested in finding new skills or upskilling. On the same note, the informal workers might have limited access to the natural capital since they live in small flats. Limited space and the absence of flat residents to initiate aquaculture or urban farming within the flat

compound might contribute to this result. However, it is interesting to acknowledge that financial capital gains among the informal workers align with the transforming structure introduced by the government on the direct and indirect fiscals, alongside borrowing from their family members and friends. In this situation, establishing strong social networks within the community is deemed essential to ensure their financial and social significance. At the same time, spirituality reinforced the coping outcomes, particularly resilience, maintaining their mental health and survival.

Notably, the study provides practical and theoretical significance. The findings of this study could help the government to provide specific assistance for informal workers in the future. In reality, the Malaysian government is still battling to ease urban poverty. Therefore, these results provide insight into the government and non-government organisations' collaboration in providing many specific programmes to relieve urban poverty, such as training to upskill workers. Besides that, these research findings are also significant for academicians and other researchers interested in urban poverty. Even though informal workers have limited capital, they overcame the challenges during the COVID-19 epidemic.

Several recommendations are proposed based on the study's findings. Firstly, the practical measures of information dissemination of government assistance should be reformed to ensure that informal workers know its existence. Therefore, policymakers such as the Economic Planning Unit (EPU) and other related agencies must focus on raising awareness of such benefits despite concurrently revolutionising the aid provided consistent with the current needs. Secondly, regardless of the assistance (monetary, skills, food banks, and others), there should be a body to look into the aid operation. The database should be created, maintained, and shared among the agencies to mitigate overlapping assistance. Hence, the resources could be leveraged by many groups of B40. Systematic assistance as such would increase human and financial capital effectively. Thirdly, the findings also highlighted the importance of spirituality as an agent to help the informal workers bounce back while facing difficulties. Thus, mental health awareness is also essential for informal workers to gain livelihoods. In this vein, more campaigns on government mental health services should be undertaken to make sure the informal workers are informed. With this in action, perhaps it would lead towards help-seeking behavior to health professional's aid.

However, this study has several limitations. Future studies should look into more parliamentary districts in Kuala Lumpur to confirm the research findings. In this sense, the results of this research could not be generalised to this metropolitan city as it focuses only on Bandar Tun Razak. Despite that, more findings should include various ethnic groups and compare how each group perceived their coping mechanisms. The data would be necessary for government intervention, especially during the budget allotment and activities planning. Finally, a comparative study among the cities in Malaysia, such as Johor Bahru, Penang, Kota Kinabalu and Kuching, on how the informal workers cope with COVID-19

impact also be seen as a potential area where the result would help the government to formulate a sound fiscal policy to support this group.

Ethics committee approval for the study was obtained from the Universiti Teknologi MARA, Faculty of Administrative Science and Policy Studies Ethics Review Committee on April 12, 2022, with reference number ERC/03/2022 (EMA737/16).

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors affirm that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors declare that the first, and corresponding, author of the study contributed to the planning, data collection and analysis of research; the second author of the study contributed to the literature review and discussion and results sections.

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A Model Proposal for Explaining the Investment Behaviour of University Students

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Abstract

This study proposes a unique structural model to understand the effects of financial literacy (F- Financial Literacy), lack of self-control (LSC-Lack of Self-Control), peer influence (PI-Peer Influence), parental socialisation (PS-Parental Socialisation) and social media (SM-Social Media) on university students' investment behaviour (IB-Investment Behaviour). The originality of the study lies in combining the effects of these factors on investment behaviour within the framework of a model. In addition to the limited studies in the literature, the study makes both theoretical and practical contributions by conducting hypothesis tests with PLS-SEM analysis. Data were collected from students (n=137) studying at the Faculty of Economics and Administrative Sciences (FEAS) during the summer term of 2023 through an online survey. The analysis revealed that the model is appropriate and financial literacy, lack of self-control, parental socialisation and social media positively affect investment behaviour, while lack of self-control has a negative effect on investment behaviour and only peer effect is not supported. This study provides an important framework for understanding the financial decision-making processes of university students and provides guidance for policy makers and educators.

Keywords: *Financial Literacy, Lack of Self-Control, Peer Effect, Parental Socialisation, Social Media, Investment Behaviour.*



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1. INTRODUCTION

Today, university students, who are generally young individuals, need to have a high level of financial awareness regarding financial knowledge and skills to increase their capacity to make important financial decisions in achieving and sustaining economic well-being (Alshebami & Aldhyani, 2022). A high level of financial literacy for the whole society, especially for the young generation of students, is very important for making the right investment behaviours (Alekm et al. 2018).

According to Yushita (2017), individuals with financial literacy are better able to manage their finances and financial literacy leads to savings and investment behaviours when applied correctly in decisions (Ayuningsih & Dewi 2023). Financial literacy is measured by various indicators such as knowledge of finance, savings, credit understanding, insurance and investment knowledge that are useful for one's future financial life (Salsabilla et al., 2022).

One of the most important supports in the development of financial literacy is parental influence. Parents' level of education and income affect children's financial literacy. Children become financially literate by observing their parents' financial behaviours such as saving and investing (Radianto et al., 2019).

In addition to parental influence, the most important social support in the development of financial literacy is peer influence and social media influence. Apart from these factors, the lack of self-control that individuals have is also important (Alshebami & Aldhyani, 2022). Mpaata et al. (2020) showed that self-control acts as a moderating variable in the relationship between financial literacy and savings behaviour.

Homan (2015) explained that peer influence has an impact on financial literacy and that students tend to refer to their peers in thinking, behaving and perceiving. According to Homan (2015), as the degree of parental education increases, children's financial literacy tends to increase (Radianto et al., 2019).

In order to determine how university students' attitudes and behaviours towards financial literacy affect their investments and whether lack of self-control, social media, parental socialization and peer influence also contribute to these investments, a study was planned especially for ESOGU FEAS students. The reason for the selection of FEAS students in the study is that the most comprehensive education on financial literacy is provided to students studying in these faculties. In many departments of these faculties, information on financial markets is given within the scope of courses such as financial management, capital markets, general economics, business finance, production management, investment analysis, evaluation of investment projects, etc. as compulsory and elective courses. In addition, the insufficient number of studies in the literature examining the effects of financial literacy (F- Financial literacy), lack of self-control (LSC- Self-control), parental socialization (PS- parental socialization), social media (SM- social media) and peer influence (PI- Peer-influence) on

investment behaviour (IB- Investment behaviour) of university students with a structural model constitutes the main starting point of this study.

2. LITERATURE REVIEW AND HYPOTHESES

The model proposed in this study explains how university students' investment behaviour is influenced by social environment (parents and peers), social media, lack of self-control and financial literacy from birth to adulthood. The following section reviews the literature on the variables affecting investment behaviour.

2.1. Financial Literacy

The financial values, knowledge and attitudes of young people are acquired from their home and environment. This includes family, school, friends and organisations (social media). These factors shape young people's financial behaviour over time (Alshebami & Aldhyani, 2022).

In their 2022 study, Rahim and colleagues addressed the issues of defining, measuring, and evaluating the levels of financial literacy in the literature on financial literacy. They noted that financial literacy can be defined in a wide variety of ways. The first definition, which they identified, includes "having relevant financial knowledge, which is referred to as knowledge and skills" (Organisation for Economic Co-operation and Development (OECD), 2020; Perbadanan Insurans Deposit Malaysia (PIDM), 2020; Thomas & Subhashree, 2020). In addition to the aforementioned definitions, Thomas and Subhashree (2020) and Perbadanan Insurans Deposit Malaysia (PIDM) (2020) include the concept of "confidence" as part of their definition of financial literacy. The second definition is based on the idea of an individual's ability to make financial decisions using financial knowledge, skills and confidence (Bawre & Kar, 2019; Henager & Cude, 2016; Lusardi & Mitchell, 2014; Perbadanan Insurans Deposit Malaysia (PIDM), 2020).

Mitchell and Lusardi (2015) defined financial literacy as "an individual's capacity to obtain, understand and use financial data to make effective and complete financial decisions". Alshebami and Aldhyani (2022) stated that family and personal investors should have the necessary level of financial literacy to be financially successful.

In their study in 2022, Rahim and colleagues identified financial instability and lack of financial literacy as key factors contributing to bankruptcy and social anxiety among young people. Lusardi and Mitchell (2014) define financial literacy as "the ability of people to process economic details and make informed decisions about financial planning, wealth accumulation, debt, and retirement".

Albeerdy and Gharlegghi (2015) defined financial literacy as "an individual's ability to make informed judgements and constructive decisions about the use and management of money". Alekam et al. (2018) assessed that financial literacy among younger generations enables individuals to manage

their money surpluses and deficits in order to make correct and accurate financial decisions for better future planning and to consider saving for retirement.

It is argued that people with high financial literacy will have better investment awareness. It is based on the assumption that people with high financial literacy will be more aware of the potential benefits of investing and therefore more likely to engage in such activities. Therefore, the following hypothesis was developed for the effect of financial literacy on investment awareness.

Hypothesis 1: Financial literacy has a positive effect on investment awareness

2.2. Lack of Self-Control Effect

In their 2015 study, Bernheim and colleagues defined self-control as "controlling behaviour in a simple choice between long-term goals and immediate pleasure". They further defined self-control as the degree to which an individual perceives oneself as having power over circumstances and current situations (Mpaata et al., 2023).

Mpaata et al., (2020) defined self-control as "essentially, behaviour control that considers the good and the bad before taking any action." The higher an individual's self-control, the higher the behavioural control of that individual. Additionally, Siswanti and Halida (2020) stated that self-control "is related to the individual's power to have values and beliefs that can be used as a guide when taking action or making decisions". In light of the findings of many researchers, Kassim et al. (2022) evaluated that self-control is the capacity of a person to regulate his own behaviour before taking action.

Shefrin and Thaler (1988) proposed the behavioural life cycle theory, which posits that individuals' financial behaviour throughout their lives is contingent upon their capacity to regulate their instincts and the costs of applying self-discipline. Ali et al. (2022) asserted that the financial behaviour of young people with higher self-control is more consistent and their capacity to manage their assets will be higher, which will increase their investment knowledge. In light of the preceding discussion, the following hypothesis is put forth:

Hypothesis 2: A lack of self-control has a negative effect on investment awareness.

2.3. Peer Influence

Jamal et al. (2015) assessed that, in addition to parenting factors, peer influence can affect individuals' financial behaviour and that in Malaysia, peer pressure is the clearest cause of young adults' deterioration in managing their financial affairs. A similar argument was also supported by Duflo and Saez (2001). There is a link between group behaviour of people with similar interests and individual behaviour.

Alekam et al. (2018) stated that peers, as well as parents, continue to be a powerful socialization tool that determines the future behaviour of adolescents. Peers can be defined as a group of people who

come after the family and become one of the sources of knowledge that cannot be obtained from the family (Kassim et al., 2022).

According to Zaihan (2016, p. 19), peer influence defines the extent to which peers influence an individual's attitudes, thoughts and behaviours. According to Hidayah and Bowo (2018), peers are environments that provide comfort in addition to the family environment where interaction with people with similarities takes place and this will have both positive and negative effects. From the views of the above experts, it can be concluded that peers are several individuals within a group who exchange information and influence each other, and there is age equality.

Based on these discussions, the following hypothesis for peer influence is proposed.

Hypothesis 3: There is a positive effect of peer influence on investment awareness.

2.4. Parental Socialization

Buccioli and Veronesi (2014) argue that parental teaching is more effective than formal education at school and that they show different behaviours according to different socio-demographic variables. OO (2019), parental influence begins with teaching saving during childhood and adolescence. In addition, parents' approach as a teaching method determines the ability to cope with financial problems in the future.

Brown et al. (1993) and Clarke et al. (2005) stated that financial literacy can be improved at a higher level by parents showing good examples and providing education to their children from an early age (Jorgansen, 2007).

A study by Kim and Jang (2014) assessed that long-term support and influence from parents can lead to a higher level of self-esteem among younger generations.

Mandell (2008) claims that one of the most important factors determining financial literacy is the education level of the parents.

Cohen and Nelson (2011) and Ramsey (2004) considered that the most important education on how to use money and investments consistently and logically, which is the basis of financial literacy, is the education given by parents at home (Alekan et al., 2018). Parents can transfer their financial practices to their children through financial socialization. Financial socialization is the development of basic terms and concepts related to financial issues such as investment, saving, banking, insurance, credit card uses, as well as knowledge and skills related to money management (Ismail et al., 2020). Considering that financial socialization within the family will contribute positively to investment awareness, the following hypothesis is proposed:

Hypothesis 4: There is a positive effect of parental socialisation on investment awareness.

2.5. Social Media

Millennials were born and raised in the age of information and communication technologies and as a result, social media has become an important tool in many activities. According to Kurnia (2020); it is stated that the degree of dependence of Generation Y on the internet and related technologies is high. Yusop and Sumari (2013) stated that Millennials, especially students, use social media to communicate, socialize, access financial information, and conduct research to complete university assignments. Asserts that social media is employed for a multitude of purposes, including the enhancement of students' financial literacy (Yanto et al., 2021). Sohn et al. (2012) evaluated various financial dissemination tools, including parents, coworkers, schools and the media. The results of the study showed that there is a significant relationship between media and financial literacy, while parents play a relatively small role in financial socialisation (Putri & Wijaya, 2020). In light of the preceding discussions, the following hypothesis is put forth for consideration:

Hypothesis 5: The use of social media has a positive effect on investment awareness.

The investment behaviour research model designed with the help of the proposed hypotheses describing the relationships between the factors is given in Figure 1.

Figure 1. Research Model

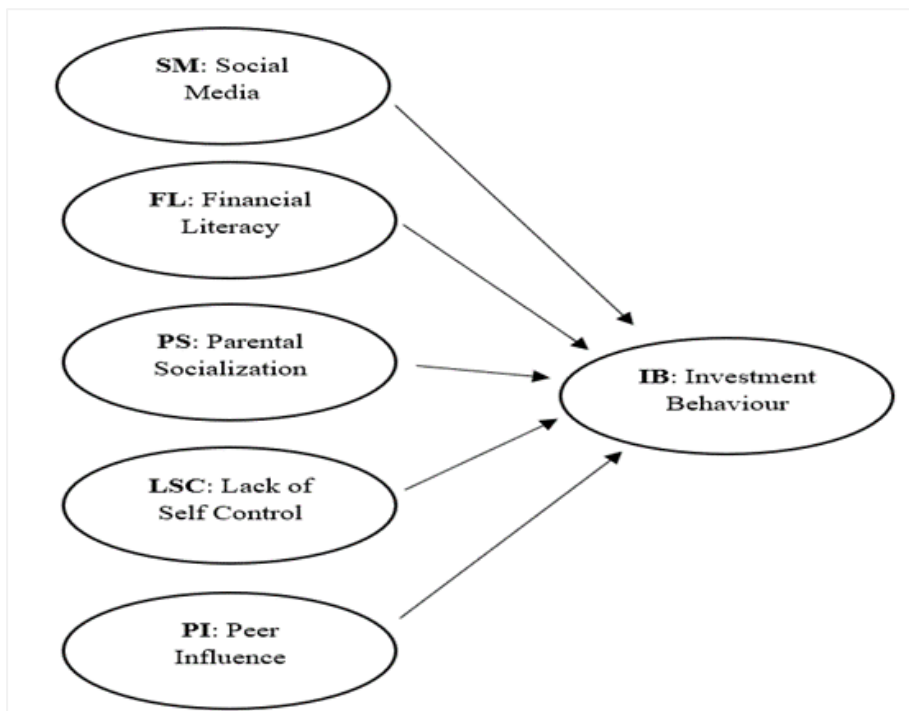


Table 1. Demographic Characteristics of Students

Variable	Level	Frequency	Percent
Gender	Female	74	54
	Male	63	46
Department	Business Administration	56	0.41
	Finance	7	0.05
	Finance and Banking	11	0.08
	Statistics	35	0.26
	Economy	10	0.07
	SBKY	18	0.13
Class	2	12	8.8
	3	36	26.2
	4	89	65.0
Income status	My Income Does Not Cover	45	32.8
	Balanced Budget	41	29.9
	My Income Covers My Expenses	51	37.2
Your Family's Income Status	Too bad	5	3.6
	Bad	76	55.5
	Middle	48	35.0
	Good	8	5.8
Total		137	100.0

2.6. Measurement Model

PLS-SEM was used to analyse the data. PLS-SEM is a technique that can be used safely with small samples and does not require the assumption of multivariate normality. Analyses in PLS-SEM usually involve evaluation of the measurement and structural model (Hair et al., 2017). The research model and survey questions of this study were developed from the study of Azizah and Mulyono (2020) and also from the literature review.

The evaluation of the measurement model is investigated by discriminant and convergent validity. Convergent validity is examined with the help of factor loadings of the statements (items) in the data collection tool, AVE and CR. Factor loadings are required to be greater than 0.70 and statistically significant. $CR > 0.70$ and $AVE > 0.50$ for the measurement model (Hair et al., 2014, 2017; Gürbüz & Yılmaz, 2023).

In the study, 1 statement from FL, one from LSC, 3 from IP and 3 from IB were excluded from the measurement model since their factor loadings were below 0.60. In the study, factor loadings were determined to be between 0.705-0.940 (see Figure 2). In addition, as can be seen in Table 2, $CR > 0.70$ and $AVE > 0.50$. Therefore, it is understood that the convergent validity of the constructs is provided (Fornell & Larcker, 1981).

Table 2. Construct Reliability and Validity

Factors	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
FL	0,816	0,871	0.576
IB	0.902	0.927	0.719
LSC	0.935	0.948	0.754
PI	0.827	0.920	0.851
PS	0.925	0.942	0.766
SM	0.881	0.918	0.736

Since the square root of the AVE in Table 2 is larger than the correlation coefficients between the variables, it can be said that the Fornel-Larcker criteria also provide discriminant validity. The diagonal values in Table 3 are the square root values of AVE.

Table 3. Discriminant Validity (Fornell-Larcker Criterion)

	FL	IB	LSC	PI	PS	SM
FL	0.759					
IB	0.592	0.848				
LSC	-0.152	-0.264	0.868			
PI	0.289	0.311	-0.183	0.923		
PS	0.221	0.312	-0.091	0.234	0.875	
SM	0.403	0.429	-0.012	0.402	0.267	0.858

The HTMT criterion proposed by Henseler et al. (2015) is the ratio of the mean of the correlation values of the statements of each variable in the model to the geometric mean of the correlations of the same variables. The authors emphasise that the HTMT value should be less than 0.85. Table 4 confirms the discriminant validity of the constructs according to the HTMT criterion

Table 4. Heterotrait-Monotrait Ratio (HTMT)

	FL	IB	LSC	PI	PS	SM
FL						
IB	0.681					
LSC	0.184	0.278				
PI	0.341	0.353	0.206			
PS	0.246	0.324	0.093	0.233		
SM	0.471	0.470	0.075	0.474	0.282	

2.7. Structural Model

At the structural model stage, path analysis and hypothesis testing are performed. Before testing the hypotheses of the study, the collinearity problem was investigated. For this purpose, Variance Inflation Factor (VIF) was used. If the VIF value is greater than 5, it is assumed that there are collinearity problems in the model (Hair et al., 2014, 2017). In the study, since Inner VIF Values < 3 ($1.062 < \text{Inner VIF Values} < 1.386$), there is no multicollinearity problem among the latent variables.

As can be seen from the model fit values in Table 5, it is understood that the structural model has sufficient fit. Figure 2 shows the path analysis, Table 6 shows the results of the general hypothesis tests and Figure 3 shows the Performance-Importance Map.

Figure 2 shows that the factor loadings of FL (financial literacy) range between 0.705-0.794. The highest correlation coefficient is between FL and FL3 (0.794). The higher the FL, the higher the FL3 'I have the ability to keep financial records for my income and expenditures'.

The factor loadings of PS (Parental Socialization) are between 0.838-0.921. The highest correlation coefficient is between PS and PS29 (0.921). The higher the PS, the higher the PS29 'I value my parents' guidance on how to manage my finances'.

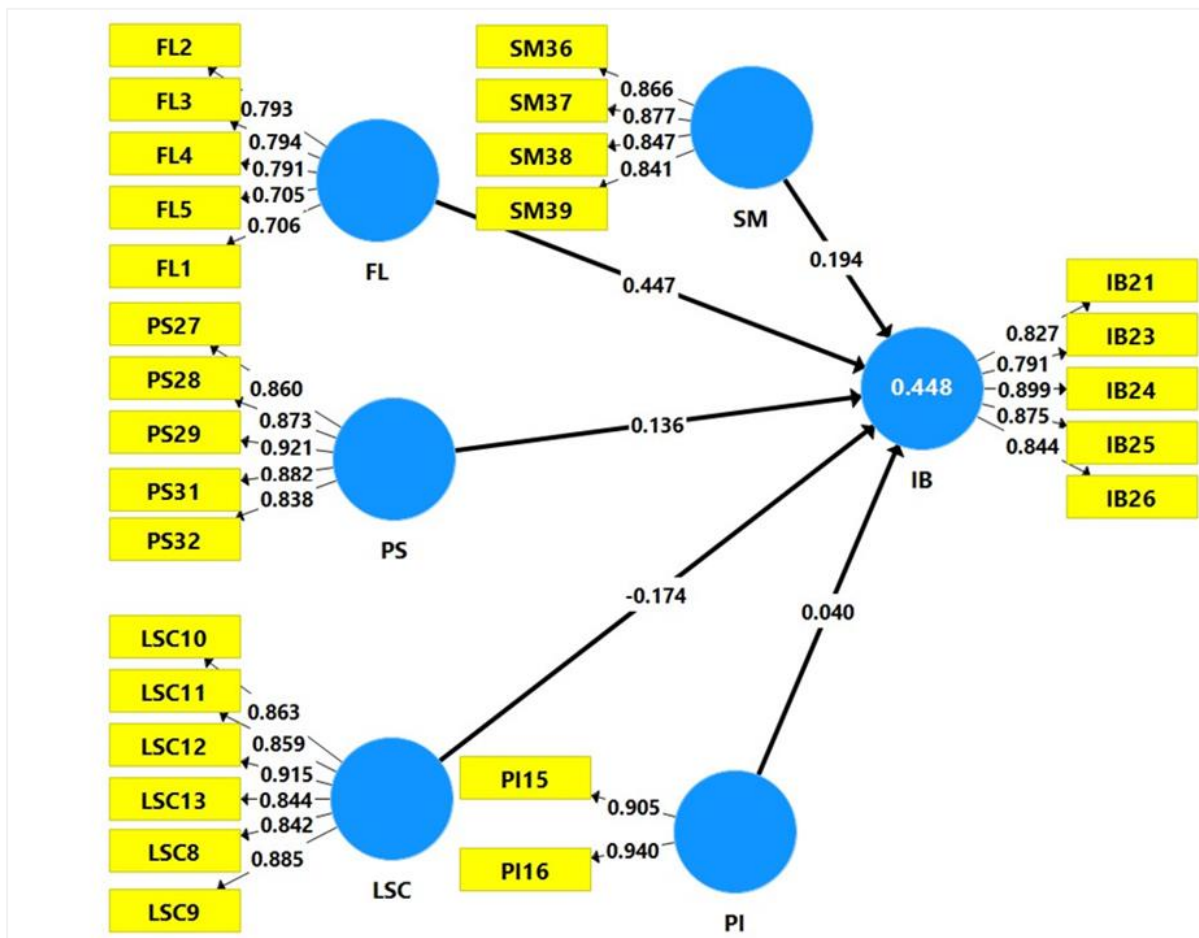
The factor loadings of LSC (Lack of Self-Control) are between 0.842-0.915. The correlation value between LSC and LSC12 is 0.915. As LSC increases, the 'Buy now, think later' thinking of LSC12 will also increase.

The factor loadings of SM: (Social Media) are between 0.841-0.877. The correlation value between SM and SM37 is 0.877. As SM increases, SM37's opinion 'I benefit from financial reports on social media when investing' will also increase.

The factor loadings of PI (Peer Influence) are 0.905 and 0.940. The correlation value between PI and PI16 is 0.940. As PI increases, PI16's statement 'I talk (discuss) with my friends about investment options' will also increase.

The factor loadings of IB (Investment behaviour) are between 0.791-0.899. The highest correlation coefficient is between IB and IB24 (0.899). As IB increases, IB24's 'I plan to manage my spending in order to invest' will increase.

Figure 2. Model of Investment Behaviour of University Students



FL: Financial Literacy, LSC: Lack of Self Control, PI: Peer Influence, IB: Investment Behaviour, PS: Parental Socialization, SM: Social Media

For structural model fit, SmartPLS calculates Geodesic Distance (d_G), Standardized Root Mean Square Error Squared (SRMR), Normed Fit Index (NFI), Chi-Square and Square Euclidean Distance (d_{ULS}) values. The goodness of fit values of the model are presented in Table 5. When the fit statistics calculated for the fit of the model in Table 5 are examined, it is seen that the structural model has adequate fit.

Table 5. Model Fit

SRMR	0.064
d_{ULS}	1.558
d_G	0.802
Chi-Square	609.388
NFI	0.781

When the results of the hypothesis tests in Table 6 are analysed; all hypotheses are supported except for the $PI \rightarrow IB$ relationship.

Table 6. Hypothesis Testing

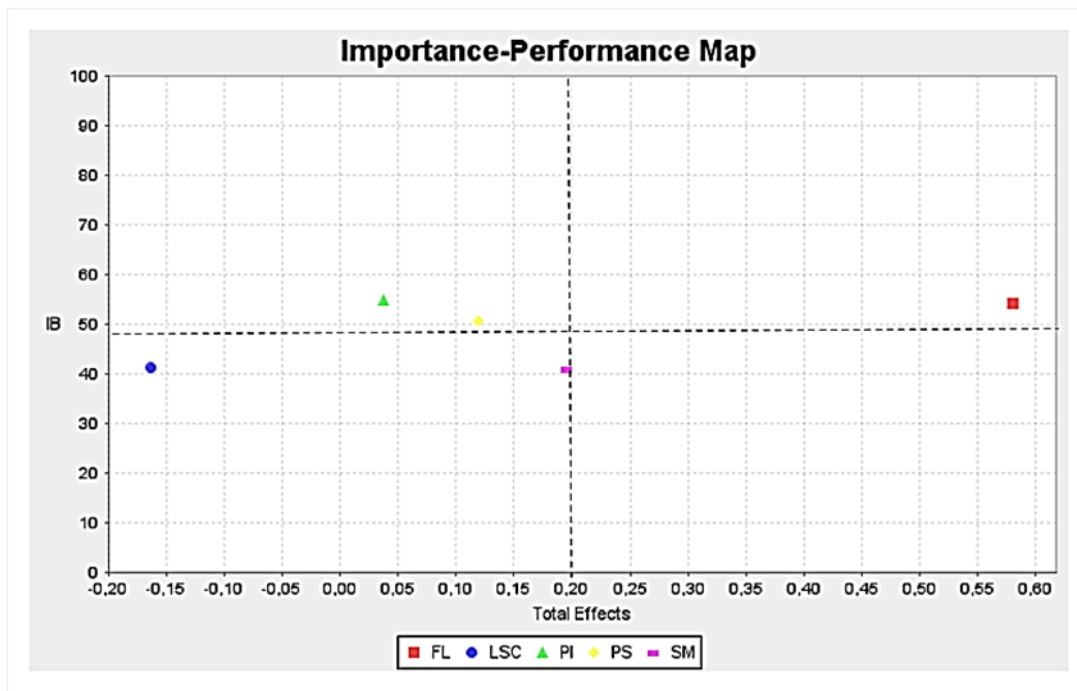
Hypothesis	Effect Coefficients	t-values	p-values	Result
FL→IB	0.447	5.269	0.001***	Supported
LSC→IB	-0.174	2.439	0.015**	Supported
PI→IB	0.040	0.399	0.690 ^{ad}	Not Supported
PS→IB	0.136	1.672	0.095*	Supported
SM→IB	0.194	2.169	0.030**	Supported

Additionally, an importance-performance map (IPMA) analysis was conducted in the study. Figure 3 illustrates the IPMA, while Table 7 presents the IPMA values of the latent variables that explain the investment variable. IPMA, a valuable analytical approach in PLS-SEM, is “also known as the importance-performance matrix, impact-performance map, or priority map analysis”. The IPMA compares the total effects, which represent the importance of the constructs in shaping a given target construct (endogenous latent variable), with the average latent variable scores, which indicate their performance. According to Ringle and Sarstedt (2016), the aim “is to identify constructs that have relatively high importance for the target construct (i.e., those with a strong total effect) but also have relatively low performance (i.e., low mean latent variable scores).”

The IPMA graphically combines these two aspects by comparing total impacts on the x-axis with latent variable performance scores scaled from 0 to 100 on the y-axis. For the interpretation of the results, the focus is on the constructs in the lower right area of the importance-performance map. These constructs have high importance for the target construct but underperform. As a result, there is a particularly high potential to improve the performance of the structures positioned in this area.

Table 7. IB's Performance-Importance Values

Variables	Total Effect (Importance)	Scores of Latent Variables (Performance%)
FL	0,58	55
LSC	-0,16	41
PI	0,04	55
PS	0,12	51
SM	0,199	41

Figure 3. Performance-Importance Map (Y axis performance, X axis importance)

When we examine the Performance and importance values in Figure 3 and Table 7, in terms of importance, FL (0.58) received the highest score, followed by SM (0.199), PS (0.12), PI (0.04) and LSC (-0.16), respectively. When we analyse the performance values; the highest score belongs to PI (55) and FL (55). PS scored (51), while PI and SM scored (41). According to this situation, it is understood that the most important variable explaining the IB (investment behaviour) of FEAS students is FL (Financial Literacy).

3. CONCLUSION

According to the results of the hypothesis tests in Table 6, it is observed that all alternative hypotheses are supported except for the PI→IB relationship. Financial literacy, lack of self-control, parental socialization, and social media significantly influence investment behaviour. With the help of Table 6; it is revealed that when the level of financial literacy among students increases by one unit, investment behaviour increases by 0.447 units, when the level of parental socialization increases by one unit, investment behaviour increases by 0.136 units, when the level of social media increases by one unit, investment behaviour increases by 0.194 units, and when the level of self-control deficiency increases by one unit among students, investment behaviour decreases by 0.174 units. It has been found that investment behaviour is most influenced by financial literacy in the study. The factor of self-control deficiency is negative in nature since it is measured with negative expressions such as "Buy now, think later" in LSC12. Therefore, it is natural for the LSC→IB coefficient to be calculated as negative. Consequently, when self-control deficiency increases by one unit among university students, investment behaviour will decrease by 0.174 units. In short, if students' uncontrolled shopping attitudes are high, investment behaviour will decrease.

According to the Performance-Importance Map, it is understood that the highest value for the investment variable is attributed to financial literacy both in terms of importance and performance. However, considering that the maximum value for performance level is 100, and the obtained value is 55, it can be seen from IPMA that there is room for further improvement in students' financial literacy levels.

Alshebami and Aldhyani (2022) determined that the influence of parents and peers positively explains financial literacy. Additionally, while financial literacy positively affects the savings habits of young people, self-control has been observed to negatively affect the relationship between financial literacy and saving behaviour. It has been found that self-control weakens the link between financial literacy and savings behaviour among Saudi youth. These findings parallel the results of the study.

Nawi et al. (2022) examined the impact of parental socialization, peer influence, financial literacy, and self-control on saving habits using multiple regression analysis. In their study, they found that, apart from financial literacy, other variables were able to explain saving habits. Therefore, it appears that similar results to our study were obtained except for the financial literacy variable.

Ali et al. (2022) investigated the relationship between financial literacy, saving behaviour, lack of self-control, family interaction and investment awareness in a study conducted among 409 students from the Faculty of Business Administration. The findings revealed that financial literacy, saving behaviour and family financial socialisation are positively related to investment awareness, while lack of self-control has a negative and significant effect on investment awareness. The findings of our study align with those of Ali et al. (2022) on financial literacy, family socialisation and lack of self-control.

Kassim et al. (2022), through regression analysis applied to students (351) from private universities in Selangor, Malaysia, revealed that financial literacy and self-control have a significant positive impact on money management behaviour, while parental socialization and peer influence do not affect money management behaviour. In our study, however, while there is a significant effect between these four variables and investment behaviour, there is only a significant negative relationship between self-control deficiency and the investment variable.

According to Alekam et al. (2018), in their study evaluating the level of financial literacy among the young generation in Malaysia (Family, Peer, Attitude, Savings, and spending behaviour), there is a significant positive relationship between behaviour and financial literacy. Furthermore, the findings indicate that Family/Parents and Peers significantly influence Financial Literacy.

Mpaata et al. (2020), from the context of developed countries, suggest that Social Influence has a positive effect on Savings Behaviour. Mpaata et al. (2023) examined the regulatory effect of self-control on the relationship between financial literacy and savings behaviour in a study conducted with 395 micro and small business owners in Kampala, Uganda. They emphasized that both financial literacy

and self-control explain savings behaviour, while also highlighting that the relationship between financial literacy and savings behaviour is governed by self-control.

In a study conducted by Zaihan (2016) on 450 students at the University Utara Malaysia (UUM), the impact of financial literacy, family socialization, peer influence, and self-control on savings was examined through multiple regression analysis. Except for peer influence, a significant relationship was found between savings and the other variables.

Jorgensen (2007) initially investigated the personal financial literacy characteristics of students using the College Student Financial Literacy Survey (CSFLS) with a sample of 450 undergraduate and graduate students. Secondly, they examined the influence of parents and peers on college students' financial literacy levels. In Jorgensen's study, it was found that financial knowledge, attitudes, and behaviour scores were low, but these scores increased significantly each year from freshman to graduate level. Additionally, it was determined that students influenced financially by their parents had higher financial knowledge, attitude, and behaviour scores. As a result, it was observed that students with higher financial knowledge had higher financial attitude scores and financial behaviour scores.

Yanto et al. (2021) collected data from 327 economics department students at universities in Indonesia through a Google survey form. At the end of this study, it was determined that students' use of social media has a positive effect on financial (literacy, attitude and behaviour).

One of the main limitations of the study is that it was conducted on students attending summer school courses at Faculty of Economics and Administrative Sciences. By increasing the sample size and diversity of faculties, various comparisons and generalizations can be made.

For future studies, other variables explaining investment behaviour could be included in the model, and additional intermediary or moderator variables could be added to strengthen the relationships in the study model.

This study is one of the few studies that explain the relationship between financial literacy, peer influence, lack of self-control, parental socialisation and social media and investment behaviour. This study, conducted on today's university students who are tomorrow's investor candidates, contributes to the existing literature and empirical findings on financial literacy, peer influence, lack of self-control, parental socialisation and social media in explaining the investment behaviour of ESOGU FEAS students and encourages investment behaviour.

The model presented in this study is an important step that can form the basis for future research and aims to increase awareness in the field of financial literacy. Limitations of the study and suggestions for future research are given below:

One of the important limitations of this study is that the data collection process covers only the students of the Faculty of Economics and Administrative Sciences (FEAS) of one university. This

situation limits the generalisability of the findings. Although PLS SEM gives successful results in small samples, the overall sample size is relatively small ($n=137$), which may reduce the statistical power. Another limitation is that the factors considered are limited and other variables that could potentially influence investment behaviour are not included in the model.

Specific suggestions for future research could be the following:

- The generalisability of the findings can be increased by testing similar models on students in different universities and various faculties.
- Including additional factors such as psychological factors, cultural factors or economic conditions in the model may provide a more comprehensive understanding of investment behaviour.
- Longitudinal studies can be conducted to examine changes in students' financial knowledge and behaviour over time.
- Moderating and mediating effects can be studied to understand the effects of financial education or economic crises on investment behaviour.

Ethics committee approval for the study was obtained from the Eskişehir Osmangazi University Ethics Committee on March 22, 2023, with meeting number 2023-04.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors affirm that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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Analysis of Climate Change Performances of G7 Group Countries: An Application Using the MEREC-based RAFSI Method

Furkan Fahri ALTINTAŞ¹

Abstract

The activities of major economies regarding climate change can influence the global climate, the global economy, and the climate change strategies of other countries. In this context, analyzing the climate change performance of G7 countries is considered important. In this research, the climate change performances of G7 countries for the year 2023 were measured using the MEREC-based RAFSI method, based on the Climate Change Performance Index (CCPI) criteria. According to the findings, the most significant climate change criteria for G7 countries within the scope of the MEREC method were identified as Greenhouse Gases Emissions and Climate Policy. According to the MEREC-based RAFSI method, the climate change performance values of the countries were ranked as follows: Germany, the UK, France, Italy, the USA, Japan, and Canada. Furthermore, it was observed that the countries with performance values above the average climate change performance value were Germany, the UK, France, and Italy. Consequently, for the improvement of global climate change and contributions to the global economy, it is assessed that G7 countries need to show development particularly in Greenhouse Gas Emissions and Climate Policy criteria, and that the USA, Japan, and Canada need to undertake activities to enhance their climate change performance. From a methodological perspective, it was concluded that the MEREC-based RAFSI method is sensitive in measuring the climate change performances of countries according to sensitivity analysis, credible and reliable according to comparative analysis, and robust and stable according to simulation analysis. Therefore, based on the results of sensitivity, comparative, and simulation analyses, it was determined that the climate change performances of countries can be measured with MEREC based RAFSI in the scope of the CCPI.

Keywords: *Climate Performance, G7, MEREC, MEREC based RAFSI.*



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1. INTRODUCTION

Climate change is a universal issue that deeply affects our planet's ecosystems, biodiversity, and human life, leading to severe consequences such as global warming and extreme weather events (Smerdon, 2018; Rebonato, 2024). In this context, the performance of countries in combating climate change impacts not only their national boundaries but also global sustainability and the quality of life for future generations (Leckie, 2018; Briggie, 2024). The effectiveness of countries' climate policies and the success of their implementations are of great importance both environmentally and economically. The comprehensive and determined execution of these efforts has become a critical necessity for the future of our planet (Pogue, 2021; Hulme, 2022).

In the context of the relationship between climate change and economic size, the strategies and activities of major economies regarding climate change can influence global climate change and the climate change policies of other countries. Therefore, analyzing the climate change performances of major economies is considered important (Wu et al., 2021). In this regard, the climate change performances of the world's largest economies, the G7 countries, were measured using the MEREC-based RAFSI method, based on the most recent and up-to-date 2023 Climate Change Performance Index (CCPI) criteria.

The first aim of the research is to calculate the weights of climate change criteria for each country using the MEREC method. The second aim is to measure the climate change performances of countries using the MEREC-based RAFSI method. Through these analyses, it was determined which CCPI criteria countries should prioritize to contribute to the improvement of climate change and the global economy, and which country or countries need to enhance their climate change performances. Thirdly, the research explains the extent to which the climate change performances of countries can be measured using the MEREC-based RAFSI method within the scope of the CCPI. In this context, the literature section of the research explains the importance of climate change for countries and the relationship between climate change and economic growth. The methodology section specifies the data set and analysis of the research, along with the MEREC and RAFSI methods. Finally, the findings are discussed in the results section, and conclusions are drawn based on the identified quantitative values.

2. LITERATURE

2.1. Climate Change and Its Importance for Countries

Climate change, in its most general definition, is characterized as a long-lasting shift in average weather conditions or climate variability (Mohanty & Mohanty, 2009). More specifically, climate change is defined as an irreversible alteration in climate due to carbon emissions (Solomon et al., 2009). From another perspective, climate change refers to a shift in the state of the climate, identifiable through statistical tests by changes in the average and/or variability of its attributes, and lasting for an extended period, usually decades or longer (Intergovernmental Panel on Climate Change [IPCC], 2007).

The adverse effects of climate change have a multifaceted nature. Environmentally, climate change contributes to air pollution, disasters, droughts, floods, sudden weather changes, global warming, an increase in forest fires, the melting of glaciers, rising sea levels, increased carbon dioxide levels, ecosystem disruption, biodiversity loss, and irregular animal migration (Corell, 2006; Matawal & Maton, 2013; Chakraborty et al., 2014; Ching-Ruey, 2020; Hamza et al., 2020; Yakovlev & Belyaev, 2023). Socially, climate change plays a role in the decline of food security quality and agricultural productivity, the spread of diseases, and the weakening of the economic structure (Patz et al., 2014; Naceur & Rahmani, 2023; Rahman et al., 2014).

With the adverse impacts of climate change, the climate change performance of countries has gained importance. By being aware of their climate change performance, countries can identify shortcomings, enhance their performance, and ensure the sustainability of their current performance through strategies, policies, and activities for both the present and future periods. Additionally, countries monitor each other's climate change performance. To address deficiencies or further develop themselves, countries can establish collaborations and partnerships with those that have a good climate change performance. Therefore, countries consistently need metrics, scales, or indices that measure their climate change performance on an international level (Bernauer & Böhmelt, 2013).

The only scale that measures the climate change performance of countries on an international level is the Climate Change Performance Index (CCPI) (Burck et al., 2006; Harmeling, 2011). The CCPI is an index created to measure the climate change performance of countries. This index provides the opportunity to compare the climate change performances of countries. The CCPI primarily consists of the following criteria: Greenhouse Gases Emissions, Renewable Energy, Energy Use, and Climate Policy (Burck et al., 2024).

2.2. Climate Change and Its Relationship with Economic Growth

A review of the literature reveals that the impact of climate change on economic growth has been evaluated as highly variable. This is because the relationship between economic size and climate change can differ depending on a country's economic structure, geographic location, average seasonal fluctuations, and climate culture (Mendelsohn, 2009). On the other hand, innovation activities and technological advancements made by countries as part of measures against climate change can contribute to their economic growth (Fankhauser & Tol, 2005). However, in the context of climate change, environmental sustainability, the increasing prominence of global warming, and the pursuit of economic growth by world economies require more stable and sustainable economies to reduce greenhouse gas emissions (Ismail, 2018; Sachs et al., 2023).

In the literature, many studies have investigated the relationship between climate change and economic growth. In this context, Dell et al. (2008) found that rising temperatures due to climate change significantly reduce economic growth only in poor countries. Roson and Mensbruggle (2010) assessed

that in the long term, rising sea levels, increasing heat, and humidity within the framework of climate change could have adverse effects on countries' tourism and agriculture sectors. Gulzar and Aziz (2013) examined the impact of climate change on economic growth for Asian countries. The researchers found that in the short and long term, increased rainfall and temperatures in Asian countries limit economic growth. Soliman et al. (2014) found that climate change does not contribute to economic growth in Arab countries. Hayaloğlu (2018) observed that, based on data for the ten countries most affected by climate change according to the Global Climate Change Risk Index from 1990-2016, climate change generally has negative impacts on economic growth and agricultural value added in these countries. Akyol (2022) determined that in newly industrialized countries, average annual temperatures and carbon dioxide emissions have a positive effect on economic growth within the context of climate change. Benhamed et al. (2023) found, using data from countries on different continents, that climate change generally does not affect economic growth. However, the authors identified that climate change has negative long-term effects on economic growth only in the hottest countries. Kızılkaya and Mike (2023) concluded in their study that climate change could have negative long-term effects on Türkiye. Petrović (2023) analyzed the relationship between climate change (temperature and carbon emissions) and economic growth using data from countries on different continents. This analysis found that climate change promotes economic growth. Stern and Stiglitz (2023) emphasized that the negative impacts of climate change on economic growth can be mitigated through innovation, artificial intelligence, advanced technologies, and green growth. Ullaha et al. (2024) concluded that, in general, climate change accelerates economic growth in Asian countries.

A review of the literature on countries' climate change performance reveals that Keleş and Ersoy (2023) examined the climate change performance of G20 countries for the years 2019-2023 using LOPCOW-based SPOTIS, WISP, and RSMVC MCDM methods. Within the framework of the G20 countries encompassing the G7 countries, the climate change performances of these countries were ranked as follows: according to the LOPCOW-based SPOTIS method, UK, Germany, Italy, France, Japan, the USA, and Canada; according to the LOPCOW-based WISP method, Germany, the UK, Italy, France, the USA, Japan, and Canada; and finally, according to the LOPCOW-based RSMVC method, UK, Germany, Italy, France, the USA, Japan, and Canada. According to Burck et al. (2024), the climate change performance for the year 2023 is ranked as Germany, the UK, France, Italy, the USA, Japan, and Canada. Additionally, the average climate change performance of these countries was measured, and it was observed that the countries with performance above the average were Germany, the UK, France, and Italy. Puška et al. (2024) assessed the climate change performance of European countries using the fuzzy MABAC method. The study identified Denmark, Estonia, and the Netherlands as the top-performing countries. Among the G7 nations, Germany ranked 5th, France 17th, and Italy 20th. Köse et al. (2024) evaluated the climate change performance of G20 countries using the MEREC-based PROMETHEE method. In their study, the performance rankings of the G7 countries within the G20

were as follows: the United Kingdom, Germany, Italy, France, Japan, Canada, and the United States. Gökğöz and Yalçın (2021) measured the climate change performance of EU countries using the CRITIC-based TOPSIS and COPRAS methods. Their findings indicated that Nordic and Baltic countries outperformed other European nations in terms of climate change performance.

One of the most significant causes of climate change is carbon emissions. Excessive carbon emissions lead to increased temperatures, resulting in seasonal fluctuations and ecological disruptions (Sachs et al., 2023). Globally, between 1970 and 2016, approximately 39% of the world's carbon emissions were attributed to the G7 countries (Graphwise, 2024). The activities, strategies, and methods of large economies regarding climate change can influence global climate change policies and the climate change plans of other countries (Wu et al., 2021). Additionally, in 2023, the climate change policies of the G7 countries have had an impact on the global reduction of carbon emissions (International Energy Agency [IEA], 2023). In this context, analyzing the climate change performance of the G7 countries can be considered important (Wu et al., 2021). The G7 countries, possessing economic power that significantly impacts global climate change, bear extensive responsibilities in combating climate change, encompassing both historical and contemporary contexts. These responsibilities are directly correlated with economic development, greenhouse gas emissions, financial contributions, and environmental sustainability objectives (Kirton & Kokotsiz, 2015). Throughout history, the G7 countries have been responsible for a significant share of global greenhouse gas emissions, particularly since the Industrial Revolution. Countries such as the United States, Canada, Germany, France, Italy, Japan, and the United Kingdom, as highly industrialized nations, have historically emitted substantial amounts of carbon dioxide (CO₂). Consequently, the responsibility of G7 countries in addressing climate change is not only linked to their current emission levels but also to the long-term impact of their accumulated greenhouse gas emissions (Jakob & Gardiner, 2022). Moreover, G7 countries have a responsibility to provide financial and technological support to developing nations in their efforts to combat and adapt to climate change. Given their advanced infrastructure and technological capacity, these countries can play a leading role in developing technological innovations and promoting low-carbon solutions in the fight against climate change (Koirala et al, 2024). Additionally, G7 nations must increase the financial commitments they have pledged to developing countries for climate financing. Under the framework of the Paris Agreement, the commitment of developed nations to provide a certain amount of climate finance annually serves as a concrete example of this responsibility (The United Nations Framework Convention on Climate Change [UNFCCC], 2021). Numerous academic studies emphasize that while wealthy nations have contributed extensively to carbon emissions since the Industrial Revolution, developing countries have made relatively lower contributions. This disparity highlights the necessity of considering historical emissions within a framework of climate justice (Roberts & Parks, 2006). In terms of greenhouse gas emissions, G7 countries are among the largest contributors to global emissions and, therefore, play a

crucial role in combating climate change. These nations bear the responsibility of reducing their global carbon footprints and achieving climate targets. Numerous scientific reports emphasize that these countries should take the lead in aligning with the Paris Agreement, which aims to limit global warming to 1.5°C (Intergovernmental Panel on Climate Change [IPCC], 2018). Furthermore, it is of great importance that G7 countries accelerate their energy transition processes by shifting toward renewable energy sources and reducing their dependence on fossil fuels. In terms of global climate policies, G7 countries possess the leadership capacity to shape climate change policies on a global scale. These nations have a responsibility to ensure environmental justice both within their own borders and at the international level when formulating climate policies (Kirton et al., 2018). In this context, it is expected that G7 countries will strengthen international cooperation in the fight against climate change and contribute positively to both their domestic policies and global negotiations. These countries can particularly take the lead in limiting greenhouse gas emissions through market-based solutions, such as carbon taxation. In conclusion, G7 countries bear a significant responsibility in the global fight against climate change. This responsibility is not limited solely to their current greenhouse gas emissions but is also directly linked to their historical emissions and the support they provide to developing countries (National Academy of Science, 2014). It is essential for G7 nations to take the lead in combating climate change, develop effective policies on a global scale, and offer financial and technological assistance to developing nations. In this context, the climate policies of G7 countries should be addressed not only from an environmental perspective but also within the framework of social and economic sustainability. As long as climate change performance does not improve, sustainability cannot be ensured in any economy-related aspect. Consequently, this situation may negatively impact the global economy, potentially leading to economic stagnation for both developed and developing countries. Accordingly, the G7 countries, as the most significant economic actors, recognize the necessity of enhancing their climate change performance to ensure sustainability (National Academy of Science, 2014).

3. MATERIAL AND METHOD

3.1. Data Set and Analysis of the Research

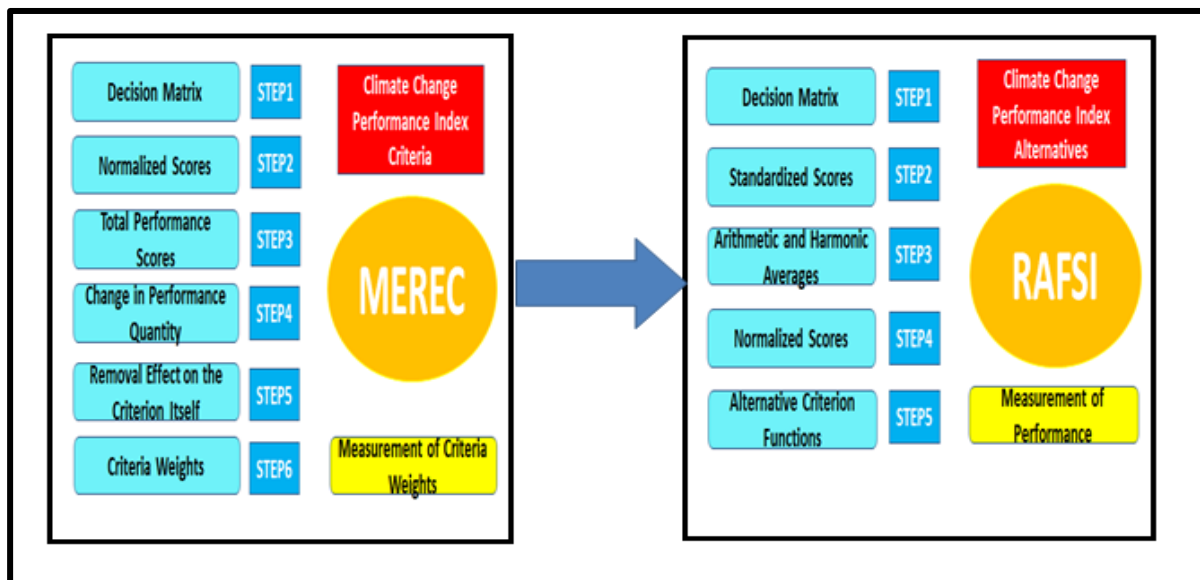
The research has compiled the CCPI criterion values for the G7 countries for the most recent year, 2023. For ease of reference, abbreviations of the CCPI criteria are shown in Table 1.

Table 1. Abbreviations of CCPI Criteria

CCPI Criteria	CCPI
Greenhouse Gases Emissions	CCPI1
Renewable Energy	CCPI2
Energy Use	CCPI3
Climate Policy	CCPI4

The primary objective of this research is to evaluate the climate change performance of G7 countries using the MEREC-based RAFSI method, employing the most recent and current CCPI (Climate Change Performance Index) criterion values. The selection of CCPI criterion data in this study is predicated on its contemporary structure and its capacity to comprehensively delineate the climate change performance of nations (Burck et al., 2024). The MEREC method, grounded in logarithmic measurement, demonstrates a superior capacity for elucidating the contribution of criteria weighting, particularly in datasets characterized by limited data points. Furthermore, from a mathematical standpoint, MEREC excels in the differentiation of criteria and the determination of their inherent characteristics. This method exhibits robust consistency in criteria weighting, ensuring a homogeneous weighting structure and mitigating the occurrence of extreme weight assignments, thereby affirming its strength and stability (Keshavarz-Ghorabae et al., 2021). Conversely, the RAFSI method, notably through the integration of ideal and anti-ideal values via arithmetic and harmonic means, manifests a framework that comprehensively considers the strength of all values within the dataset. This methodology provides a more realistic framework for performance assessment (Žižović et al., 2020). Consequently, in consideration of the distinct characteristics of these methodologies, this study employs MEREC for criteria weighting and RAFSI for the evaluation of climate change performance among alternatives, specifically nations. In this context, the research model pertaining to this is illustrated in Figure 1.

Figure 1. Research Model



3.2. MEREC Method

MEREC (A New Method Based on The Removal Effects of Criteria) is one of the current objective criterion weighting methods, which considers changes in the total criterion weight by excluding and disabling criteria from consideration (Ayçin & Arsu, 2021). Accordingly, criteria that have a greater impact on decision alternatives have higher weights (Keshavarz-Ghorabae et al., 2021).

Upon reviewing the MEREC literature, it has been observed that many researchers have utilized the MEREC method for measuring criterion weights. Consequently, some studies using the MEREC method are shown in Table 2.

Table 2. MEREC Literature

Author(s)	Method(s)	Theme
Shanmugasundar et al. (2022)	MEREC-CODAS, COPRAS, COCOSO, MABAC and VIKOR	Assessment of ideal spray-painting robot
Ulutaş et al. (2022)	MEREC-WISP S	Analysis of pallet truck selection
Banik et al. (2023)	MEREC-GRA	Analysis of pentagonal neutrosophic environment
Bektaş (2023)	MEREC-MABAC	Evaluation of financial performance of energy companies
Narang et al. (2023)	fuzzy extension of MEREC	Evaluation of parabolic measure
Popović et al. (2022)	MEREC-COBRA	Selection of e-commerce development strategy
Pucar et al. (2023)	MEREC-CRADIS	Assessment of learning management systems
Sümerli Sarıgül et al. (2023)	MEREC-MARCOS, COCOSO	Assessment of airport service quality
Risti et al. (2024)	MEREC-MARCOS	Analysis of urban of pedestrian crossings
Zhai et al. (2022)	MEREC-Pythagorean fuzzy sets	Evaluation of the agriculture supply chain risks

Regarding this matter, the application steps of the aforementioned method are explained below (Keshavarz-Ghorabae et al., 2021; Keleş, 2023).

Step 1: Formation of the Decision Matrix

$i = 1, 2, 3 \dots m, m$: number of decision alternatives

$j = 1, 2, 3, \dots n, n$: number of criteria

d_{ij} = It denotes the value corresponding to alternative i for criterion j .

d_{ij}^* = It denotes the normalized value corresponding to alternative i for criterion j .

D : Decision matrix

The decision matrix is ensured by Equation 1

$$D = [d_{ij}]_{m \times n} = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad (1)$$

Second Step: Measurement of Normalized Values of the Decision Matrix

for benefit-oriented criteria:

$$d_{ij}^* = \frac{mind_{ij}}{d_{ij}} \quad (2)$$

for cost-oriented criteria

$$d_{ij}^* = \frac{d_{ij}}{makd_{ij}} \quad (3)$$

Third Step: Measurement of the Total Performance Values of Decision Alternatives

$$S_i = \ln\left(1 + \left(\frac{1}{m} \sum_j |\ln(d_{ij})|\right)\right) \quad (4)$$

Fourth Step: Calculation of the Change in Performance Quantity of Decision Alternatives without Considering the Value of Each Decision Alternative

$$S'_{ij} = \ln\left(1 + \left(\frac{1}{m} \sum_{k, k \neq j} |\ln(d_{ik}^*)|\right)\right) \quad (5)$$

Fifth Step: Calculation of the Sum of Absolute Deviations (Calculation of the Removal Effect on the Criterion Itself)

$$E_j = \sum_i |S'_{ij} - S_i| \quad (6)$$

Sixth Step: Calculation of Criterion Weights

$$w_j = \frac{E_j}{\sum_k E_k} \quad (7)$$

3.3. RAFSI Method

RAFSI (Ranking of Alternatives through Functional Mapping of Criterion Sub-intervals into a Single Interval) method does not apply the classic normalization process but instead introduces an original standardization method that transforms data changes in any range of the decision matrix, meeting the conditions for ideal decision making (Žižović et al., 2020). The method allows for adjustment to a different criterion weight through component functions and component sub-intervals within the decision matrix, particularly achieving heterogeneous criterion weights based on arithmetic and harmonic means of the components' properties. Additionally, the method permits subjective reasoning of decision-makers in calculating ideal and anti-ideal values, distinguishing RAFSI's significant feature from other MCDM methods (Demir, 2021). Studies using the RAFSI method can be found in the literature, and relevant research is detailed in Table 3.

Table 3. RAFSI Literature

Author(s)	Method(s)	Theme
Pamucar et al. (2021)	FUCOM-RAFSI	Evaluation of ports
Alossta et al. (2021)	AHP-RAFSI	Analysis of resolving a location
Božanić et al. (2021)	D NUMBERS – FUCOM – FUZZY RAFSI	Evaluation of construction machines
Gokasar et al. (2023)	Type-2 neutrosophic numbers based RAFSI	Assessment of alternatives of introducing electric vehicles
Deveci et al. (2023)	LMAW-RAFSI	Analysis of optimal e-scooter parking locations
Deveci et al. (2022)	LAAW-RAFSI	Selection of floating photovoltaic site
Bisht & Pal (2024)	Fuzzy modified RAFSI	Analysis of five stocks under the national stock exchange
Deveci et al. (2024)	Fuzzy trigonometric based OPA and RAFSI	Evaluation of aircraft type selection
Ali et al. (2024)	CRITIC-RAFSI	Impact of financial risks on the financial sustainability

In this context, the application steps of the RAFSI method are outlined below in bullet points (Žižović et al., 2020).

First Step: Formation of the Decision Matrix and Determination of Ideal and Anti-ideal Values

$i: 1, 2, 3, \dots, m$ represents the decision alternatives, N denotes the decision matrix, and d_{ij} specifies the i – th decision alternative on the j – th component. Subsequently, by ensuring the condition $\sum_{j=1}^n w_j = 1$ and considering the utility and cost orientations of the components, the decision matrix in Equation 8 is formed.

$$N = [n_{ij}]_{m \times n} = \begin{bmatrix} n_{11} & n_{12} & \dots & n_{1n} \\ n_{21} & n_{22} & \dots & n_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ n_{m1} & n_{m2} & \dots & n_{mn} \end{bmatrix} \quad (8)$$

In the context of determining ideal and anti-ideal values, for each component $C_j (j=1, 2, \dots, n)$, two values are identified by the decision maker: a_{ij} (ideal value of criterion C_j) and a_{Nj} (anti-ideal value of criterion C_j). For benefit-oriented criteria, $a_{ij} > a_{Nj}$ and for cost-oriented criteria, $a_{ij} < a_{Nj}$ determined.

Second Step: Mapping Decision Matrix Values to Component Weights (Establishing the Standard Decision Matrix).

Firstly, Equation 9 is applied for benefit-oriented components.

$$C_j \in [a_{Nj}, a_{lj}] \quad (9)$$

Equation 10 is applied for cost-oriented components.

$$C_j \in [a_{lj}, a_{Nj}] \quad (10)$$

The transfer of all components of the decision matrix to the component range is achieved with a number sequence in interval k by transferring $k - 1$ points between the minimum and maximum values of component weights, as specified by Equation 11.

$$n_1 < n_2 \leq n_3 \leq n_4 \leq n_5 \leq n_6 \dots \leq n_{2k-1} \leq n_{2k} \quad (11)$$

The component weight is constant for all components and has fixed points. The maximum value is n_{2k} for benefit (a_{lj}) and cost (a_{Nj}) directional components. In contrast, the minimum value is n_1 for benefit (a_{Nj}) and cost (a_{lj}) directional components. It is recommended that the ideal value should be 6 times better than the anti-ideal value. Therefore, if $n_1 = 1$, then $n_{2k} = 6$ should be applicable. Additionally, it is suggested that for $n_1 = 1$, values such as $n_{2k} = 9$ can also be used. Subsequently, a function $f_s(x)$ is defined that maps the sub-interval component weight to $[n_1, n_{2k}]$. The function $f_s(x)$ is elaborated in Equation 12.

$$f_s(x) = \frac{n_{2k} - n_1}{n_{lj} - a_{Nj}} \cdot x + \frac{a_{lj} \cdot n_1 - a_{Nj} \cdot n_{2k}}{a_{lj} - a_{Nj}} \quad (12)$$

Equation 12 specifies the relationship indicating the preference quantity of n_{2k} and n_1 over the ideal to anti-ideal values. The determination of numbers (a_{lj}) and (a_{Nj}) defines the criterion weight values and the extreme points of criterion weight. Within the scope of the research, the definitions of (a_{lj}) and (a_{Nj}) are established through the extreme points of criterion weight. Thus, ensuring all values in the matrix are mapped to the $[n_1, n_{2k}]$ interval, the standardized decision matrix $S = [S_{ij}]_{m \times n}$ is obtained where $i = 1, 2, \dots, m$ and $j = 1, 2, \dots, n$. Following the functional mapping of initial decision matrix (N) values to the $[n_1, n_{2k}]$ criterion weight, S_{ij} is established for each i and j as $n_1 < S_{ij} < n_{2k}$.

$$S = [S_{ij}]_{m \times n} = \begin{bmatrix} S_{11} & S_{12} & \dots & S_{1n} \\ S_{21} & S_{22} & \dots & S_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ S_{m1} & S_{m2} & \dots & S_{mn} \end{bmatrix} \quad i=1,2,\dots,m \quad j=1,2,\dots,n \quad (13)$$

In Equation 13, the values of matrix S , denoted as S_{ij} , are determined by $S_{ij} = f_{A_i}(C_j)$. For benefit-oriented components, if there exists an a_{xj} that satisfies the condition $a_{xj} > a_{lj}$, then there exists

$f(a_{xj}) = f(a_{ij})$. Similarly, for cost-oriented components, if there exists an a_{xj} that satisfies the condition $a_{xj} < a_{ij}$, then there exists $f(a_{xj}) = f(a_{ij})$.

Third Step: Measurement of Arithmetic and Harmonic Averages

The arithmetic mean for the maximum and minimum series of n_{2k} and n_1 values is calculated using Equation 14, and the harmonic mean is calculated using Equation 15.

$$A = \frac{n_1 + n_{2k}}{2} \quad (14)$$

$$H = \frac{2 \cdot n_{2k} \cdot n_1}{n_{2k} + n_1} \quad (15)$$

Fourth Step: Formation of the Normalized Decision Matrix

The normalization process of the S matrix values utilizes Equation 16 for benefit-oriented components and Equation 17 for cost-oriented components, ensuring normalization within the $[0,1]$ range, resulting in the normalized decision matrix provided by Equation 18.

$$\hat{S}_{ij} = \frac{s_{ij}}{2A} \quad (16)$$

$$\hat{S}_{ij} = \frac{H}{2s_{ij}} \quad (17)$$

$$(\hat{S}) = [\hat{S}_{ij}]_{m \times n} = \begin{bmatrix} \hat{S}_{11} & \hat{S}_{12} & \cdots & \hat{S}_{1n} \\ \hat{S}_{21} & \hat{S}_{22} & \cdots & \hat{S}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \hat{S}_{m1} & \hat{S}_{m2} & \cdots & \hat{S}_{mn} \end{bmatrix} \quad i=1,2,\dots,m \quad j=1,2,\dots,n \quad (18)$$

Equation 18 is derived using Equation 19 for benefit-oriented components and Equation 20 for cost-oriented components.

$$0 < \frac{n_1}{2A} \leq \hat{S}_{ij} \leq \frac{H}{2n_1} < 1 \quad (19)$$

$$0 < \frac{H}{2n_{2k}} \leq \hat{S}_{ij} \leq \frac{H}{2n_1} < 1 \quad (20)$$

Fifth Step: Determination of Alternative Criterion Functions

Equations 21 are used to determine $(V(A_i))$. Subsequently, these values are ranked in descending order to arrange the performance of decision alternatives from best to worst. $V(A_j) = w_1 \cdot \hat{S}_{i1} + w_2 \cdot \hat{S}_{i2} + \dots + w_n \cdot \hat{S}_{in}$

$$\hat{S}_{i1} + w_2 \cdot \hat{S}_{i2} + \dots + w_n \cdot \hat{S}_{in} \quad (21)$$

4. FINDINGS

4.1. Computational Analysis

In the study, initially, the weights (importance degrees) of CCPI components (criteria) using the MEREC method were calculated for G7 countries. In this regard, in the first step of the MEREC method, Decision Matrix was formed with Equation 1. In the second step of the method, Equation 2 was applied to normalize the values of the Decision Matrix. Accordingly, the values of the Decision Matrix and the normalized Decision Matrix are presented in Table 4.

Table 4. Decision (D) and Normalized Matrix (d_{ij}^*)

Decision Matrix				
Text	CCPI1	CCPI2	CCPI3	CCPI4
Canada	14.59	3.4	4.04	9.52
France	27.02	4.55	12.84	12.71
Germany	28.47	7.38	14.54	15.39
Italy	23.2	7.38	13.52	6.49
Japan	21.42	5	13.15	2.5
UK	30.95	5.2	16.63	9.58
USA	16.88	3.03	6.69	16.2
Normalized Scores				
Text	CCPI1	CCPI2	CCPI3	CCPI4
Canada	1.000	0.891	1.000	0.263
France	0.540	0.666	0.315	0.197
Germany	0.512	0.411	0.278	0.162
Italy	0.629	0.411	0.299	0.385
Japan	0.681	0.606	0.307	1.000
UK	0.471	0.583	0.243	0.261
USA	0.864	1.000	0.604	0.154

In the third step of the MEREC method, Equation 4 was used to calculate the total performance values (S_j) of decision alternatives, in the fourth step followed by Equation 5 to measure changes in countries' performances (S'_{jj}) by subtracting the values of all criteria.

Table 5. S_i and S'_{ij} Scores

Countries	S_i	S'_{ij}			
		CCPI1	CCPI2	CCPI3	CCPI4
Canada	0.445	0.445	0.000	0.445	0.109
France	1.314	0.704	1.150	0.942	0.879
Germany	1.492	0.942	1.217	1.152	1.094
Italy	1.356	1.023	1.123	0.983	1.014
Japan	1.120	0.986	1.084	0.634	0.823
UK	1.424	0.919	1.292	1.008	1.017
USA	16.88	3.03	6.69	16.2	

In the fifth step of the method, Equation 6 was utilized to calculate the sum of absolute deviations (E_j) of the criteria, and in the sixth step, Equation 7 was employed to determine the weights of the criteria. The computed values are presented in Table 6 accordingly.

Table 6. E_j and w Scores

Countries	CCPI1	CCPI2	CCPI3	CCPI4
Canada	0.000	0.445	0.000	0.336
France	0.611	0.164	0.372	0.435
Germany	0.550	0.275	0.340	0.398
Italy	0.333	0.233	0.373	0.342
Japan	0.134	0.036	0.486	0.297
UK	0.505	0.133	0.416	0.408
USA	0.709	0.223	0.251	0.548
E_j	2.842	1.509	2.238	2.764
w	0.304	0.161	0.239	0.295
w Mean	0.250			
Rank	1	4	3	2

Upon reviewing Table 6, the weight values of the CCPI criteria are ranked as CCPI1, CCPI4, CCPI3, and CCPI2 across countries. Additionally, based on Table 6, noticeable differences are observed among CCPI3 and CCPI2 in terms of the higher weight values attributed to CCPI1 and CCPI4 criteria. Furthermore, the average weight value of CCPI criteria across countries has been calculated, revealing that CCPI1 and CCPI4 criteria have weights higher than the average value.

In the study, secondly, using the MEREC-based RAFSI method, countries' performances on climate change have been calculated. In this context, initially within the RAFSI method, Equation 8 was

employed to determine the ideal and anti-ideal values for the decision matrix and criteria. The decision matrix in question was previously constructed via Equation 1 within the MEREC method and presented in Table 3. Accordingly, the ideal and anti-ideal values for the criteria are indicated in Table 7.

Table 7. Ideal (a_{ij}) and Anti-ideal Scores (a_{Nj})

Criteria	Ideal Values	Anti-ideal Values	Description
CCP1	14.59	30.95	CCPE (30.95;14.59)
CCP2	3.03	7.38	CCPE (7.38;3.03)
CCP3	4.04	16.63	CCPE (16.63;4.04)
CCP4	2.5	16.2	CCPE (16.2;2.5)

In the second step of the method, Equations 9, 10, 11, 12, and 13 were utilized to construct the standard decision matrix for the criteria, and the values of the constructed standard decision matrix are detailed in Table 8.

Table 8. Standard Decision Matrix (S)

Countries	CCPI1	CCPI2	CCPI3	CCPI4
Canada	1.000	1.425	1.000	3.562
France	4.799	2.747	4.495	4.726
Germany	5.242	6.000	5.170	5.704
Italy	3.631	6.000	4.765	2.456
Japan	3.087	3.264	4.618	1.000
UK	6.000	3.494	6.000	3.584
USA	1.700	1.000	2.052	6.000

In the third step of the RAFSI method, the arithmetic mean value was determined using Equation 14, and the harmonic mean value was determined using Equation 15, with the respective arithmetic and harmonic mean values presented in Table 9.

Table 9. Means Score

Means	Measures
Arithmetic Mean	$A = \frac{1 + 6}{2} = 3.5$
Harmonic Mean	$H = \frac{2}{\frac{1}{6} + \frac{1}{1}} = 1.71$

In the fourth step, the normalized decision matrix values are calculated using Equations 16, 18, and 19. The calculated normalized values are explained in Table 10.

Table 10. Normalized Decision Matrix (\hat{S})

Countries	CCPI1	CCPI2	CCPI3	CCPI4
Canada	0.143	0.204	0.143	0.509
France	0.686	0.392	0.642	0.675
Germany	0.749	0.857	0.739	0.815
Italy	0.519	0.857	0.681	0.351
Japan	0.441	0.466	0.660	0.143
UK	0.857	0.499	0.857	0.512
USA	0.243	0.143	0.293	0.857

In the final step of the method, Equation 21 is used to calculate the criterion functions (Countries' climate change performances). In this context, countries' climate change performances are detailed in Table 11.

Table 11. Climate Change Performance Score $V(A_i)$

Countries	CCPI1	CCPI2	CCPI3	CCPI4	Sum	Rank
Canada	0.043	0.033	0.034	0.150	0.261	7
France	0.208	0.063	0.154	0.200	0.625	3
Germany	0.228	0.138	0.177	0.241	0.783	1
Italy	0.158	0.138	0.163	0.104	0.563	4
Japan	0.134	0.075	0.158	0.042	0.409	6
UK	0.260	0.081	0.205	0.151	0.697	2
USA	0.074	0.023	0.070	0.253	0.420	5
Mean					0.537	---

Upon reviewing Table 11, countries' climate change performances are ranked as Germany, the UK, France, Italy, the USA, Japan, and Canada. Furthermore, upon examining Table 11, countries' average climate change performance based on the MEREC-based RAFSI method has been calculated, identifying Germany, the UK, France, and Italy as the countries with performance above the average.

4.2. Sensibility Analysis

In this study, we conducted a sensitivity analysis to evaluate the methodological robustness of the LOPCOW-based DNMA method. Sensitivity analysis, within the framework of MCDM (Multi-Criteria Decision Making), involves applying various weighting techniques to a single dataset. This approach allows for a comparative evaluation of the resulting values and rankings of decision alternatives' performance. We anticipate a divergence in the performance rankings of the identified decision alternatives, ensuring the sensitivity of the chosen weight coefficient calculation method. This divergence is expected when comparing the performance rankings of decision alternatives obtained

through the application of alternative methods (Gigovič, et al., 2016). In this specific context, Table 12 presents the values obtained by applying various weighting methods to the CCPI criteria for different countries.

Table 12. Weight Values of Criteria According to Weighting Methods

Countries	CCPI1	CCPI2	CCPI3	CCPI4
ENTROPY	0.114	0.184	0.287	0.415
Rank	4	3	2	1
CRITIC	0.185	0.227	0.222	0.367
Rank	4	2	3	1
SD	0.249	0.268	0.242	0.240
Rank	2	1	3	4
SVP	0.436	0.036	0.244	0.284
Rank	1	4	3	2
LOPCOW	0.239	0.191	0.292	0.278
Rank	3	4	1	2

In the continuation of the sensitivity analysis, the climate change performances of the countries are ranked according to the RAFSI method based on ENTROPY, CRITIC, SD, SVP, and LOPCOW, taking into account the criterion weights calculated by the objective weighting methods shown in Table 12. The determined rankings are presented in Table 13.

Table 13. Climate Change Performance and Rankings of Countries According to the RAFSI Method Based on ENTROPY, CRITIC, SD, SVP, and LOPCOW

Countries	ENTROPY RAFSI		CRITIC RAFSI		SD RAFSI		SVP RAFSI		LOPCOW RAFSI	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Canada	0.306	7	0.291	7	0.247	7	0.249	7	0.256	7
France	0.615	3	0.606	3	0.594	4	0.662	3	0.614	3
Germany	0.793	1	0.795	1	0.791	1	0.769	1	0.785	1
Italy	0.558	4	0.570	4	0.608	3	0.523	4	0.584	4
Japan	0.385	6	0.386	6	0.429	5	0.411	6	0.427	5
UK	0.648	2	0.649	2	0.678	2	0.746	2	0.693	2
USA	0.494	5	0.457	5	0.376	6	0.426	5	0.409	6

When examining Table 12 and Table 13 together, it is observed that the rankings of countries' climate change protection performances are consistent according to the RAFSI method based on MEREC, ENTROPY, CRITIC, and SVP. In contrast, the performance rankings identified using the MEREC-based RAFSI method differ from those determined using the SD and LOPCOW-based RAFSI methods. Consequently, it is assessed that the measurement of countries' climate change performances using the MEREC-based RAFSI method is sensitive within the context of CCPI.

4.3. Comparative Analysis

The comparative analysis evaluates the relationships and positions of the proposed approach in comparison to other methodologies used for calculating MCDM methods. The proposed method should demonstrate credibility, reliability, and consistency with other methodologies, while also showing a favorable and statistically significant correlation with various weight coefficient methodologies (Keshavarz-Ghorabae et al., 2021). Consequently, the climate change performances of the countries were first measured using MEREC-based WASPAS, ARAS, TOPSIS, WPA, and GRA methods. The performance values and rankings of the countries according to these methods are presented in Table 14.

Table 14. Climate Change Performance Scores of Countries According to MEREC-Based MCDM Methods

Countries	MEREC	ARAS	MEREC WASPAS		MEREC TOPSIS	
	Score	Rank	Score	Rank	Score	Rank
Canada	0.452	7	0.356	7	0.010	7
France	0.780	3	0.663	4	0.734	3
Germany	0.931	1	0.770	2	0.846	2
Italy	0.695	4	0.699	3	0.589	4
Japan	0.543	6	0.620	5	0.499	5
UK	0.823	2	0.775	1	0.943	1
USA	0.634	5	0.419	6	0.160	6

Countries	MEREC	WPA	MEREC GRA		MEREC MARCOS	
	Score	Rank	Score	Rank	Score	Rank
Canada	0.500	7	0.238	7	0.354	7
France	0.834	4	0.425	4	0.706	4
Germany	0.944	2	0.574	2	0.835	2
Italy	0.872	3	0.478	3	0.750	3
Japan	0.794	5	0.372	5	0.654	5
UK	0.945	1	0.624	1	0.844	1
USA	0.579	6	0.258	6	0.422	6

When Table 11 and Table 14 are examined together, it is observed that the performance values of countries under the MEREC-based RAFSI method are consistent only with the MEREC-based ARAS method. The visual representations of the MEREC-based MCDM methods are presented in Figures 2, 3, and 4.

Figure 2. Position of MEREC based RAFSI

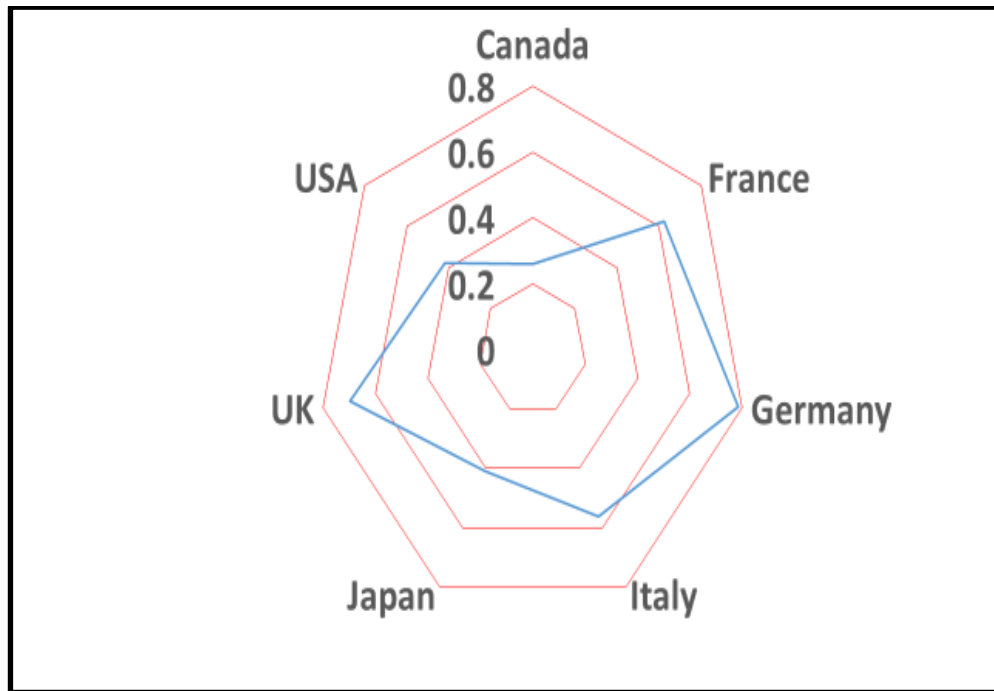


Figure 3. Position of MEREC based MCDM Positions-1

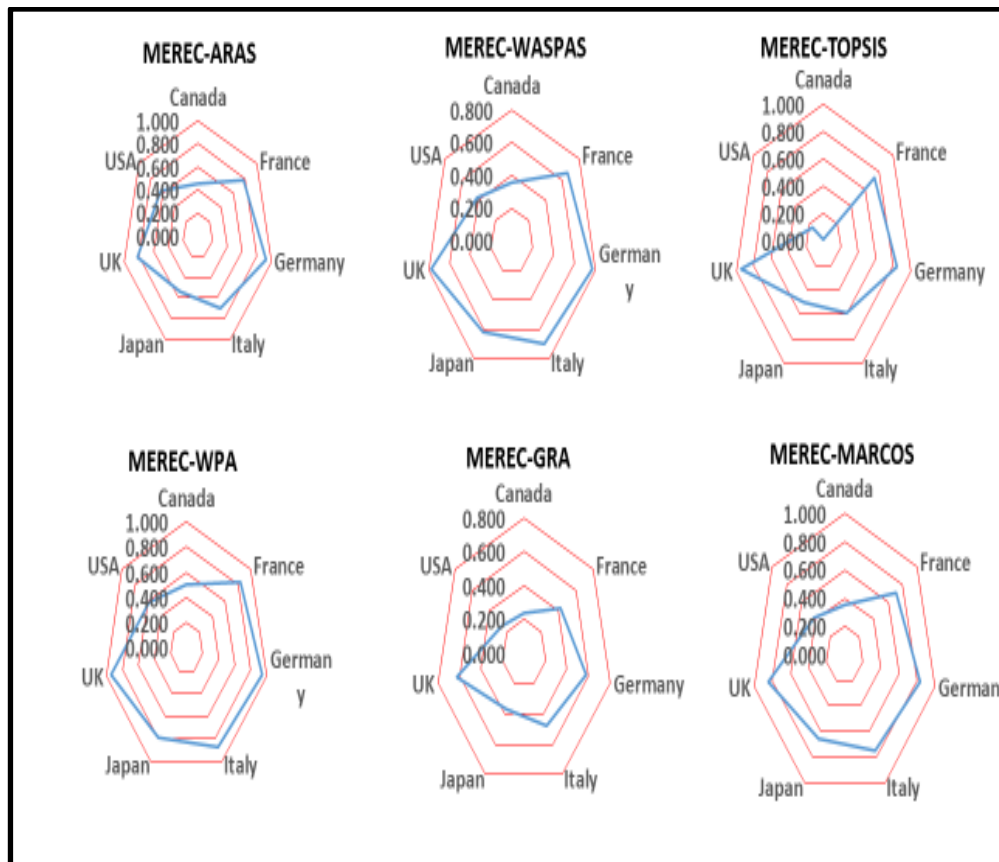
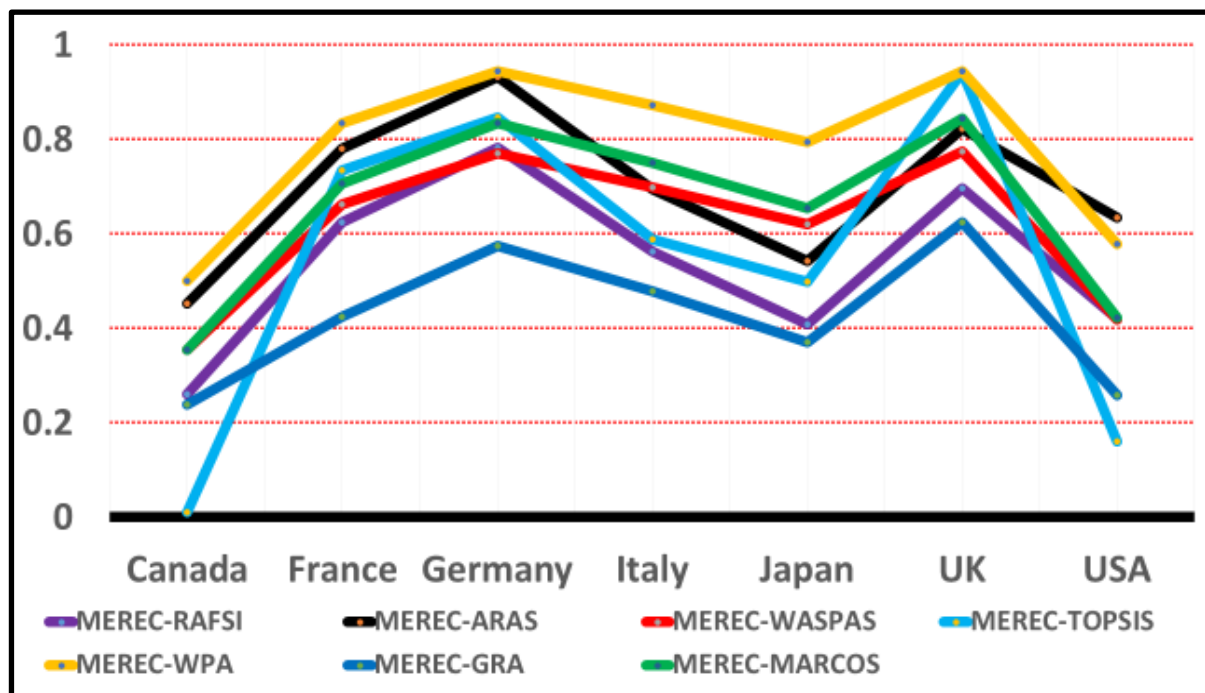


Figure 4. Position of MEREC based MCDM Positions-2



When Figures 2, 3, and 4 are evaluated together, it is observed that the fluctuations in the climate change performance values of countries calculated using the MEREC-based RAFSI method are generally consistent with the fluctuations in the performance values of countries measured by other MCDM methods. Consequently, it is concluded that there are positive, significant, and high or very high correlations between the climate change performance values of countries calculated using the MEREC-based RAFSI method and those measured by other MCDM methods.

In Walters' (2009) study, Keshavarz-Ghorabae et al. (2021) stated that a Pearson correlation ranging from 0.400 to 0.600 between the MEREC method and other methods (SD, ENTROPY, and CRITIC) indicates a moderate level of relationship between the variables. If the correlation exceeds 0.600, the relationship is considered statistically significant. Accordingly, the correlation values between the MCDM methods are shown in Table 15.

Table 15. Correlations Among the MCDM Methods

MCDM METHODS	MEREC ARAS	MEREC WASPAS	MEREC TOPSIS	MEREC WPA	MEREC GRA	MEREC MARCOS
MEREC RAFSI	0.823**	0.999**	0.977**	0.999**	0.963**	0.927**

Note: **p<.01

Upon examining Table 15, it is observed that the correlation values between the climate change performance scores of countries calculated using the MEREC-based RAFSI method and those calculated using other MEREC-based MCDM methods are all significant, positive, and high. In this

context, it is concluded that the MEREC-based RAFSI method is credible and reliable for measuring countries' climate change performance within the scope of the CCPI.

4.4. Simulation Analysis

To assess the robustness and stability of the proposed method's results, a simulation analysis will be conducted. This analysis will involve generating various scenarios by applying different values to decision matrices. A reliable method should demonstrate increasing divergence in its results compared to other methods as the number of scenarios increases. Subsequently, the average variance of criterion weights determined by the proposed method across the scenarios should be notably higher than that of at least one other objective weighting method. This would indicate the superior ability of the proposed method to differentiate between the relative importance of criteria. Finally, the analysis should establish consistency in the variance of criterion weights across all methods within each individual scenario (Keshavarz-Ghorabae et al., 2021). In this context, Table 16 presents the correlation coefficients between the MEREC-based RAFSI method and other MEREC-based MCDM methods, calculated based on the initial 10 scenarios of the simulation analysis.

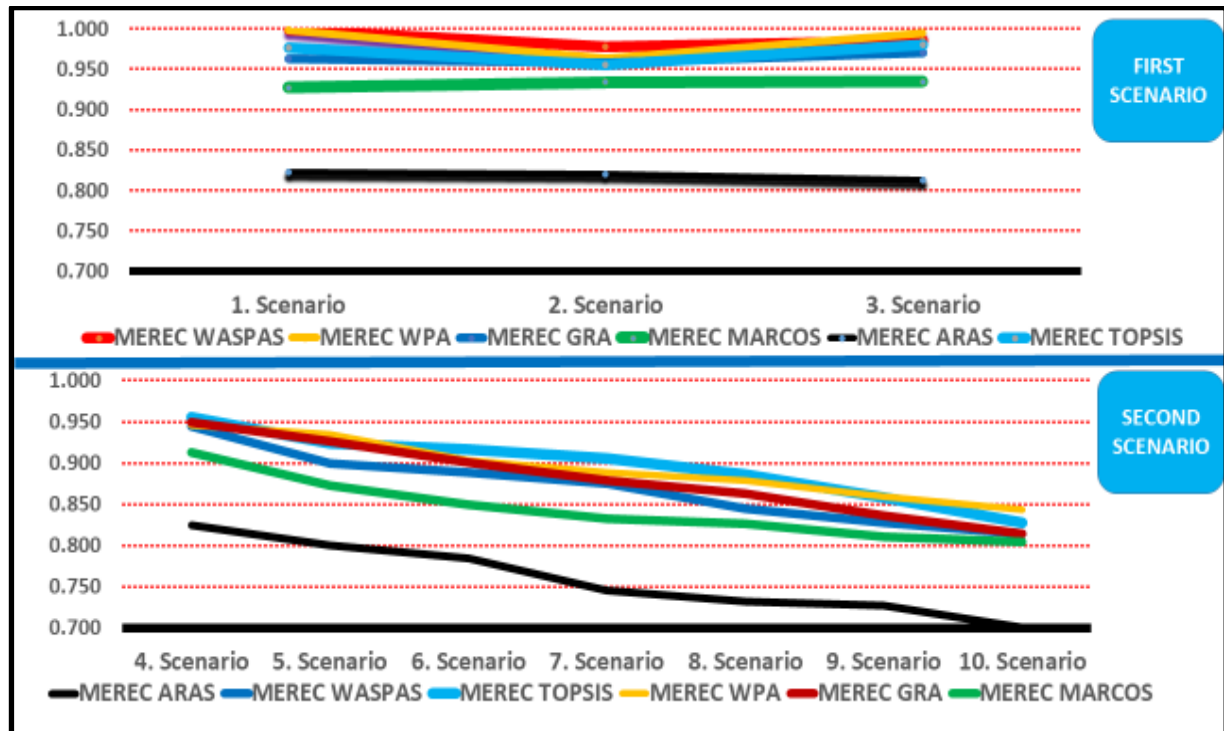
Table 16. Correlations Scores between MEREC-based RAFSI and Other MCDM Methods

MCDM METHODS	MEREC ARAS	MEREC WASPAS	MEREC TOPSIS	MEREC WPA	MEREC GRA	MEREC MARCOS
1. Scenario	0.823**	0.999**	0.977**	0.999**	0.963**	0.927**
2. Scenario	0.820**	0.978**	0.956**	0.963**	0.958**	0.934**
3. Scenario	0.813**	0.985**	0.980**	0.995**	0.971**	0.935**
MCDM METHODS	MEREC ARAS	MEREC WASPAS	MEREC TOPSIS	MEREC WPA	MEREC GRA	MEREC MARCOS
4. Scenario	0.825**	0.945**	0.955**	0.946**	0.949**	0.913**
5. Scenario	0.800**	0.900**	0.924**	0.935**	0.926**	0.873**
6. Scenario	0.784**	0.888**	0.916**	0.903**	0.901**	0.849**
7. Scenario	0.745**	0.875**	0.905**	0.888**	0.879**	0.833**
8. Scenario	0.732**	0.845**	0.886**	0.879**	0.863**	0.827**
9. Scenario	0.727**	0.828**	0.858**	0.859**	0.836**	0.811**
10. Scenario	0.700**	0.814**	0.828**	0.843**	0.814**	0.805**
Mean	0.777	0.906	0.919	0.921	0.906	0.871**

Note: **p<.01

Table 16 divides the 10 scenarios into two groups. The first group consists of the initial 3 scenarios, while the second group includes the remaining scenarios. Upon reviewing Table 16, it is observed that as the number of scenarios increases, the correlation values between the MEREC-based RAFSI method and other methods decrease. This trend is illustrated in Figure 5.

Figure 5. Correlation Positions of MEREC-based RAFSI Among the Other MEREC-based MCDM



Upon inspection of Figure 5, it becomes apparent that the MEREC-based DNMA method exhibits increasing divergence and separation from other MEREC-based MCDM methods as the number of scenarios grows. This observation suggests that the distinctive characteristics of the MEREC-based RAFSI method become more accentuated with an increase in scenarios. Absolutely, here's the revised text in English:

To further investigate the simulation results, ADM (ANOM for variances with Levene) analysis was employed to assess the consistency of variances in the criterion weights of the MEREC-based RAFSI method across different scenarios. This method offers a visual representation to evaluate the homogeneity of variances. The graphical output comprises three key elements: a central line representing the overall mean ADM, flanked by upper decision limits (UDL) and lower decision limits (LDL). If a group's (cluster's) standard deviation falls outside these decision limits, it signifies a statistically significant deviation from the overall mean ADM, implying heterogeneity in variances. Conversely, when the standard deviations of all groups remain within the UDL and LDL boundaries, it confirms the homogeneity of variances (Keshavarz-Ghorabae et al., 2021). Within the framework of this analysis, the variance values for the performance scores of countries, as assessed by the MEREC-

based RAFSI method, were calculated for each scenario. These variance values for the various methods within each scenario are subsequently presented in Table 17 (next page).

In analyzing Table 17, the MEREC-RAFSI method displays a higher average variance across the scenarios compared to the MEREC-ARAS, MEREC-WASPAS, MEREC-WPA and MEREC-GRA methods. This finding suggests that the MEREC-RAFSI method exhibits greater discriminatory power in differentiating between criteria. Additionally, the ADM analysis for the MEREC-RAFSI method within the scenarios is presented visually in Figure 6.

Table 17. Variance Values of MCDM Methods in scope of Scenarios

Scenarios	MEREC RAFSI	MEREC ARAS	MEREC WASPAS	MEREC TOPSIS	MEREC WPA	MEREC GRA	MEREC MARCOS
1. Sce.	0.028482	0.023251	0.024832	0.106795	0.028759	0.021784	0.035794
2. Sce.	0.031321	0.020187	0.020965	0.102831	0.025026	0.018051	0.032061
3. Sce.	0.027098	0.024893	0.025379	0.105874	0.029073	0.022447	0.035937
4. Sce.	0.030744	0.021562	0.022146	0.104147	0.02634	0.019118	0.033304
5. Sce.	0.024917	0.019976	0.019713	0.101982	0.024617	0.017685	0.031571
6. Sce.	0.033186	0.025128	0.024285	0.107055	0.028882	0.022112	0.036074
7. Sce.	0.026563	0.022245	0.023052	0.103418	0.027509	0.019789	0.034341
8. Sce.	0.029899	0.020719	0.021529	0.105542	0.025776	0.018456	0.032618
9. Sce.	0.032635	0.024572	0.025046	0.106329	0.029191	0.022581	0.035525
10. Sce.	0.025372	0.021091	0.022783	0.102266	0.026442	0.019423	0.033092
Mean	0.029022	0.0223624	0.022973	0.1046239	0.0271615	0.0201446	0.0340317

Figure 6. ADM Visual

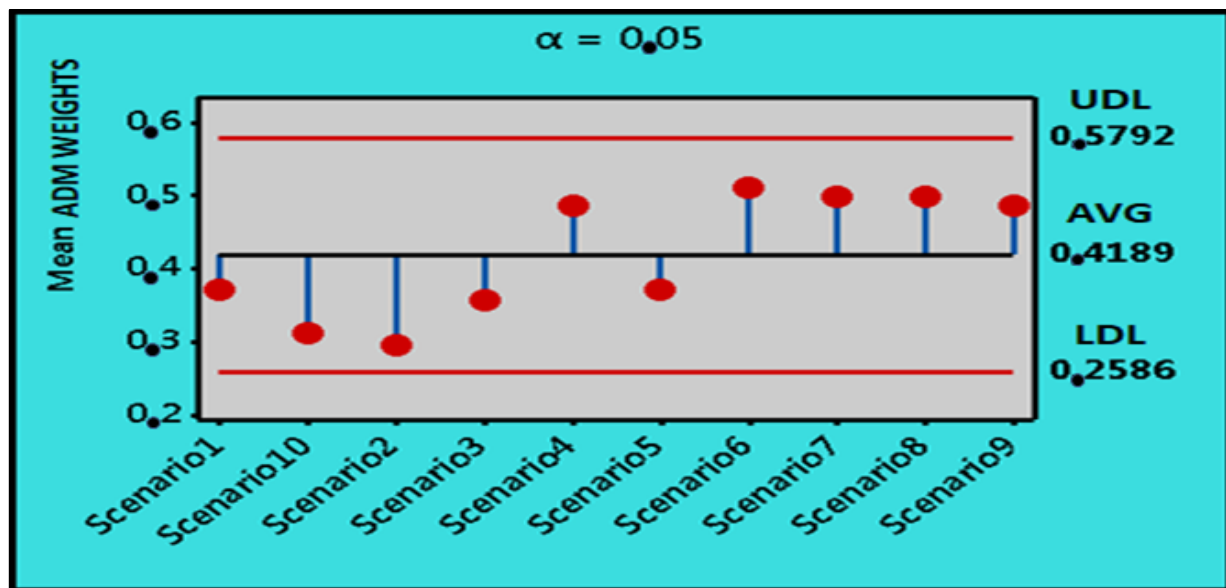


Figure 6 depicts a homogenous range for the calculated ADM values across all scenarios. Notably, all values fall within the pre-defined Upper Decision Limit (UDL) and Lower Decision Limit (LDL). This observation suggests consistent weight variances across the scenarios. Levene's Test, whose key statistics are presented in Table 18, further corroborates this finding.

Table 18. Variance Values of MCDM Methods in scope of Scenarios

Levene Statistic	df1	df2	Sig.
0.256	2	10	0.178

Note: * $p < .05$

Upon examining Table 18, it is observed that the Levene Statistic value is 0.256, and the significance value is greater than 0.05, indicating that the variances are homogeneous. Consequently, when the simulation analysis results are collectively considered, it is concluded that the MEREC-based RAFSI method is robust and stable for measuring countries' climate change performance within the scope of the CCPI.

5. CONCLUSION

Climate change presents new opportunities for major economies. Investing in areas such as renewable energy, energy efficiency, and sustainable infrastructure promotes economic development, creates new job opportunities, and enhances competitiveness. At the same time, investing in the necessary infrastructure and technologies to adapt to the effects of climate change also strengthens long-term economic resilience. Therefore, it can be considered important to analyze the climate change performance of major economies. In this context, the study measures the climate change performance of the G7 countries, which have the largest economies in the world, using the most recent and updated CCPI criteria values for the year 2023. This measurement is conducted through the MEREC-based RAFSI method.

The research first calculated the weights of CCPI criteria for countries using the MEREC method, ranking these criteria weights as CCPI1 (Greenhouse Gases Emissions), CCPI4 (Climate Policy), CCPI3 (Energy Use), and CCPI2 (Renewable Energy). It was observed that CCPI1 and CCPI4 criteria significantly differed from other criteria in terms of having higher weight values, surpassing the average weight values significantly.

In the study, secondly, countries' climate change performances were measured using the MEREC-based RAFSI method, and the measured values were ranked. According to the findings, countries' climate change performance scores were ranked as Germany, the UK, France, Italy, the USA, Japan, and Canada. Additionally, the average climate change performance of countries was calculated using the MEREC-based RAFSI method, and it was found that Germany, the UK, France, and Italy exceeded the average performance value.

In the study, thirdly, sensitivity, comparative, and simulation analyses were conducted within the framework of the management scope to assess countries' climate change performances based on the CCPI criteria using the MEREC-based RAFSI method. Regarding sensitivity analysis, it was observed that the rankings of countries' climate change performance determined by the MEREC-based RAFSI method differed from those determined by the SD and LOPCOW-based RAFSI methods, indicating that the MEREC-based RAFSI method is sensitive in measuring countries' climate change performances within the CCPI context. In terms of comparative analysis, it was found that the rankings of countries' climate change performances identified by the MEREC-based RAFSI method were different from those identified by the MEREC-based WASPAS, TOPSIS, WPA, GRA, and MARCOS methods. However, it was concluded that the climate change performance values of countries measured by the MEREC-based RAFSI method are significantly, positively, and highly correlated with those measured by all MEREC-based MCDM methods. Therefore, within the CCPI context, the MEREC-based RAFSI method was determined to be credible and reliable in measuring countries' climate change performances. In the Simulation Analysis, firstly, 10 scenarios (10 different decision matrices) were created, and it was observed that as the scenarios increased, the correlation coefficient between the climate change performance values of countries measured by the MEREC-based RAFSI method and those calculated by other MEREC-based MCDM methods decreased. Secondly, in the simulation analysis, under 10 scenarios, the average variance values of the MEREC-based RAFSI method were compared with those of other MEREC-based MCDM methods, and it was found that the average variance value calculated by the MEREC-based RAFSI method was higher than those of the MEREC-based ARAS, WASPAS, WPA, and GRA methods. Therefore, this result indicates that the MEREC-based RAFSI method distinguishes CCPI criteria more effectively compared to the MEREC-based ARAS, WASPAS, WPA, and GRA methods. Lastly, ADM analysis was conducted in the simulation analysis, leading to the conclusion that the variances were homogeneous. Therefore, based on the results of the simulation analysis, within the CCPI context, the MEREC-based RAFSI method was evaluated to be stable and robust in measuring countries' climate change performances.

Upon reviewing the literature, it is observed that studies measuring countries' climate change performances using various MCDM or other mathematical methods belong to Keleş and Ersoy (2023) and Burcks et al., (2024). In Keleş and Ersoy (2023), it was found that in the measurement of G7 countries' climate change performances using LOPCOW-based SPOTIS, WISP, and RSMVC methods, the top four positions were occupied by the UK, Germany, the UK, Italy, and France, while Japan, Canada, and the USA occupied the last three positions. In the current study, it was determined that in the ranking of G7 countries' climate change performances, the UK, Germany, the UK, Italy, and France occupied the top four positions, with Japan, Canada, and the USA occupying the last three positions. However, when comparing both studies, none of the climate change rankings identified in the current study showed consistency with the three different MCDM methods used in Keleş and Ersoy (2023). On

the other hand, in the study by Burcks et al. (2024), the rankings of G7 countries' climate change performances were consistent with the rankings identified in the current study. Furthermore, according to the current study and Burcks et al. (2024), it was found that the G7 countries with climate change performance values above the average were Germany, the UK, France, and Italy. Consequently, considering the findings of the current study along with Keleş and Ersoy (2023) and Burcks et al. (2024), it is evaluated that Germany, the UK, France, and Italy demonstrate higher climate protection performance compared to the USA, Japan, and Canada. In both the present study and the research conducted by Köse et al. (2024), Germany, the UK, France, and Italy have demonstrated superior performance compared to the USA, Canada, and Japan. Notably, when comparing the findings of the present study with those of Puška et al. (2024), it has been observed that the performance rankings of Germany, France, and Italy are consistent with each other. Additionally, the study by Gökgöz and Yalçın (2021) indicates that non-G7 Northern European countries have exhibited better climate protection performance than the G7 countries analyzed in the present research.

In terms of recommendations, firstly, it is evaluated that G7 countries should implement policies, strategies, methods, management, and activities to enhance Greenhouse Gases Emissions and Climate Policy areas, which have values above the average, to improve global climate change and contribute to the global economy. Additionally, it is considered that G7 countries, including the USA, Japan, and Canada, which have climate change performances below the average, should demonstrate developments to enhance their climate change performances for improving global climate change and contributing to the global economy. Furthermore, in future studies, not only G7 countries but also countries belonging to other international economic organizations (such as BRICS, OECD, ASEAN, APEC, etc.) or those contributing the most to environmental carbon emissions could be examined for their climate change performances. In our study, expanding the applicability of the model not only within the current context but also to other international organizations, such as BRICS and ASEAN, represents a significant research direction. Given the varying socio-economic, environmental, and cultural characteristics of such organizations, further studies are needed to explore how the model can be adapted at the international level and how it may yield different results across diverse geographical regions. In this regard, future research may include case studies and comparative analyses to assess the model's performance within these organizations. Additionally, when considering the potential limitations of using the MEREC-RAFSI method in climate performance analysis, it is conceivable that these limitations could negatively impact the model's accuracy and scope. However, several improvements can be suggested to overcome these limitations. For instance, enhancing the model to account for environmental factors in more detail, diversifying the datasets, and increasing the model's flexibility could be significant steps in addressing these limitations. Moreover, incorporating more data and an expanded model structure, particularly for complex issues such as climate performance, could improve the model's accuracy and provide more reliable results for future research. Countries can

implement various measures to enhance their climate change performance and, consequently, contribute to global efforts in mitigating climate change. In this context, Canada can focus on improving CCPI1, CCPI2, and CCPI3 components, while Japan, the USA, France, the UK, and Germany should enhance their CCPI2 component. Lastly, Italy needs to focus on advancing its CCPI4 component. Regarding CCPI2, the relevant countries should adopt policies aimed at fostering the development of technology, infrastructure, investments, integration, and regulatory frameworks for renewable energy. These efforts would enhance the efficiency and sustainability of renewable energy utilization. For CCPI1, Canada must prioritize reducing greenhouse gas emissions by fundamentally transforming its energy consumption habits and production models. This involves reducing reliance on fossil fuels and transitioning toward cleaner energy sources, such as solar, wind, and hydroelectric power. Increasing investments in renewable energy and improving energy efficiency are crucial steps in this regard. In the transportation sector, expanding the use of electric vehicles and enhancing public transportation systems are key strategies. In the industrial sector, adopting cleaner production technologies and implementing effective waste management practices are essential. Similarly, the agricultural sector should embrace sustainable practices to preserve soil and water resources. Moreover, protecting forests and promoting reforestation efforts play a critical role in reducing atmospheric carbon dioxide levels. For these transitions to be effective, governments must introduce strong policies, enact necessary regulations, and raise public awareness. In essence, reducing greenhouse gas emissions requires a comprehensive transformation involving all sectors and individuals. Additionally, Canada should focus on optimizing energy use by prioritizing energy efficiency in both industrial and daily life applications. This can be achieved through investments in energy-saving technologies. Reducing dependence on fossil fuels and shifting toward environmentally friendly energy sources are also crucial. Expanding the use of renewable energy sources such as solar, wind, and hydroelectric power not only diversifies the energy supply but also minimizes environmental impacts. Furthermore, adopting smart grids and energy storage systems can optimize energy management and contribute to a more sustainable energy future. Lastly, increasing societal awareness of energy efficiency and renewable energy use can help individuals and institutions modify their energy consumption habits. Regarding climate policy, Italy must undergo a profound transformation in its energy sector to improve its climate policy framework. This transformation should involve increasing investments in renewable energy sources, such as solar and wind power, to reduce dependence on fossil fuels. Enhancing energy efficiency in buildings and industrial processes will lower overall energy consumption and significantly reduce greenhouse gas emissions. In the transportation sector, expanding the use of electric vehicles and improving public transportation systems will facilitate the transition to a more sustainable transportation model. To preserve its natural landscapes and strengthen carbon sinks, Italy must also prioritize forest conservation and afforestation initiatives. Lastly, Italy should actively participate in global climate change mitigation efforts and engage in international cooperation, which is essential for the success of an effective climate policy. Methodologically, countries' climate change performances can be measured using various

MCDM methods (such as EDAS, CODAS, DNMA, OPA, SECA, WISP, CRADIS, PSI, OWA Operator, TODIM, MULTIMOORA, MOOSRA, ROV, MAUT, MAIRCA, COCOSO, EDAS, COPRAS, etc.), and the rankings of countries' climate change performance values identified within these methods can be compared.

Ethics Committee approval was not required for this study.

The author declares that the study was conducted in accordance with research and publication ethics.

The author confirms that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The author declares that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article.

The author affirms that the entire research process was performed by the sole declared author of the article.

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Financial and Operational Performance Analysis Using LOPCOW Based MARCOS Method: A Case Study of the Asian Airline Market

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Abstract

The purpose of the study is to view how companies operating in the Asian airline market responded to the crisis caused by the COVID-19 pandemic. Additionally, it aims to compare the financial and operational performance of airlines in the Asian airline market before, during, and after the COVID-19 pandemic. In this context, the financial and operational performance of 18 airlines in the Asian airline market for the period 2019-2022 was analysed using the Lopcow-based Marcos method. Firstly, financial and operational variables related to airlines were weighted using the Lopcow method. As a result of the weighting conducted with the Lopcow method, it was determined that the Dept Ratio and ROA variables had the most weight on the performance of these airlines. Subsequently, the performance ranking of airlines was conducted using the Marcos method. According to the ranking results obtained by the Marcos method; Spring Airlines (2019), Qantas Airways (2020), Air Arabia (2021) and Singapore Airlines (2022) were found to have the best performance. This study will make a significant contribution to the performance management of airlines in the Asian airline market. It will provide airline managers with insights and guidance on how to enhance the performance of their airlines during periods of crisis, such as the COVID-19 pandemic.

Keywords: *Financial Performance, Operational Performance, Lopcow Method, Marcos Method, Airlines.*



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1. INTRODUCTION

The aviation industry, which had positive sentiments towards the industry and its future, suddenly transformed into a structure characterized by negative sentiments because of the crisis triggered by the COVID-19 pandemic. Until the end of 2019, forecasts for the aviation industry's future were quite optimistic. For instance, Airbus and Boeing projected an average growth of 4.3% and 4.6%, respectively, for the period 2019-2038, along with an expected increase of around 39,000 to 44,000 in new aircraft orders (Airbus, 2019; Boeing, 2019). However, these optimistic forecasts vanished with the spread of the COVID-19 pandemic worldwide in the early months of 2020. The implementation of quarantines and lockdown measures along with restrictions on movement negatively affected the aviation industry. In subsequent periods, as lockdown measures and quarantines were gradually lifted, the aviation industry started showing signs of recovery. However, the figures indicate that the aviation industry has not yet reached the levels of 2019. Globally, the total number of passengers decreased by 60% in 2020 compared to 2019, by 49% in 2021, and by 29% in 2022. Similarly, the total amount of losses in the aviation industry was \$372 million in 2020, \$324 million in 2021, and \$175 million in 2022 (The International Civil Aviation Organization [ICAO], 2023).

The sudden decline in passenger demand during the COVID-19 pandemic resulted in a substantial decline in airlines' total revenues. This situation weakened the financial structure of airlines. Airlines seeking to strengthen their financial structure have pursued various strategies such as reducing costs, maintaining cash flow, and increasing security measures. To reduce costs, airlines have grounded aircraft, phased out old and inefficient aircraft from their fleets, implemented pay cuts for employees, or laid off staff. To maintain cash flow, airlines have repositioned their aircraft from business-focused routes to leisure-focused routes, converted passenger aircraft into cargo aircraft to meet increased cargo demand, sought subsidies from governments, and lowered ticket prices to stimulate demand. In order to increase safety measures, airlines have made mask usage mandatory on aircraft, left middle seats empty to increase social distancing, improved aircraft cleaning processes with cabin ventilation systems, ensured the use of protective equipment for cabin crew, and developed passenger screening measures such as COVID-19 tests during boarding processes (Albers & Rundshagen, 2020; Adrienne et al., 2020; Bombelli, 2020; Dube et al., 2021; Milne et al., 2021; Gualini et al., 2023).

The Asian aviation market, one of the largest in the world, was severely affected by the COVID-19 pandemic. Many airlines had to reduce the number of flights as a result of the pandemic, but still had to make debt payments on purchases, aircraft maintenance and leasing fees. This situation increased the risk of bankruptcy risk for some airlines (Thai Airways, Cathay Dragon, Philippine Airlines) (Abdullah et al., 2020). Furthermore, the international travel restrictions imposed during the pandemic period prompted traditional airlines with international flight networks to return to domestic routes. The concentration of traditional and low-cost carrier (LCC) airlines on domestic routes led to an intensification of competition. However, Asian airlines were not equally affected by the negative effects

of the COVID-19 pandemic. Some airlines have distinguished themselves from their competitors by demonstrating superior performance. For instance, major, traditional airlines such as Air China, China Eastern Airlines, and China Southern Airlines incurred losses amounting to \$6.3 billion in 2021, whereas Spring Airlines, the largest LCC Airlines in China, generated a profit of \$6.2 million (Wu et al., 2025). The principal aim of this study is to examine the financial and operational performance of traditional and low-cost carrier (LCC) airlines in the Asian airline market, with a particular focus on the period preceding, during and following the pandemic.

This study is regarded as a significant contribution to the expanding body of literature examining the impact of the COVID-19 pandemic on the aviation industry. The study's key contributions to this as follows:

1. This study provides information on the financial and operational performance of traditional and LCC airlines in Asia before, during and after the COVID-19 pandemic.
2. This study compares the financial and operational performance of airlines using different business models in the Asian air transport market.
3. In accordance with the model proposed in this study, performance criteria of significance to the airlines in question have been identified.
4. This study provides an opportunity to evaluate whether these airlines are affected by the COVID-19 outbreak depending on the performance criteria included in the analysis.

The main reasons for using the LOPCOW method in this study can be explained as follows; (a) it allows the objective data to be evaluated together, (b) it can be used by decision makers without the need for any software program, (c) it makes objective weighting by taking into account the negative values in the data set, (d) it is an objective weighting method based on a simple mathematical basis (Ecer & Pamucar, 2020). The main reasons for using the MARCOS method are (a) it allows ranking in terms of ideal and non-ideal solutions, (b) although it is a relatively new method, it is a flexible, effective and practical method, (c) it is simple and applicable for decision makers to make objective and consistent decisions (Stević & Brković, 2020).

In the subsequent sections of the study, detailed information about the studies in the literature is provided in section 2. The data included in the analysis and the methods used are explained in section 3. The findings obtained from the analysis are discussed in section 4. In conclusion, the research findings are assessed in the final section.

2. LITERATURE

The Marcos method, introduced by Stević et al. in 2020, is a flexible and effective technique designed to tackle multi-criteria decision-making (MCDM) challenges. Since then, numerous studies employing the Marcos method have been added to the literature. For instance, Pamucar et al. (2021) utilized the SWARA and Grey MARCOS methods to assess the service quality of airports in Spain. As

a result of the research, it was determined that Wi-Fi connection and car park access at airports are critical factors in evaluating service quality. Özdağoğlu et al. (2021) analysed the operational performance of the world's busiest airports in 2019 using the PIPRECIA-E, SMART, and MARCOS methods. The study revealed that Beijing Airport exhibited the most optimal performance, whereas Amsterdam Airport demonstrated the least favourable performance. Miškić et al. (2021) applied the SWARA-based MARCOS method to evaluate criteria in inventory management within the logistics sector and to effectively classify products. The research findings indicated that the model could be effectively employed in inventory management and product classification. Additionally, Altıntaş (2022) used the MABAC and MARCOS methods to study the innovation performance of countries that contribute most to energy innovation globally. The findings of the research indicated that Finland exhibited the most optimal performance, whereas Estonia demonstrated the least favourable performance. Gönüllü (2022) measured the financial performance of 20 companies in the Borsa Istanbul Metal Main Index during the pandemic period using the ENTROPY and MARCOS methods. The study revealed that the majority of companies included in the research exhibited a decline in financial performance during the period of the pandemic. Ghouschi et al. (2023) employed both the SWARA and MARCOS methodologies to identify critical factors in road safety, prioritise accident risk factors and improve the decision-making process. The findings of the research indicated that the human factor is a more significant contributor to accident risk than other factors. Uzgör (2024) analysed the environmental performance of the five largest airports in Turkey using the SWARA, COCOSO, MARCOS, TOPSIS, VIKOR and BORDO methods. As a result of the research, it is seen that Istanbul airport has the best performance in terms of environmental performance, while Izmir Adnan Menderes Airport has the worst performance.

There are numerous studies that use MCDM techniques to analyse airlines from a financial and operational perspective. These studies are aimed at solving complex decision problems in the air transport sector, increasing companies' efficiency, controlling costs and improving service quality. For example, Avcı and Çınaroğlu (2018) employed TOPSIS and AHP methods to examine the financial performance of five European-based airlines for the period 2012-2016. The study found that Ryanair had the best financial performance, while Lufthansa had the worst. Pineda et al. (2018) proposed a hybrid model consisting of DRSA, DEMATEL, DANP and VIKOR approaches for determining the key criteria that significantly enhance airline performance. The research demonstrated that the proposed model is applicable for comparing the operational and financial performance of different airlines. Kiracı and Bakır (2019) used the CRITIC-based EDAS method to analyse the operational performance of 13 airlines over the specified period 2005-2012, using criteria specific to the air transport sector. The study found that there were no significant changes in the airlines' performance rankings over the period. Kiracı (2019) scrutinized the financial performance of Star Alliance member airlines before and after joining the alliance. The investigation utilized trend analysis and CRITIC-based TOPSIS techniques. The

findings indicated that participating in global alliances impacts airlines' financial performance. Kiracı and Bakır (2020) evaluated the financial performance of Star Alliance member airlines for the period 2015-2017 using CRITIC and CODAS methods. The results indicated that financial criteria had a greater impact on performance than operational criteria, and that there were differences in how airlines were affected by the global crisis. Bakır et al. (2020) assessed the operational performance of 11 airlines in developing nations employing the PIPRECIA and MAIRCA methodologies. The study found that operating costs were the most important performance criterion. Sumerli Sarıgül et al. (2023) examined the financial performance of six airlines based in Europe for the period 2019-2021 using CRITIC, MAUT and MARCOS methods. The study found differences in the airlines' financial performance rankings. Tanrıverdi et al. (2023) analysed the financial, operational, and environmental performance of 56 airlines for the period 2017-2021 using MEREC-based CoCoSo and Borda methods. The results showed that low-cost carriers (LCCs) and traditional airlines, which operate more extensively in national networks, had better performance.

There is a multitude of studies in the literature investigating how the COVID-19 pandemic has affected the financial performance of firms. These studies typically focus on country economic indicators, sectoral analysis and the financial status of firms. For example, Bağcı et al. (2020) analysed the effect of the reported number of COVID-19 cases worldwide on the stock prices of global airlines using the quantile-quantile regression method. The results of the analysis indicated that airline stock prices were adversely impacted by the COVID-19 pandemic. Chen and Yeh (2021) analysed the effect of the COVID-19 pandemic on the stock markets across different countries, contrasting it with the global financial and economic crisis of 2008-2009. The results of the study indicated that the adverse effects of the COVID-19 pandemic on countries' stock markets was more severe than during the global economic crisis. Czerny et al. (2021) evaluated the recovery model affected by the Chinese government's aviation policy decisions during the COVID-19 pandemic. The study found that China's domestic aviation sector recovered more quickly than the domestic aviation sectors of other countries. Kiracı and Asker (2021) analysed the effect of the COVID-19 pandemic on airline performance using MCDM methods. In this context, they evaluated the operational performance of six airlines from the first quarter of 2018 to the third quarter of 2020, employing CRITIC-based EDAS and trend analysis methodologies. The results of the study showed that the COVID-19 pandemic had a negative impact on the performance of the airlines. Pereira and Mello (2021) measured the operational performance of Brazilian airlines throughout the COVID-19 pandemic using Data Envelopment Analysis. The analysis showed that demand and efficiency in the air transport industry decreased due to flight restrictions during the pandemic. Hu and Zhang (2021) examined the financial performance of international firms during the COVID-19 pandemic. The study concluded that the pandemic exerted a significant negative impact on firms' financial performance and that firms with more developed financial systems were less affected by the pandemic. Tanrıverdi and Eryaşar (2022) analysed the performance of 35 airlines that are part of the

Star Alliance, SkyTeam, and Oneworld alliances, before and during the COVID-19 pandemic using CRITIC and CoCoSo methods. The findings indicated that operating profit and load factor emerged as crucial success indicators for global airline alliances during the period in question. Asker (2023) examined the financial performance of LCC airlines for the period 2019Q4-2021Q4 during the COVID-19 pandemic using CRITIC and ARAS methods. The study found variations in the financial performance of LCC airlines. Gualini et al. (2023) examined the strategies implemented by airlines within the US air transport market amidst the COVID-19 pandemic. The study concluded that LCC airlines were less affected by the pandemic due to their stronger position in domestic markets. Kaffash and Khezrimotlagh (2023) measured the effect of the COVID-19 pandemic on the performance of US airlines using Network Data Envelopment Analysis. The study found that LCC airlines were more efficient than traditional airlines.

A review of the literature on the impact of the COVID-19 pandemic on the air transport sector reveals that early studies focused on the effects of the pandemic on airlines, particularly on the decline in demand and revenue (Sanchez et al., 2020; Lacus et al., 2020). Subsequent studies have examined the strategies employed by airlines during the pandemic period (Czerny et al., 2021; Bauer et al., 2020). A number of studies have examined the influence of the pandemic on the business models of airlines (Perez et al., 2022; Kaffash and Khezrimotlagh, 2023). However, it has been observed that these studies cover airlines in the USA and focus exclusively on performance measurement before and during the pandemic. There is no study in the literature that examines the performance of airlines operating in Asia before and after the COVID-19 pandemic. In this respect, this study, which examines the performance of airlines in Asia before and after the pandemic, is thought to fill this gap in the literature.

3. DATA AND METHODOLOGY

This study employs the Lopcow and Marcos methods to analyse the financial and operational performance of 18 airlines operating in the airline transport market in Asia for the period 2019-2022. The analysis focuses on 10 criteria. The reason for choosing this time period is that the COVID-19 pandemic emerged in the last months of 2019, spread to a large part of the world in 2020, its effects started to decrease in 2021 and its effects decreased significantly in 2022. In order to examine the impact of the pandemic on airlines operating in Asia, data for the 2019-2022 period are included in the analysis.

In order to analyse airlines' responses to situations caused by external influences, the characteristics and context of the situation in question should be the same for all parties (Sartal et al., 2017). The effects of the COVID-19 pandemic on the air transport sector have varied by region and time. For example, in early 2020, airlines in Europe and America continued to operate normally, while airlines in Asia were struggling with the COVID-19 pandemic. For these reasons, it was decided to examine airlines in Asia, which have a significant share of global flight traffic. Three of these airlines are LCC airlines (Air Arabia, Cebu Air, Spring Airlines). LCC airlines offer lower fares than traditional

airlines by reducing the services provided in the cabin (Malighetti et al., 2009). Previous studies have revealed that traditional airlines and LCC airlines adopted disparate strategies during the pandemic period, with traditional airlines exhibiting superior performance compared to LCC airlines (Asker, 2024). However, other studies have yielded contrasting findings (Kaffash & Khezrimotlagh, 2023). In this respect, it is quite remarkable to examine the performance comparison between traditional airlines and LCC airlines.

The financial and operational criteria employed in the study were selected from the most commonly utilised criteria in studies on performance measurement within the air transport sector. The financial and operational performance criteria utilised in the study are presented in Table 1.

Table 1. Performance Indicators Used in the Analysis

Classification	Indicators	Code	Formula	References
Financial	ROA	C1	$\frac{Net\ Profit}{Total\ Assets}$	(Dave & Dave, 2012; Dinçer et al., 2017; Pires & Fernandes, 2012)
	ROE	C2	$\frac{Net\ Profit}{Total\ Equity}$	(Wang, 2008; Pineda et al., 2018)
	Current Ratio	C3	$\frac{Current\ Assets}{Current\ Liabilities}$	(Kiracı & Bakır, 2020; Asker & Aydın, 2021)
	Dept Ratio	C4	$\frac{Total\ Dept}{Total\ Assets}$	(Al-Najjar & Kalaf, 2012; Jandghi & Ramshini, 2014; Asker & Aydın, 2021; Kiracı et al., 2022)
	Net Profit Margin	C5	$\frac{Net\ Profit}{Total\ Revenue}$	(Teker et al., 2016; Asker, 2022)
	Operating Margin	C6	$\frac{Operating\ Income}{Total\ Revenue}$	(Merkert & Pearson, 2015; Asker, 2022)
Operational	CASK	C7	$\frac{Operating\ Costs}{ASK}$	(Sakthidharan & Sivaraman, 2018; Gramani, 2012)
	RASK	C8	$\frac{Total\ Revenue}{ASK}$	(Mhlanga, 2019)
	RRPK	C9	$\frac{Total\ Revenue}{RPK}$	(Barros & Peypoch, 2009)
	Load Factor	C10	$\frac{RPK}{ASK} * 100$	(Min & Joo, 2016; Asker, 2021)

Source: Author's own elaboration.

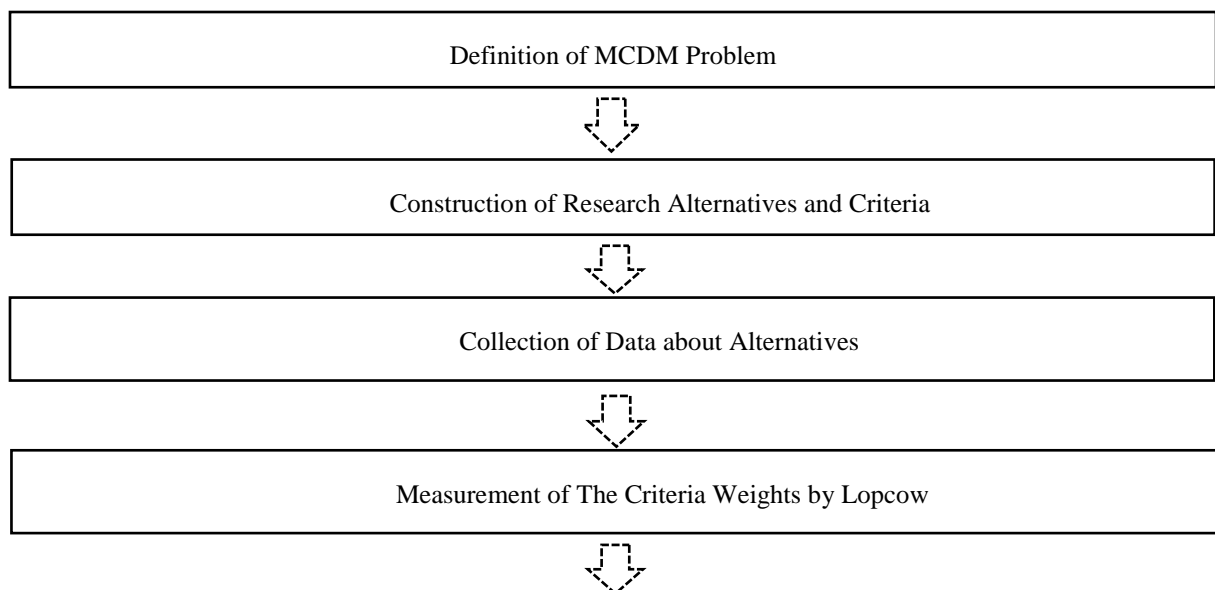
As illustrated in Table 1, six variables were identified for the assessment of the financial performance of airlines in Asia. The return on assets (ROA) indicates the profitability of a companies

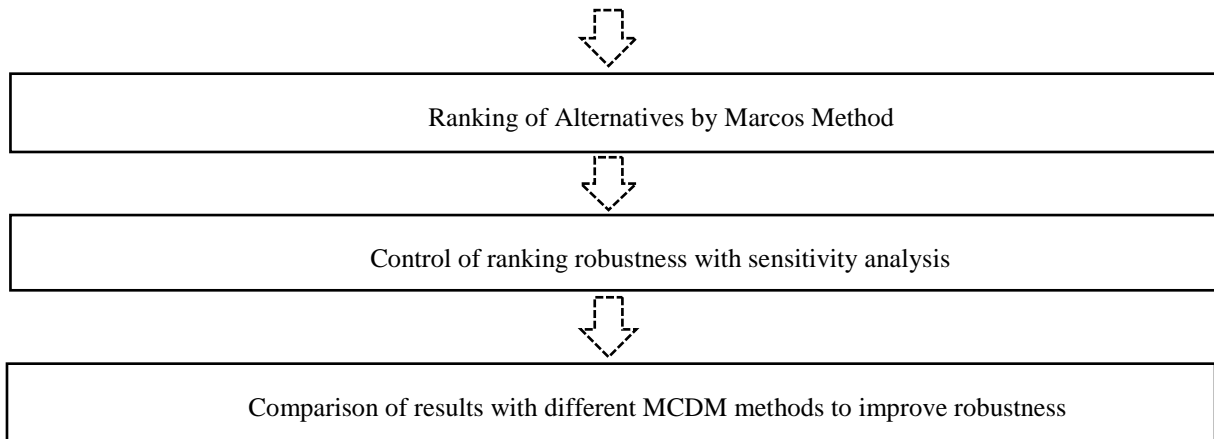
in relation to its assets. In other words, it is an important ratio that demonstrates the efficiency with which the company utilises its assets (Dave & Dave, 2012). The return on equity (ROE) is a significant financial ratio that demonstrates the profitability of a company in relation to the capital invested by its shareholders (Zhang et al., 2014). The current ratio is an important financial ratio that expresses the ability of a companies to pay its short-term debts using its current assets (Dinçer et al., 2017). The debt ratio is an important financial ratio that provides insight into the solvency of companies. A high debt ratio is indicative of an elevated financial risk (Al-Najjar & Kalaf, 2012). The net profit margin is an important ratio that demonstrates the extent to which a company's revenues generate profit (Teket et al., 2016). The operating margin is an important ratio that indicates the profitability of a company's activities (Merkert & Pearson, 2015).

In the context of the study, four variables were identified as key metrics for evaluating operational performance. All of these variables are related to the concepts of ASK (Available Seat Kilometre) and RPK (Revenue Passenger Kilometre). The variable ASK is calculated by multiplying the available seat capacity by the distance flown. RPK is defined as the number of seats sold multiplied by the distance flown (Barros & Peypoch, 2009). CASK represents the cost per seat for aircraft owned by airlines. CASK represents the primary operational cost measurement indicator within the airline transport sector (Sakthidharan & Sivaraman, 2018). RASK demonstrates the revenue generated per seat on aircraft owned by the airline. It is a crucial operational revenue indicator in the airline industry (Mhlanga, 2019). RRPK represents revenue per passenger in the airline sector (Vasigh et al., 2015). Load Factor is a significant operational indicator that expresses the occupancy rate of aircraft under the ownership of airlines (Min & Joo, 2016).

Financial data related to airlines was obtained from the Bloomberg database, while operational data was obtained from the airlines' annual reports.

Figure 1. Flow chart of the application model





Source: Author's own elaboration.

In Figure 1, the Lopcow and Marcos methods used in the study are presented within a flowchart. In the first step, the problem related to MCDM (Multi-Criteria Decision Making) was identified. In the second step, alternatives related to the problem and the financial and operational criteria for these alternatives were determined. The third step involved collecting data for these criteria. In the fourth step, the aforementioned financial and operational criteria were weighted using the Lopcow method. In the fifth stage, the Marcos method was utilized to rank the performance of the alternatives (airlines). In the last step, the obtained ranking results were compared with those of other MCDM methods to strengthen the reliability of the proposed model.

3.1. Lopcow Method

Ecer and Pamucar introduced the Lopcow (Logarithmic Percentage Change-driven Objective Weighting) method to the literature (Ecer & Pamucar, 2020, pp. 4-5). The Lopcow method provides benefit or cost-oriented solutions for criteria without the need for any criterion constraints. The most significant difference of this method from other criterion weighting methods is the elimination of the difference (gap) caused by the size of the series by considering the standard deviation percentage and mean squares of the series. Another feature of the method is that it is not affected by data with negative values (Ecer et al., 2023). The application steps of the Lopcow method are shown below (Ecer & Pamucar, 2020, p. 5):

Step 1: In the first step of the method, an initial decision matrix (IDM) consisting of "m" alternatives and "n" criteria is arranged for the determination and resolution of the decision problem, as specified in Equation (1).

$$IDM = \begin{bmatrix} y_{11} & y_{12} & \dots & y_{1n} \\ y_{21} & y_{22} & \dots & y_{2n} \\ \dots & \dots & \dots & \dots \\ y_{m1} & y_{m2} & \dots & y_{mn} \end{bmatrix} \quad (1)$$

Step 2: In the second step of the method, the evaluation criteria in the decision matrix are normalized according to whether they are benefit-oriented or cost-oriented using Equation (2) or Equation (3).

$$r_{ij} = \frac{x_{max} - x_{ij}}{x_{max} - x_{min}} \quad \text{if } j \in C \quad (2)$$

$$r_{ij} = \frac{x_{ij} - x_{min}}{x_{max} - x_{min}} \quad \text{if } j \in B \quad (3)$$

Step 3: In the third step of the method, the percentage value (PV value) for each evaluation criterion is calculated using Equation (4).

$$PV_{ij} = \left| \ln \left\{ \frac{\sqrt{\frac{\sum_{i=1}^m r_{ij}^2}{m}}}{\sigma} \right\} * 100 \right| \quad (4)$$

Where "m" stands for the quantity of alternatives, and "σ" denotes the standard deviation.

Step 4: In the final step of the method, the importance weight value for each criterion is calculated using Equation (4).

$$W_j = \frac{PV_{ij}}{\sum_{i=1}^n PV_{ij}} \quad (5)$$

3.2. Marcos Method

The Marcos Method, developed by Stević et al., (2020), establishes associations between alternatives and reference values (ideal and non-ideal alternatives) to rank alternative performance, as outlined by Stević and Brković, (2020). This method employs benefit functions to assess alternatives based on these relationships, facilitating the ranking process relative to the reference values. Benefit functions indicate the positioning of each decision alternative concerning ideal and non-ideal solutions. Consequently, the alternative with the highest ranking is closest to the ideal reference point and farthest from the non-ideal reference point. The procedural steps of the Marcos method, as outlined by Stević et al., (2020):

Step 1: The initial decision matrix consisting of evaluation criteria and decision alternatives is arranged as specified in Equation (1).

$$Y = [y_{ij}] = \begin{bmatrix} y_{11} & y_{12} & \dots & y_{1n} \\ y_{21} & y_{22} & \dots & y_{2n} \\ \dots & \dots & \dots & \dots \\ y_{m1} & y_{m2} & \dots & y_{mn} \end{bmatrix} \quad (1)$$

Step 2: Ideal (AI) and non-ideal (AAI) solution values are determined, and the initial decision matrix is expanded as indicated in Equation (6).

$$Y = \begin{matrix} AAI \\ A_1 \\ A_2 \\ \vdots \\ A_m \\ AI \end{matrix} \begin{bmatrix} C_1 & C_2 & \dots & C_n \\ y_{aa1} & y_{aa2} & \dots & y_{aan} \\ y_{11} & y_{12} & \dots & y_{1n} \\ y_{21} & y_{22} & \dots & y_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ y_{m1} & y_{m2} & \dots & y_{mn} \\ y_{ai1} & y_{ai2} & \dots & y_{ain} \end{bmatrix} \quad (6)$$

The values (AI) and (AAI) in Equation (6) represent the best ideal and worst ideal solutions, respectively. These values are calculated using Equation (7) and Equation (8).

$$AAI = \min_i y_{ij} \text{ if } j \in B \text{ ve } \max_i y_{ij} \text{ if } j \in C \quad (7)$$

$$AI = \max_i y_{ij} \text{ if } j \in B \text{ ve } \min_i y_{ij} \text{ if } j \in C \quad (8)$$

In these equations, the benefit criterion is denoted by "B" and the cost criterion by "C".

Step 3: The criteria in the expanded initial decision matrix are normalized according to whether they are cost-oriented or benefit-oriented using Equation (9) and Equation (10).

$$n_{ij} = \frac{x_{ai}}{x_{ij}} \text{ if } j \in C \quad (9)$$

$$n_{ij} = \frac{x_{ij}}{x_{ai}} \text{ if } j \in B \quad (10)$$

Step 4: The normalized decision matrix is weighted by the weight values of the criteria obtained through the Lopcow method, as specified in Equation (11).

$$V_{ij} = n_{ij} * w_j \quad (11)$$

Step 5: The benefit degrees of decision alternatives (K_i) are calculated based on ideal and non-ideal solutions using Equation (12) and Equation (13).

$$H_i^- = \frac{S_i}{S_{aa1}} \quad (12)$$

$$H_i^+ = \frac{S_i}{S_{ai}} \quad (13)$$

The value (S_i) represents the total value of weighted matrix elements for each alternative, calculated using Equation (14).

$$S_i = \sum_{j=1}^m V_{ij} \quad (14)$$

Step 6: Benefit functions of alternatives $f(H_i)$ are calculated using Equation (15).

$$f(H_i) = \frac{H_i^+ + H_i^-}{1 + \frac{1 - f(H_i^+)}{f(H_i^+)} + \frac{1 - f(H_i^-)}{f(H_i^-)}} \quad (15)$$

The value $f(H_i^-)$ in the formula represents the benefit function relative to the non-ideal solution, while $f(K_i^+)$ represents the benefit function relative to the ideal solution. These functions are calculated using Equation (16) and Equation (17).

$$f(H_i^+) = \frac{H_i^-}{H_i^+ + H_i^-} \quad (16)$$

$$f(H_i^-) = \frac{H_i^-}{H_i^+ + H_i^-} \quad (17)$$

Step 7: In the final step, as indicated in Equation (15), alternatives are ranked in descending order based on the values of $f(H_i)$. The alternative with the highest $f(H_i)$ value is considered the best alternative.

4. RESULTS

In this section, the operational and financial performance of 15 traditional and 3 LCC airlines operating in the Asian airline market before and after the COVID-19 pandemic were examined using the Lopcow-based Marcos method. To enhance the robustness of the applied model, sensitivity analysis was performed. Then the obtained results were compared with other MCDM methods. The operational and financial performance of 18 airlines for the period 2019-2022 was compared within the scope of the study.

4.1. Lopcow Results

In this section, the weights of criteria in the initial decision matrix concerning airlines (alternatives) were determined using the Lopcow method. The initial decision matrix consists of values for alternatives and criteria. In this study, a decision matrix of 18×10 was created for each year covering the period 2019-2022. When looking at Table 2, we can observe both the variation within each criterion and over time. It is noted that the variable with the highest weight is Dept Ratio in 2019 and 2022, while it is ROA in the period of 2020-2021. The variable with the lowest weight is Current Ratio in 2019, CASK in 2020, RRPK in 2021, and ROE in 2022.

Table 2. Lopcow Method Performance Criteria Weight, 2019–2022

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
2019	0.1101	0.1184	0.0619	0.1308	0.0872	0.1204	0.1206	0.0643	0.0646	0.1218
2020	0.1938	0.0501	0.0802	0.1270	0.1724	0.1492	0.0327	0.0521	0.0496	0.0924
2021	0.1925	0.0223	0.0855	0.1560	0.1693	0.1484	0.0726	0.0203	0.0115	0.1211
2022	0.0511	0.0257	0.0910	0.1913	0.1048	0.1540	0.1116	0.0483	0.0485	0.1738

Source: Author's own calculation.

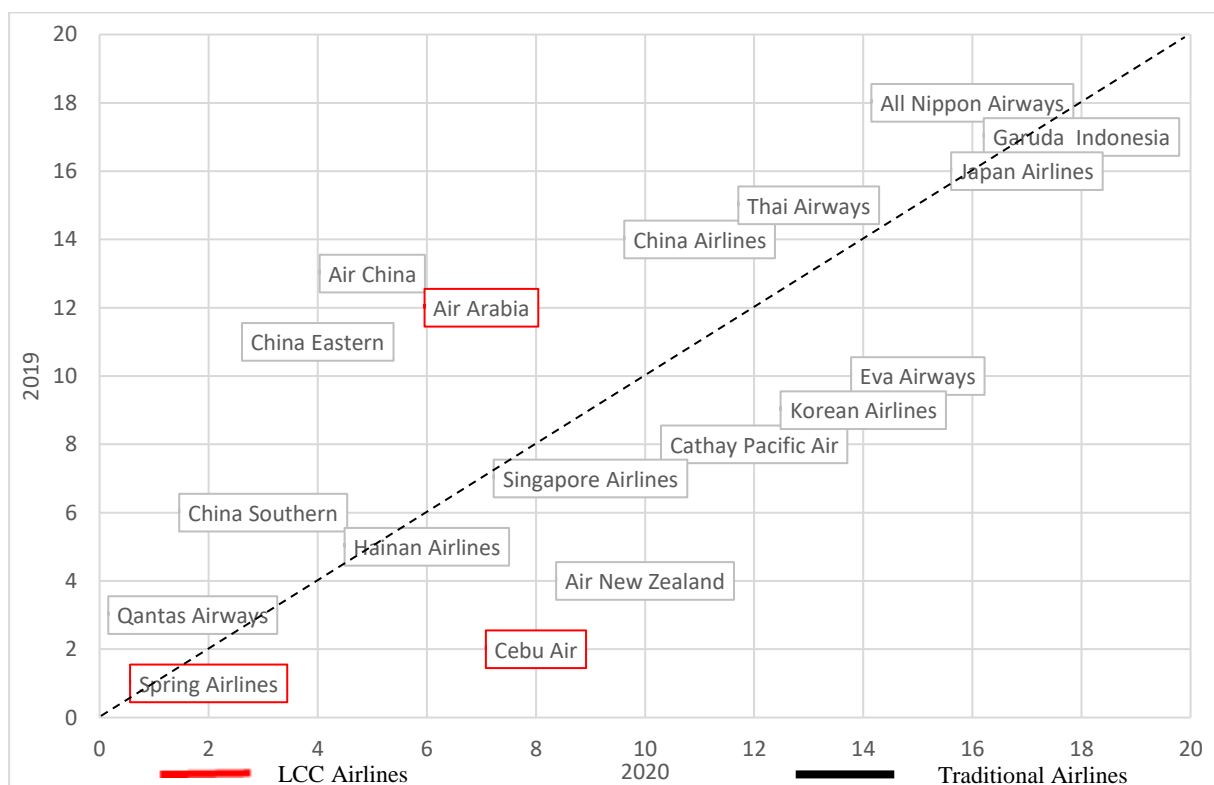
4.2. Marcos Results

After determining the criterion weights of airlines using the Lopcow method, their performance rankings were established using the Marcos method. Initially, the performance rankings of airlines in

2019 (Before Covid-19) were compared, followed by those in 2020 (During Covid-19). As indicated in Figure 2, according to the ranking results of the Marcos method for the year 2019, Spring Airlines demonstrated the best performance, while All Nippon Airways showed the worst performance. Regarding the ranking results for the year 2020, Qantas Airways exhibited the best performance, while Garuda Indonesia showed the worst performance. It can be observed that China Southern, Hainan Airlines, and Cebu Air consistently ranked high in both operational and financial performance for both 2019 and 2020, whereas Japan Airlines, Thai Airways, Garuda Indonesia, and All Nippon Airways were consistently ranked lower.

It has been observed that low-cost carrier (LCC) airlines such as Spring Airlines and Cebu Air demonstrated better performance compared to a significant portion of traditional airlines during the 2019-2020 period. LCC airlines are characterized by their utilization of secondary airports, offering paid in-flight services, and operating fleets consisting solely of narrow-body aircraft. Due to these characteristics, LCC airlines are able to significantly reduce their operational costs. LCC airlines in the study performed better 2019-2020 period due to their cost-efficient operations

Figure 2. Performance Ranking of Asian Airlines According to the Marcos Method (2019-2020)

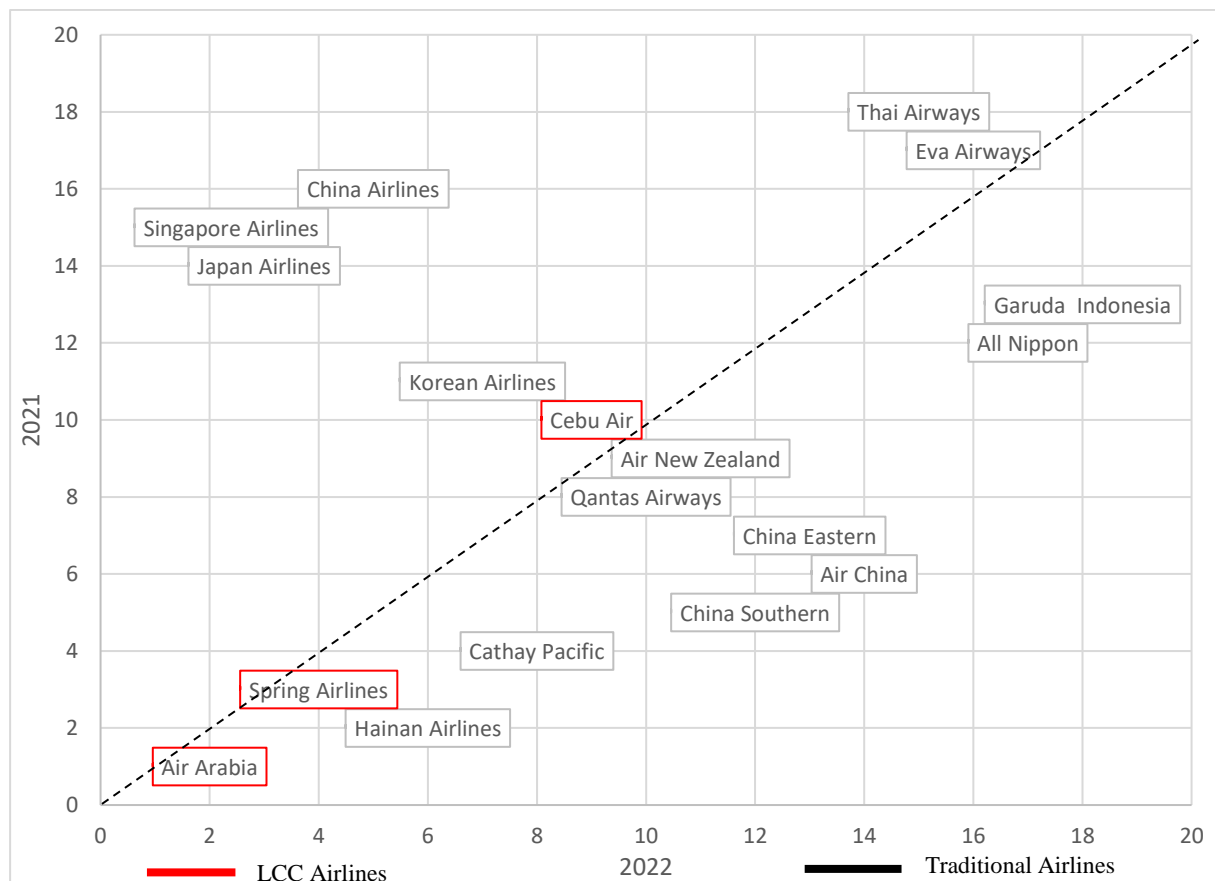


Source: Author's own calculation.

In the second step of the analysis, we compared the performance rankings of airlines in the years 2021 (New Normal) and 2022 (After Covid-19) using the Marcos method. As shown in Figure 3, according to the rankings obtained from the Marcos method in 2021, Air Arabia demonstrated the best performance, while Thai Airways exhibited the worst performance. Regarding the rankings in 2022,

Singapore Airlines showed the best performance, while Garuda Indonesia showed the worst performance. It can be observed that Air Arabia, Hainan Airlines, and Spring Airlines consistently ranked at the top in terms of operational and financial performance in both 2021 and 2022. On the other hand, All Nippon Airways, Eva Airways, Garuda Indonesia, and Thai Airways consistently ranked at the bottom in both years.

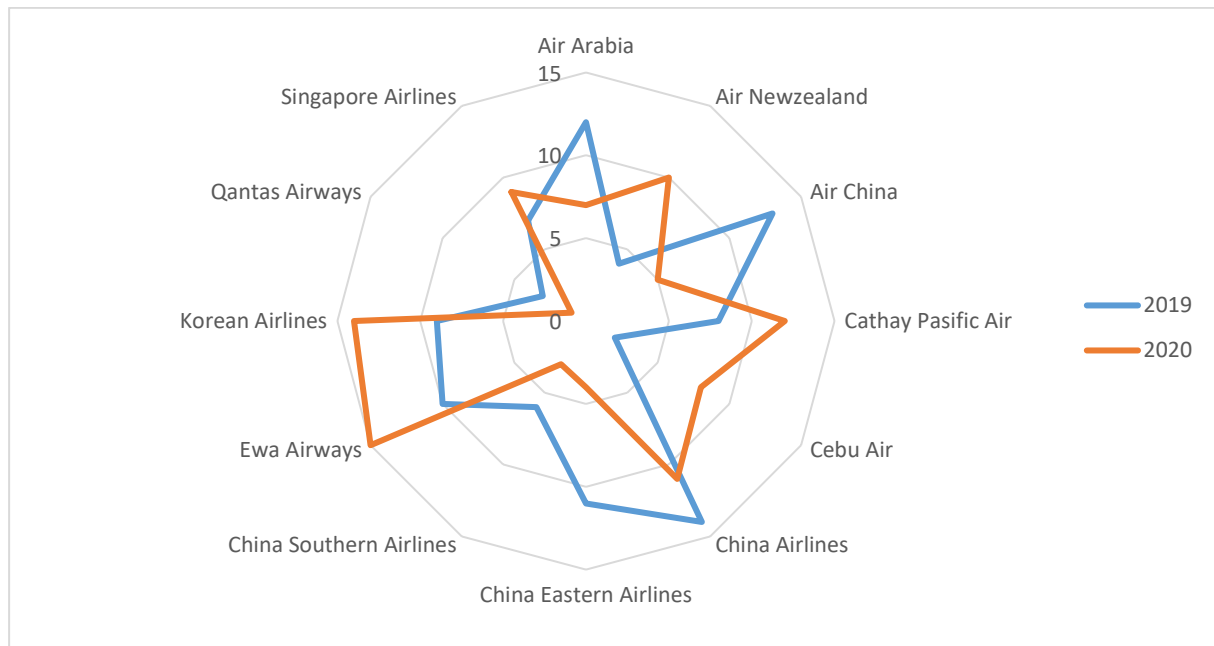
Figure 3. Performance Ranking of Asian Airlines According to the Marcos Method (2021-2022)



Source: Author's own calculation.

Based on the ranking results obtained from the Marcos method, as indicated in Figure 4, the performance of Air New Zealand, Cathay Pacific Air, Ewa Airways, Korean Airlines, Singapore Airlines, and Cebu Air in 2020 was significantly lower compared to 2019. Possible reasons for this could include a substantial decrease in operational revenues and the deterioration of liquidity structures for these airlines. On the other hand, improvements in performance rankings from the previous year were observed for Air Arabia, China Airlines, Air China, China Eastern Airlines, Qantas Airways, and China Southern Airlines in 2020. This improvement can be attributed to the strong liquidity structure of these airlines.

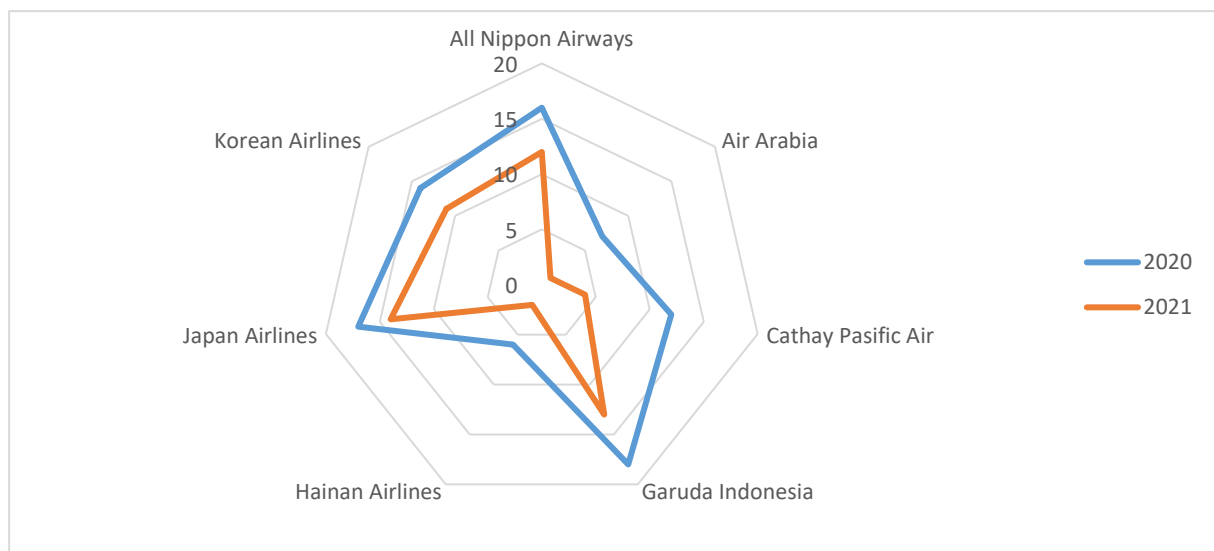
Figure 4. Performance Ranking of Some Airlines According to the Marcos Methods (2019-2020)



Source: Author's own calculation.

Based on the findings depicted in Figure 5, it is evident that All Nippon Airways, Air Arabia, Garuda Indonesia, Cathay Pacific Air, Hainan Airlines, Korean Airlines, and Japan Airlines exhibited improved performance in 2021 compared to the preceding year. Possible reasons for this could include subsidies provided by governments and the lifting of travel restrictions.

Figure 5. Performance Ranking of Some Airlines According to the Marcos Methods (2020-2021)

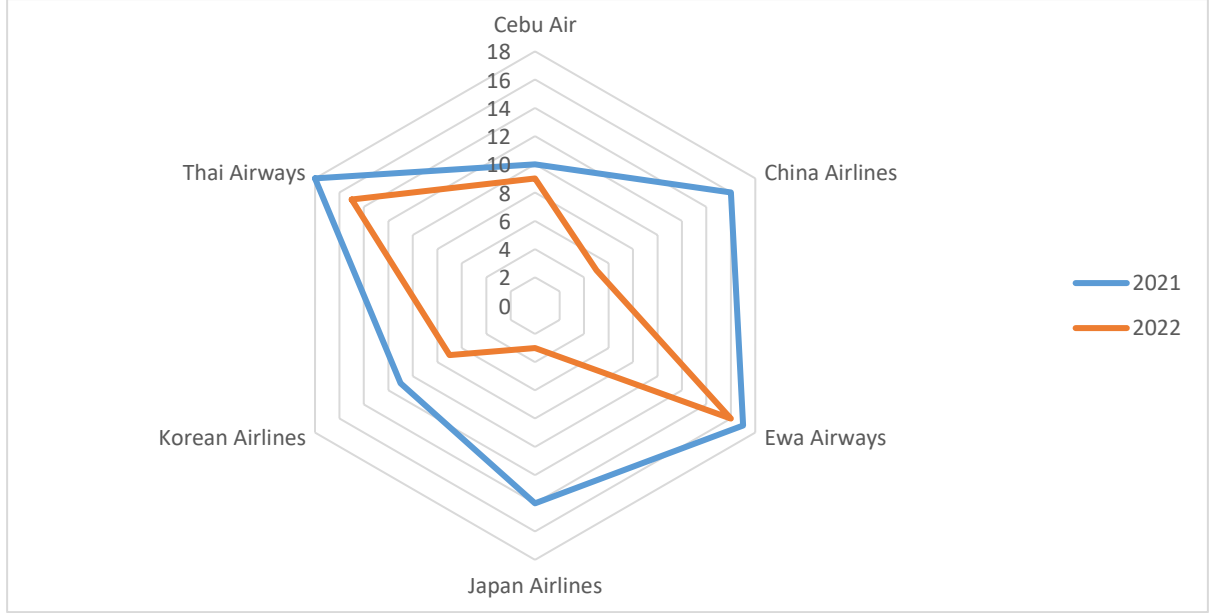


Source: Author's own calculation.

According to the ranking results, as shown in Figure 6, it is observed that Cebu Air, China Airlines, Ewa Airways, Japan Airlines, and Korean Airlines' performance in 2022 was better compared

to the previous year. This indicates that these airlines recovered faster than other airlines in terms of financial and operational performance in the post-pandemic period.

Figure 6. Performance Ranking of Some Airlines According to the Marcos Methods (2021-2022)



Source: Author's own calculation.

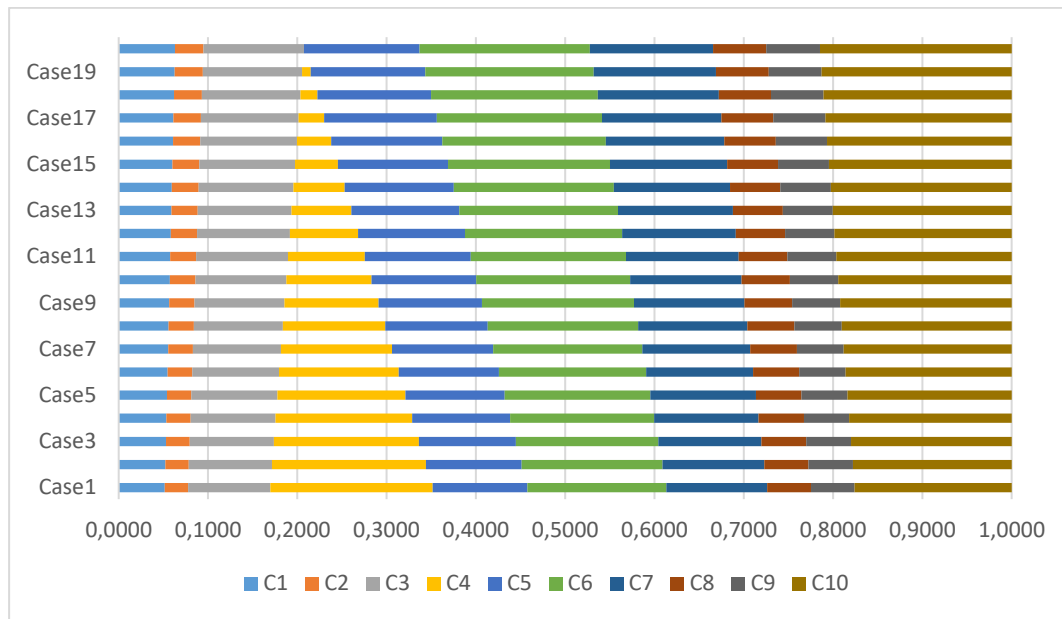
4.3. Robustness and Validation

In the final step of the analysis, a two-step sensitivity analysis was conducted to verify the applicability and robustness of the proposed model. In the first step, the impact of different weights of the criteria on the results was tested. For this purpose, 20 different scenarios were created based on the criterion with the highest weight (C4) obtained from the 2022 analysis using the Lopcow method. The weights for each scenario were calculated using equation (18).

$$W_{n\beta} = (1 - W_{n\alpha}) * \frac{W_{\beta}}{(1 - W_n)} \quad (18)$$

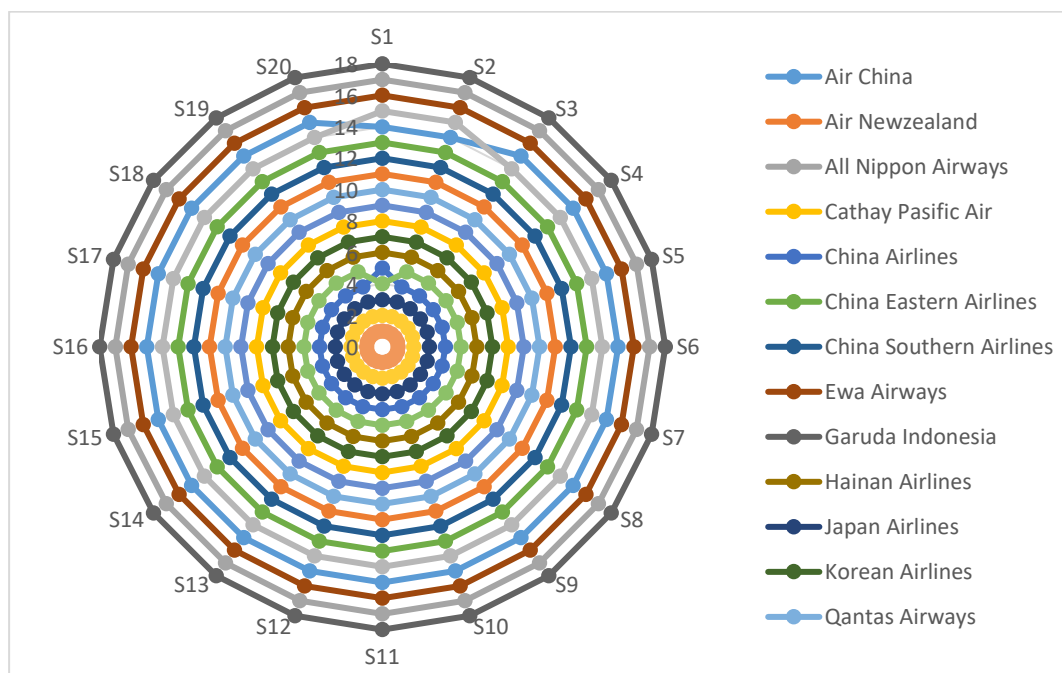
In the formula, W_{β} denotes the original weight of the criteria, W_n denotes the original weight of the most important criterion (C4), $W_{n\alpha}$ denotes the reduced values of the most important criterion (C4) and $W_{n\beta}$ denotes the weights of each scenario (Kirkwood, 1997). In the analysis, the reduction rate of the $W_{n\alpha}$ value was set at 5%. The weight values of the criteria for 20 scenarios are shown in Figure 7. In addition, the scenario-based rankings of the airlines in question are shown in Figure 8. There is no significant change in the performance rankings of the airlines in the scenario-based rankings. This supports the validity and reliability of the proposed model.

Figure 7. Weights of Criteria According to 20 Scenarios



Source: Author's own calculation.

Figure 8. Ranking of Airlines According to all Scenarios



Source: Author's own calculation.

In the subsequent phase of the analysis, the reliability and robustness of the ranking results produced by the Marcos method were assessed by comparing them with results from other MCDM methods. In this context, the sample was subjected to the ARAS, MABAC, TOPSIS, and WASPAS methods. The ranking results for the airlines according to all MCDM methods for the year 2022 are shown in Table 3.

Table 3. Ranking Results According to all MCDM Methods

AIRLINES	ARAS	MABAC	MARCOS	TOPSIS	WASPAS
Air China	16	18	14	14	14
Air New Zealand	12	10	11	11	7
All Nippon Airways	17	16	17	18	17
Cathay Pacific Air	8	6	8	8	8
China Airlines	6	4	5	5	6
China Eastern Airlines	18	17	13	13	15
China Southern Airlines	14	13	12	12	9
Ewa Airways	10	12	16	16	13
Garuda Indonesia	13	14	18	17	16
Hainan Airlines	9	9	6	6	10
Japan Airlines	2	5	3	3	4
Korean Airlines	3	3	7	7	2
Qantas Airways	7	11	10	10	11
Singapore Airlines	4	2	1	1	3
Thai Airways	15	15	15	15	18
Air Arabia	1	1	2	2	1
Cebu Air	11	7	9	9	12
Spring Airlines	5	8	4	4	5

Source: Author's own calculation.

According to Table 3, Air Arabia ranks highest according to 3 different MCDM methods (ARAS, MABAC, WASPAS), while Singapore Airlines ranks highest according to 2 different MCDM methods (MARCOS, TOPSIS). Additionally, although there are some differences, generally similar ranking results are observed across all 5 different methods. These results support the reliability and robustness of the proposed model. Furthermore, to show the direction and strength of the relationship between the proposed model and other MCDM methods, Spearman correlation analysis was conducted. The outcomes of the Spearman correlation analysis are presented in Table 4.

Table 4. Spearman Correlation Results for All MCDM Methods

ARAS	MABAC	MARCOS	TOPSIS	WASPAS
ARAS	1			
MABAC	0.919505	1		
MARCOS	0.849329	0.872033	1	
TOPSIS	0.857585	0.876161	0.997936	1

Source: Author's own calculation.

Based on the correlation results in Table 4, there is a strong positive correlation among all MCDM methods. These findings support the results of the Lopcow-based Marcos method.

5. DISCUSSION

The evaluation of the financial and operational performance of airlines plays a pivotal role in the identification of deficiencies, effective risk management, the facilitation of future planning and the enhancement of passenger satisfaction. The evaluation of the sustainable performance of airlines with effective and robust methods, which take into account financial and operational criteria, enables a multitude of stakeholders associated with the airline sector to make more rational, robust and practical decisions.

Crises such as the COVID-19 pandemic and similar events are highly likely to recur. Such crises pose great challenges for the air transport sector. Authorities can learn lessons from the events experienced during the pandemic period and take some measures to help the air transport sector overcome these challenges. For example, when such a crisis occurs, authorities may reduce airport usage and landing fees to reduce airlines' operating costs. Financial rescue packages can be offered to airlines in order to provide support, maintain operational activities, ensure cash flow and prevent insolvencies. In addition, taking into account the changing nature of the pandemic, it can contribute to the establishment of unified health guidelines and protocols to avoid different and inconsistent practices applied in various countries. In addition, competent authorities can act in harmony with other competent authorities in the measures taken internationally to reduce the effects of the pandemic and to eliminate it completely.

This study, which analyses the financial and operational performance of airlines in Asia, has several practical implications. Firstly, it provides a new framework for assessing the multidimensional performance of airlines. Secondly, the proposed model has a procedure that can be easily applied by decision makers with a basic knowledge of mathematics. Thirdly, the findings from sensitivity and comparison analyses support the conclusion that the proposed model provides consistent and robust results.

The findings of this study have implications for the management of airlines. Primarily, the results, which focus on the financial and operational performance of airlines, are useful to the senior management teams and boards of directors of these airlines in improving the overall performance of the airlines and achieving sustainable competitive advantage. Secondly, the comparison of the multidimensional performance of these airlines provides important information to all stakeholders about the success of the strategies followed by the airlines.

6. CONCLUSION

This research investigates the adverse impacts of quarantine measures and travel restrictions implemented because of the COVID-19 pandemic on the operational and financial performance of airlines in the Asian aviation sector. Moreover, it contrasts the operational and financial performance of

Asian airlines both pre and post the pandemic. To achieve this, the operational and financial performance of 18 Asian airlines from 2019 to 2022 has been scrutinized utilizing the Lopcow-based Marcos method.

In the analysis stage, operational and financial data of airlines were first weighted using the Lopcow method. Based on the results of the Lopcow method, it was determined that Dept Ratio was the variable with the highest weight on the performance of these airlines in 2019 and 2022, while ROA had the highest weight during the period of 2020-2021. From this perspective, it can be said that foreign resource utilization had a greater impact on the performance of these airlines both before and after the pandemic. Furthermore, it is evident that financial indicators play a pivotal role in the operations of the airlines under consideration. Given the crucial role of financial performance in enabling airlines to maintain their operations and viability, this outcome is to be expected. This result is similar to the results of Avcı and Çınaroğlu (2018), Kiracı and Bakır (2020) and Tanrıverdi et al. (2023), but not similar to the results of Bakır et al. (2020) and Kiracı and Asker (2021). This situation is thought to be due to the airline sample selected or the different period examined. In the second stage of the analysis, the performance ranking of airlines was conducted using the Marcos method. According to the ranking results of the Marcos method, Spring Airlines (2019), Qantas Airways (2020), Air Arabia (2021), and Singapore Airlines (2022) were found to have the best performance. It was also observed that some LCC airlines (Spring Airlines, Cebu Air) performed better than Traditional airlines in the pre-pandemic period (2019) and some (Air Arabia, Spring Airlines) in the post-pandemic period (2021-2022). This result is similar to the results of Kaffash and Khezrimotlagh (2023) and Taliah and Zervopoulos (2024), while is not similar to the results of Jaroenjitrkam et al. (2023), Asker (2024) and Wu et al. (2024). It is thought that this situation is due to the difference in the period analysed and the performance criteria selected.

The results of the proposed Lopcow-based Marcos method provide a detailed insight into the performance of airlines operating in the Asian airline market during the period of 2019-2022. Additionally, they indicate differences in the relative performance rankings of these airlines before, during, and after the COVID-19 pandemic. For example, it was observed that the performance rankings of Air New Zealand, Cathay Pacific Air, Cebu Air, Ewa Airways, Korean Airlines, and Singapore Airlines in 2020 lagged significantly behind those of 2019. This could be explained by a significant decrease in operational revenues and disruption in liquidity structure for these airlines. However, Air Arabia, China Airlines, Air China, China Southern Airlines, China Eastern Airlines, and Qantas Airways showed improvements in their performance rankings in 2020 compared to the previous year. Among the possible reasons for this could be the strong liquidity structure of these airlines.

Based on the analysis results, it was found that the performance rankings of All Nippon Airways, Air Arabia, Garuda Indonesia, Cathay Pacific Air, Japan Airlines, Hainan Airlines, and Korean Airlines were higher in 2021 compared to 2020. Among the possible reasons for this could be the subsidies provided by governments and the lifting of travel restrictions.

According to the ranking results of the Marcos method, it is observed that the performance of Cebu Air, China Airlines, Ewa Airways, Japan Airlines, and Korean Airlines in 2022 is better compared to the previous year. This indicates that these airlines have recovered more quickly in terms of financial and operational performance than other airlines in the post-pandemic period.

It is believed that this study, utilizing the Lopcow and Marcos methods, will add to the growing body of literature regarding the impact of the COVID-19 pandemic on the aviation industry. In addition, it is thought that the findings obtained will contribute to the performance management of these airlines and will provide airline managers with the opportunity to make managerial inferences in improving the performance of these airlines in crisis periods similar to the COVID-19 pandemic. It also provides stakeholders in the aviation industry with information on the operational and financial performance of airlines in Asia. However, the study has some limitations. These limitations include focusing on a specific market, examining performance only from operational and financial perspectives, the relative nature of the MCDM methods used to measure performance, including only airlines engaged in passenger transportation in the research, and the potential variation in performance rankings based on the variables used. It is recommended that future studies expand the sample size, examine a range of performance dimensions, and employ a more comprehensive performance evaluation approach that incorporates diverse variables into the analytical process. Furthermore, airlines can be evaluated using a variety of multidimensional performance measurement methods.

Ethics Committee approval was not required for this study.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors affirm that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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The Relationship Between Health Expenditures and Inflation by Provinces in Türkiye: Wavelet Coherence Analysis

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Abstract

The aim of this study is to reveal the relationship between inflation and health expenditures in Türkiye. The relationship between inflation, and health expenditures has been frequently analyzed. Existing studies generally prefer to use classical time series analyses for investigation of relationship between inflation and health expenditures. However, these analyses fail to reveal the contagion and interdependence effects. In order to reveal these effects, Wavelet analysis is preferred in this study. In this study, health expenditure for 81 provinces of Türkiye and inflation variables (PPI and CPI) are analyzed with Wavelet coherence analysis for the period 2004-2022. Wavelet coherence analysis allows for the investigation of the contagion and interdependence effects between the variables in short-, medium- and long-term cycles. According to the findings of the study, the relationship between health expenditures and inflation variables differs in seven regions of Türkiye. Moreover, interdependence effects between health expenditures and PPI are observed in almost all provinces. On the other hand, both contagion and interdependence effects are observed between CPI.

Keywords: *Health Economics, Health Policies, Health System, Wavelet Coherence Analysis.*

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1. INTRODUCTION

Health expenditures are considered as an investment expenditure designed for individuals (Schultz, 1961). The increase in investment expenditures within health expenditures subsequently increases health services, health facilities and employment (Orhaner, 2018). In the historical background of health services in Türkiye, the research on health expenditures between 1996-1998 and the results obtained can be considered as the beginning of taking action to reduce expenditures (Kostekci, 2014). The activities carried out for health expenditures continued in the following processes, and efforts to ensure the balance between scarce resources and unlimited needs were carried out within the scope of the health system.

The recent change/transformation in the health system, including health expenditures (Health Transformation Program), is considered among the studies conducted. Within the framework of the "Health Transformation Program", the issue of financing was examined, and "General Health Insurance" was introduced (Republic of Türkiye Ministry of Health Report, 2003). In addition to general health insurance, the purchasing power of individuals for health services has increased as a result of complementary health insurance and private health insurance. This situation is a determinant of individuals' health expenditures. In this regard, there have been developments in factors such as economy, technology (RateMDs (A platform where patients share their experiences with physicians to help other patients choose a physician), PatientsLikeMe (A platform where patients with the same disease share information and experiences about their treatment)), information level and life expectancy at birth. Accordingly, the concept of the conscious patient has emerged, and this has shaped health expenditure amounts. The fact that conscious patients conduct the necessary research on health services and increase their health literacy levels in this sense can play a decisive role in health expenditures. As a matter of fact, the outputs of the "Health Literacy Survey" recently launched by the Ministry of Health in 15 thousand households support this issue (Gocumlu Calık, 2023). Therefore, many factors determine health expenditures, but especially the economic conjuncture is an important factor that determines the amount of health expenditures (Los, 2016). One of the most important indicators of the economic conjuncture is inflation. Especially for the Turkish economy, it is monitored using the producer price index (PPI) and consumer price index (CPI) variables. The relationship between health expenditures and inflation has long been studied in the economics literature (Russell, 1975; Dikmen, 2004; Hayaloglu & Bal, 2015; Teimourizad et al., 2014; Dunn et al., 2018; Kubar, 2016; Taskaya & Demirkiran, 2016; Turgut et al., 2017; Akobi et al., 2021; Ankara & Zeybek, 2021; Ilgun et al., 2023). Existing studies have generally examined the relationship between health expenditures and inflation variables using econometric methods such as time series analysis, panel data analysis, regression analysis, least squares method, co-integration analysis. Although these methods have been able to reveal the interaction between health expenditures and inflation variables, they carry important assumptions of time series

analysis (e.g. stationarity). However, these methods are not sufficient to explain a contagion or interdependence effect between health expenditures and inflation (Kangalli Uyar, 2021).

This study aims to explain the contagion and interdependence effects between health expenditure and inflation variables, unlike the existing literature. For this purpose, we use Wavelet Analysis, which allows us to analyze the co-movement of economic time series with respect to both frequency and time. In addition, in order to better understand the nature of the relationships between the variables, wavelet coherence analysis will be used, which allows us to examine how the relationships change over time according to different frequencies. Monthly health expenditure data for 81 provinces of Türkiye between 2004 and 2022 and Türkiye's PPI and CPI rates are used as the research dataset. The research findings are expected to provide outputs that will enable the interpretation of the changes in health policies and system in the short-, medium- and long-term. The findings are planned to shed light on the positive/negative consequences of these differences in policy and system.

The next section of the study presents the literature review, while the third section explains the data and methodology. The fourth section interprets the findings of the analysis and the next section discusses the results.

2. LITERATURE REVIEW

The studies in the literature on health expenditures and inflation have been conducted on various topics, target groups and methods. Russell (1975) investigated the effect of inflation on federal health expenditures. Dikmen (2004) investigated the relationship between relative price variability and inflation by expenditure groups in Türkiye. Hayaloglu and Bal (2015) investigated the relationship between health expenditures and economic growth. Teimourizad et al. (2014) investigated the health sector inflation rate and its determinants. Dunn et al. (2018) investigated health expenditures and inflation. Kubar (2016) investigated the relationship between development indicators and economic growth in less developed and developing countries. Taskaya and Demirkiran (2016) investigated the causality relationship between inflation, income and health expenditure. Turgut et al. (2017) investigated the relationship between health expenditures and inflation. Akobi et al. (2021) investigated public expenditures and inflation rate. Ankara and Zeybek (2021) investigated health expenditures and health inflation after health transformation. Ilgun et al. (2023) investigated the impact of health reform, inflation and income on health expenditures.

Studies on the relationship between inflation and health expenditures have been conducted in many countries (Russell, 1975; Dikmen, 2004; Hayaloglu & Bal, 2015; Teimourizad et al., 2014; Dunn et al., 2018; Kubar, 2016; Taskaya & Demirkiran, 2016; Turgut et al., 2017; Akobi et al., 2021; Ankara & Zeybek, 2021; Ilgun et al., 2023). According to the studies on inflation and health expenditures, inflation rate has a negative and significant effect on economic growth (Hayaloglu & Bal, 2015). Health inflation has a significant effect on general inflation. In addition, health inflation has a decreasing role

on general inflation (Ankara & Zeybek, 2021). There is a positive and significant relationship between the rate of increase in inflation and the rate of increase in health expenditures (Turgut et al., 2017). The most relevant measures of the impact of inflation on medical prices are personal health care and personal consumption expenditures (Dunn et al., 2018). Inflation rate and health expenditures positively affect economic growth in low-income countries (Kubar, 2016). There is a positive relationship between health inflation and the number of dentists (Teimourizad et al., 2014). Policies designed to reduce inflation have less impact on health sector inflation (Russell, 1975). Changes in the inflation rate have a very weak effect on the relative price change of health expenditures (Dikmen, 2004). GDP per capita has no effect on health expenditures included in GNP (Taskaya & Demirkiran, 2016). Annual inflation has no effect on health expenditures per capita (Ilgun et al., 2023). Inflation rate has a positive and significant effect on health expenditures (Akobi et al., 2021).

In studies on the relationship between health expenditures and inflation, various econometric methods such as time series analysis (Russell, 1975; Teimourizad et al., 2014; Dunn et al., 2018; Ankara & Zeybek, 2021), panel data analysis (Hayaloglu & Bal, 2015; Kubar, 2016), regression analysis (Dikmen, 2004; Turgut et al., 2017; Akobi et al., 2021), cointegration analysis (Taskaya & Demirkiran, 2016) and ARDL test (Ilgun et al., 2023) have been employed. In classical econometric methods where inflation and health expenditures are investigated, the issue of stationarity plays a decisive role. This situation causes the data to change and transform. In order to test the contagion and interdependence between variables, Wavelet analysis method is preferred in this study. Unlike previous studies, this method dynamically analyzes the relationship between health expenditures and inflation in short-, medium- and long-term economic cycles.

3. DATA AND METHODOLOGY

In accordance with the purpose of the study, Wavelet Multi-Scaling and Wavelet Coherence (WTC) were preferred among Wavelet analyses to examine the relationship between inflation variables (PPI and CPI) and health expenditures. The research will be conducted by using the health expenditures of 81 provinces and PPI and CPI rates of Türkiye. Between 2004 and 2022, monthly health expenditures are obtained from the Republic of Türkiye Ministry of Treasury and Finance dataset, while monthly inflation data for the same period are obtained from the Central Bank of the Republic of Türkiye database. The reason why the dataset starts from 2004 is that the data on health expenditures by provinces have been created since 2004. Descriptive statistics of the data set are presented in the table in Appendix-1.

Least squares estimators provide limited information about the dynamics of the relationship between economic time series indicators. For this reason, wavelet analysis has been widely used in economics for some time to further examine the dynamic relationships between economic time series indicators. Ramsey and Zhang (1997) first used wavelet analysis in economics and finance. Especially

in economic time series analysis, this method can be used to generate short-, medium- and long-term cycles. Additionally, a variety of scaling techniques can provide important information about how indicator behavior differs across business cycles. Wavelet analysis is another type of Fourier transform used in various fields of signal processing and has important applications in scientific fields such as engineering, health sciences, physics, and astronomy. The use of Wavelet analysis in economics and finance can be done by using different sub-techniques of the analysis: General Wavelet Transform, Stationary Process, Denoising, Multi-Scaling, and Coherence.

The main purpose of the wavelet multiscale technique is to achieve time series decomposition by creating a natural platform without loss of data at the highest computable probability frequency. For wavelet analysis, two basic wavelet functions can be defined: father wavelet (ϕ) and mother wavelet (ψ). The father wavelet, or scaling function, contains the low-frequency components of the original data, showing the smooth part of the data, while the mother wavelet contains the high-frequency components of the original data, thus reflecting the details of the data (Nelson, 2008; In & Kim, 2013). In other words, the father wavelet essentially represents the smooth and trend part of the signal, whereas the mother wavelets represent the detailed parts by scale (Crowley, 2007). The father and mother wavelet can be defined in Equation (1) and Equation (2) respectively:

$$\phi_{j,k}(t) = 2^{-\frac{j}{2}} \phi(2^{-j} * t - k), \quad j = 1, 2, \dots, J; \quad k = 0, 1, \dots, 2^j - 1 \quad (1)$$

$$\psi_{j,k}(t) = 2^{-\frac{j}{2}} \psi(2^{-j} * t - k), \quad j = 1, 2, \dots, J; \quad k = 0, 1, \dots, 2^j - 1 \quad (2)$$

The wavelet functions in Equations (1) and (2) depend on the scale or frequency parameter denoted by j and the location parameter denoted by k . The scale parameter controls the length of the wavelet, while the position parameter determines the position of the wavelet (Gallegati & Semmler, 2014). The scale parameter from 1 to J indicates that the time series is divided into J different time scales, where J is the highest-level time scale. $\phi(\cdot)$ and $\psi(\cdot)$, are real-valued functions defined on the real axis $(-\infty, +\infty)$ and satisfy the following normalization conditions:

$$\int_{-\infty}^{+\infty} \phi(t) dt = 1 \quad (3)$$

$$\int_{-\infty}^{+\infty} \psi(t) dt = 0 \quad (4)$$

Therefore, the time series $y(t)$ defined in $L^2(R)$ (If $\int_{-\infty}^{+\infty} y(t)^2 dt < \infty$, the square of $y(t)$ is called an integrable function) can be described in terms of wavelet functions as follows:

$$y(t) = \sum_{k=0}^{2^j-1} s_{j,k} \phi_{j,k}(t) + \sum_{j=1}^J \sum_{k=0}^{2^j-1} d_{j,k} \psi_{j,k}(t) \quad (5)$$

In Equation (5), $s_{j,k} = \int_{-\infty}^{+\infty} y(t) \phi_{j,k}(t) dt$ and $d_{j,k} = \int_{-\infty}^{+\infty} y(t) \psi_{j,k}(t) dt$ are defined. $s_{j,k}$ is called the smoothing coefficient, and $d_{j,k}$ is called the detail coefficient. These coefficients ($s_{j,k}$, $d_{j,k}$) are usually called wavelet transform coefficients and measure the proportion of the corresponding

wavelet function in the original data. When we rearranged the Equation (5), it can be expressed as in Equation (6):

$$y(t) = S_J(t) + \sum_{j=1}^J D_j(t) \quad (6)$$

In Equation (6), $S_J(t)$ can be defined as $\sum_{k=0}^{2^J-1} s_{J,k} \phi_{J,k}(t)$, and $D_j(t)$ can be present $\sum_{k=0}^{2^j-1} d_{j,k} \psi_{j,k}(t)$, $j = 1, 2, \dots, J$. The expression in Equation (6) contains components of the time series decomposed into different time scales. $S_J(t)$ represents the smooth part of the data because it is the component belonging to the highest-level time scale. $D_j(t) = (D_1(t), D_2(t), \dots, D_J(t))$ is the details of the data fluctuation on the time scale $2^{-4}, 4^{-8}, \dots, 2^J - 2^{J+1}$ respectively. Table 1 shows the time horizons used for the multi-scaling technique at different scales: annual, monthly, and daily.

Table 1. Multi-Scales for Different Time Horizons

Scales	Annually	Monthly	Daily
Scale-1 (D1)	2-4	2-4	2-4
Scale-2 (D2)	4-8	4-8	4-8
Scale-3 (D3)	8-16	8-16 (8m-1y4m)	8-16
Scale-4 (D4)	16-32	16-32 (1y4m-2y8m)	16-32 (3w1d-6w2d)
Scale-5 (D5)	32-64	32-64 (2y8m-5y4m)	32-64 (6w2d-12w4d)
Scale-6 (D6)	64-128	64-128 (5y4m-10y8m)	64-128 (12w4d-25w3d)
Scale-7 (D7)	128-256	128-256 (10y8m-21y4m)	128-256 (25w3d-51w1d)
Scale-8 (D8)	256-512

WTC analysis can be applied to examine how the relationship between two time series evolves over time according to different frequencies. With WTC analysis, all regions in time-frequency space where two time series move together or interact can be identified (Kangalli Uyar, 2021). Accordingly, it enables the calculation of the local correlation coefficient between two time series in time-frequency space. For two time series $x(t)$ and $y(t)$, the WTC measure can be defined as in Equation (7):

$$R(u, s) = \frac{|S(s^{-1}W_{xy}(u, s))|}{S(s^{-1}|W_x(u, s)|^2)^{1/2} * S(s^{-1}|W_y(u, s)|^2)^{1/2}}, \quad (7)$$

Here, S denotes the smoothing processor at the time scales. Smoothing is a necessary operation for all time scales, without which the wavelet coherence coefficient, $R(u, s)$, would be equal to 1 for each time scale (Rua & Nunes, 2009; Vacha & Barunik, 2012). The squared expression of this coefficient is expressed as in Equation (8). The squared wavelet coherence coefficient takes values between 0 and 1: $0 \leq R^2(u, s) \leq 1$.

$$R^2(u, s) = \frac{|S(s^{-1}W_{xy}(u, s))|^2}{S(s^{-1}|W_x(u, s)|^2) * S(s^{-1}|W_y(u, s)|^2)}, \quad (8)$$

A value of $R^2(u, s)$ close to 0 indicates that the local correlation between the two different time series is weak, while a value close to 1 indicates that it is strong (Rua & Nunes, 2009). By calculating this coefficient for different time scales, the nature of the relationship between two different economic indicators can be analyzed. A significant increase in high frequencies, especially for certain periods (e.g. crisis periods), is considered as an indicator of contagion effects, while a still strong relationship at low frequencies is interpreted as an indicator of interdependence between markets.

The outputs of the WTC analysis can be displayed as heat graphs instead of being presented as tables. The direction of the arrows in the WTC graphs provides information about the direction of the relationship between time series (Tekin et al., 2024; Tekin, 2024; Tekin & Temelli, 2024). Arrows pointing to the right indicate that the relationship between variables is positive, while arrows pointing to the left indicate that the direction of the relationship is negative. The direction of the arrows also allows us to examine the causality between the time series. Arrows pointing upwards indicate that the first time series affects the second, while arrows pointing downwards indicate that the second time series affects the first. The WTC heat plots dynamically present the relationship between variables at different time scales. Therefore, there is a need to compare the results using a benchmark. Correlation coefficients ($\rho_{X,Y}$) are calculated using Equation (9).

$$\rho_{X,Y} = \frac{\sum_{i=1}^n (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^n (X_i - \bar{X})^2} \sqrt{\sum_{i=1}^n (Y_i - \bar{Y})^2}} \quad (9)$$

where, since X and Y are two random variables, they are inflation and health expenditures in the analyses.

3.1. Findings

According to the results of the analysis, WTC graphs were obtained for each province to evaluate the relationship between variables in the short-, medium- and long term. While analyzing the findings, the WTC graph of one province representing each region was evaluated. Graphs for other provinces are presented in Appendix-2. Considering that the time period of the study was 2004-2021, the provinces representing the regions were determined by considering the number of primary, secondary and tertiary applications in 2021 for each province. According to the statistics of the Ministry of Health for 2021, Istanbul represents the Marmara Region; Samsun represents the Black Sea Region; Izmir represents the Aegean Region; Adana represents the Mediterranean Region (Mersin province could not be included in the evaluation since there is no data in the relevant statistical yearbook); Gaziantep represents the Southeastern Anatolia Region; Van represents the Eastern Anatolia Region; and Ankara represents the Central Anatolia Region (Republic of Türkiye Ministry of Health Ministry of Health Report, 2021). The reason for conducting the analysis over seven provinces representing seven regions is that each region has its own geographical and demographic characteristics. Different structural

characteristics may lead to different types of diseases and different levels of health expenditure. For instance, Mediterranean anemia and skin cancer, which are common in the Aegean and Mediterranean regions, do not occur with the same frequency in the Black Sea region. Likewise, due to the Chernobyl disaster, cancer diseases that are common in the Black Sea region may be less common in other regions. This situation causes differences in health expenditures. WTC results for these provinces are shown in Figure 1.

Figure 1. The Results of Wavelet Coherence (The 50th, 100th, 150th and 200th observations on the horizontal axis in the graphs refer to February 2008, April 2012, June 2016 and August 2020, respectively)

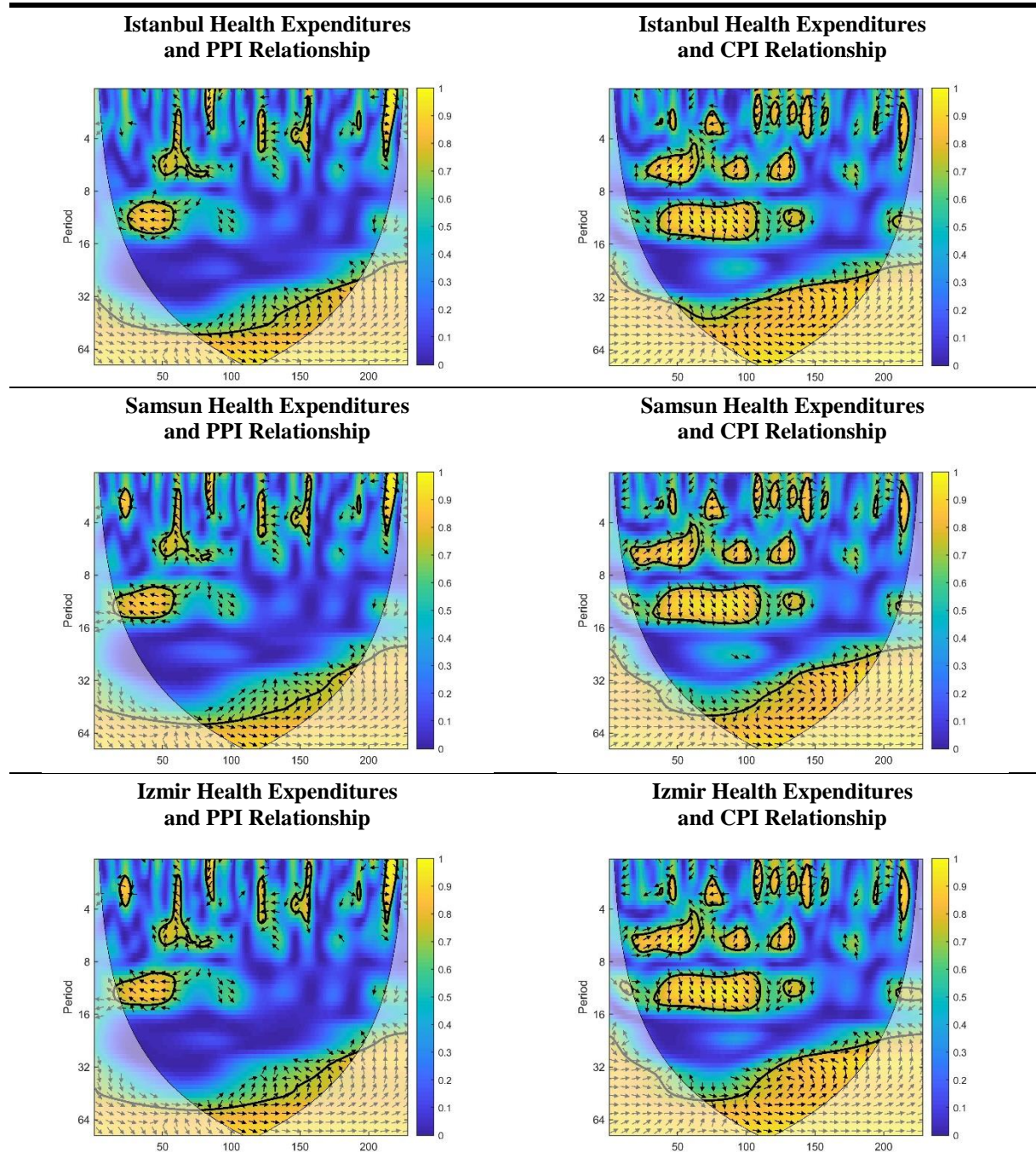
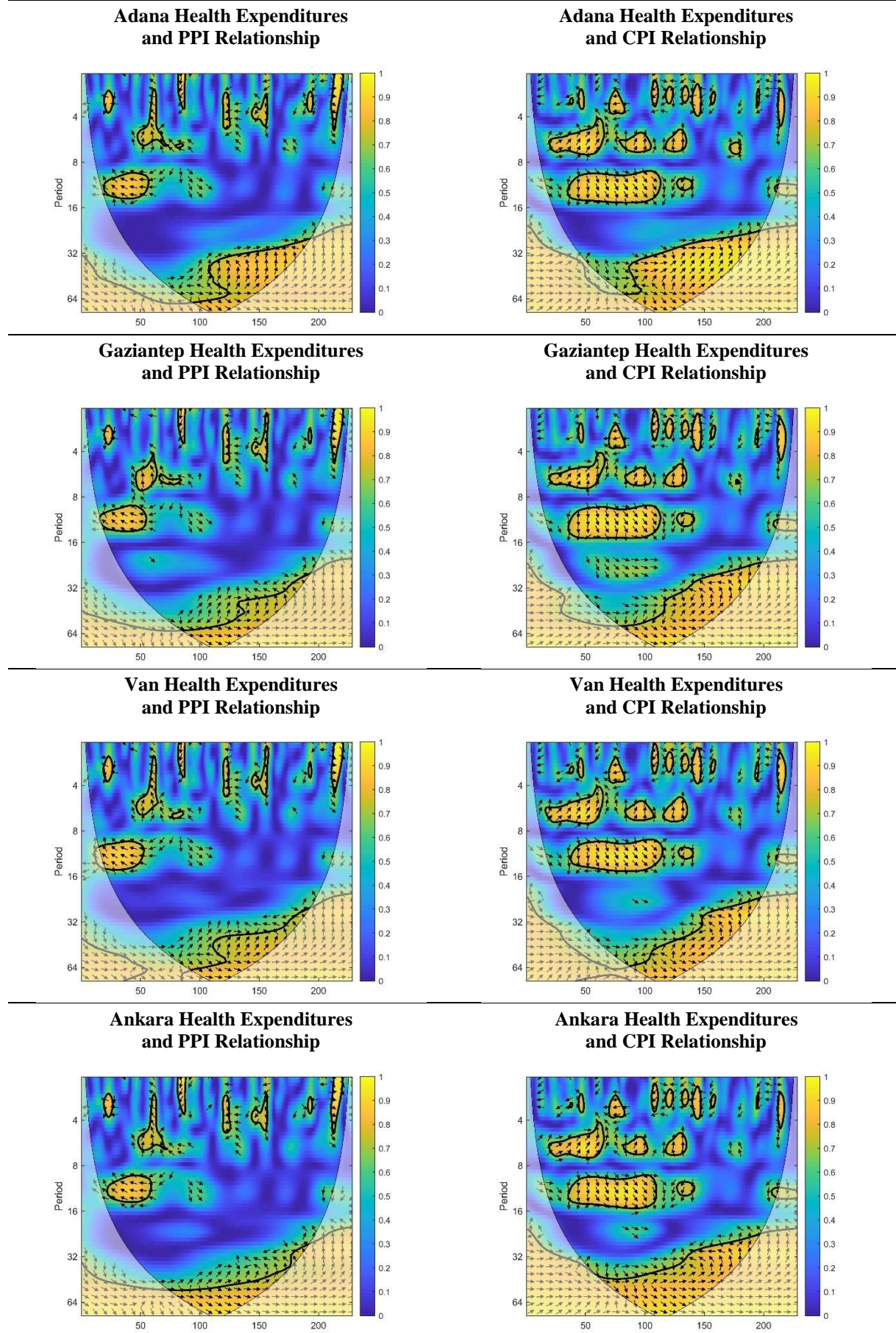


Figure 1 (cont.)



In Figure 1, the relationship between health expenditures and inflation variables (PPI and CPI) for provinces representing seven different regions is presented using WTC heat graphs. Based on the studies of Gencay et al. (2005), and Torrence and Compo (1998), Wavelet Multi-Scaling and WTC techniques are used in the analyses and the relationship directions and causality links are analyzed at five different scales. D1 and D2 scales are interpreted as short-term, D3 and D4 scales as medium-term, and D5 scales as long-term cycles (or relationships). The faded area outside the u-shape in the WTC graphs represents the region that cannot be interpreted. This region represents the area where there are not enough observations to complete the Wavelet cycles and is excluded from interpretation. The areas delimited by solid lines indicate statistically significant regions. Moreover, arrows pointing to the right indicate that the relationship between the variables is positive, while arrows pointing to the left indicate that the direction of the relationship is negative. On the other hand, arrows pointing upwards indicate that health expenditures affect the inflation variable, while arrows pointing downwards indicate the opposite effect.

When the graphs showing the relationship between health expenditures and PPI are analyzed, it is observed that the results are quite weak for all provinces in short-term economic cycles and cannot be interpreted clearly. In the medium-term economic cycles, a negative correlation is observed between May 2006 and May 2008. The direction of the arrows is mostly upward in statistically significant areas. This implies that there is a causality relationship from health expenditures to PPI. An increase in health expenditures in the period leads to a decrease in PPI, which is an indicator of inflation in producer input prices. This finding may be related to the transformations in the health system in the relevant years. As of 2006, the family medicine system came into effect in Türkiye and accordingly, access to health services became easier. In 2007, according to the Social Security Institution Health Implementation Statement published in 2007, co-payments for examinations and medication were collected from individuals (The Official Gazette Türkiye, 2007). These differences in the health system support the relationship between health expenditures and PPI. An analysis of long-term economic cycles reveals different results across provinces. While no significant relationship is observed for Samsun, Izmir and Ankara in the long-run cycles, a positive correlation is found for Istanbul starting from July 2015, Adana and Van from January 2013 and Gaziantep from September 2014. The causality direction of the relationship is from health expenditures to PPI as in medium-term cycles. The fact that the provinces in the findings are located in different regions of Türkiye leads to a higher prevalence of different diseases. On the other hand, socio-demographic and socio-economic factors, lifestyle, culture, and health literacy also determine individuals' use of health services. This situation takes on a determining role in health expenditures.

When the graphs showing the relationship between health expenditures and CPI are analyzed, short-term relationships can be detected in short-term cycles in all provinces between 2010 and 2015. The sign of these relationships is negative, and the direction is from CPI to health expenditures. It can

be interpreted that an increase in the CPI leads to short-term decreases in health expenditures. It is thought that this finding may be related to the correct management of the health service process of individuals. In this context, the contributions of family physicians in managing the health service process of individuals and their guidance to them are important. Therefore, unnecessary waste of time and cost can be prevented through the patient who can manage/direct the health service process correctly. This has an important role in reducing health expenditures. When the medium-term cycles are analyzed, there is a positive relationship between the variables between 2008 and 2012 for all provinces. The direction of causality is from CPI to health expenditures. It is observed that increases in the CPI within the 8–16-month cycle periods increase health expenditures on a provincial basis. This relationship is not sustained in any province after 2012 in the analyzed data period. It is predicted that the developments in the Turkish health system may explain the relationship between the variables in the medium-term cycles. Accordingly, the signing of agreements between the Social Security Institution and private hospitals in 2010, the closure of the Hygiene Institutes in 2011 and the importation of vaccines, the establishment of the Public Hospitals Union in 2011 and its closure in 2017, and the transition to General Health Insurance in 2012 may be the reason for the positive relationship between CPI and health expenditures. When long-term cycles are analyzed, a positive-sign relationship from health expenditures to CPI is observed for all provinces. The reversal of the relationship from CPI to health expenditures in short- and medium-term cycles to the opposite in long-term cycles is a noteworthy finding. This finding, which is interpreted as health expenditures increasing inflation in long-term economic cycles, is important for policymakers. It is thought that the difference between the cycle periods, especially in the long-term period, may be related to the period 2004–2022, when the study data were collected. Factors such as city hospitals, public hospital unions, family medicine, general health insurance, health literacy level, digital hospitals, differentiation of health perception, information sharing from online platforms for health services, etc., especially the "Health Transformation Program" that came into force as of 2003, which has been experienced in the Turkish health system between these years, may assume a determining role on the general results obtained regarding the variables.

The starting points of the long-term loop relationship vary across regions. For Samsun, Izmir, Adana and Van provinces, there is a continuous relationship starting after April 2012, while for Istanbul there is a continuous relationship starting after July 2010, for Gaziantep after November 2013 and for Ankara after July 2015. This long-term cyclical relationship can be explained by significant changes in the Turkish Health System. In 2011, the era of "Contracted Management" began and managers' salaries were paid from the revolving fund. In 2012, the General Health Insurance system was introduced in Türkiye. General health insurance is a system in which all citizens are covered by health insurance against the risk of disease, regardless of their economic power and will. In 2016, with the establishment of city hospitals, supply elements in health services were increased. The increase in the number of hospitals, beds and personnel also played a role in increasing health expenditures. In 2012, a pilot

scheme for digital hospitals was launched in Ankara. In this regard, the digital/paperless hospital project entered into force. After the effective date of these practices, a positive causality relationship emerges from health expenditures to the inflation variable in long-term economic cycles.

The start of the long-term economic cycle relationship in Istanbul in 2010 can be explained by other structural changes. Istanbul has both the largest population and the highest population density in Türkiye. With its dense population, Istanbul is an attractive location for health tourism. In addition, joint disorders are more common in the metropolitan city than in other regions. There are a total of 10 mental health and illness hospitals in Türkiye, which serve as separate specialty hospitals. There are only two of these hospitals in Istanbul (Bakirkoy Prof. Dr. Mazhar Osman Mental Health and Neurological Diseases Training and Research Hospital and Erenkoy Mental and Neurological Diseases Training and Research Hospital). Therefore, in the referral system, Istanbul's health expenditures increase in mental health services as well as in other areas of health services.

Overall, the findings suggest that there are dynamic correlations between inflation variables and health expenditures in the short, medium and long run. This finding, which is in line with the theoretical expectation, has different relationship directions in different cycles. Moreover, the cycles and directions of the relationship vary across the seven different regions of Türkiye.

4. CONCLUSION

Health services are a type of service whose supply and demand are realized simultaneously, cannot be postponed and cannot be stocked. Expenditures and financing constitute the basis of health services, which have different characteristics. The fact that health expenditures continue to increase day by day is a common denominator of countries globally. In this framework, health systems, especially the level of development of countries, play an important role in shaping expenditures. In this respect, health expenditures are tried to be managed in the desired way by preventing waste in services. To save time and cost, health services are evaluated under three headings: preventive, curative, and rehabilitative health services (Tengilimoglu, 2012). In 2003, Türkiye experienced a transformation in order to solve the problems experienced in health services and the "Health Transformation Program" came into force. In line with the relevant program, many changes have occurred in health services. These changes have enabled similar practices (number of hospitals, family medicine model, public hospitals union, health financing, etc.) to be implemented in Türkiye. As a matter of fact, in Türkiye's health system, this situation is supported by the decision of "effective, gradual referral chain" within the framework of the Health Transformation Program that started to be implemented in 2003 (Akdağ, 2008).

In the economics literature, there are many studies on the differences in Türkiye's health system and the desired management of health expenditures. The findings of each study and the path that it subsequently shows play an important role in ensuring improvements and progress in the health system. However, the methods used in the studies are important in terms of the results to be obtained. Especially,

there are many studies that examine the relationship between health expenditures and inflation. These studies mostly use time series analysis, panel data analysis, regression analysis, least squares method, co-integration analysis. Each econometric analysis serves different purposes and examines the relationship from a different perspective. However, these methods fail to reveal the contagion and interdependence effects between health expenditures and inflation. Contagion refers to the temporary strengthening of economic linkages after a shock to the economy. Interdependence, on the other hand, refers to long-lasting strong linkages between variables that exist before and after any crisis or structural change. The existence of contagion and/or interdependence effects between health expenditures and inflation means providing important information to policy makers who aim to save time and cost in the health system.

In this study, the relationship between health expenditures and inflation is tested with the help of Wavelet coherence analysis for 81 provinces of Türkiye for the period 2004-2022. Yet, for the sake of clarity, one province from each of the seven regions of Türkiye was selected and analyzed in detail. Wavelet coherence analysis is an analysis that allows the examination of mutual relations without the need to apply any transformation to the time series. It allows to analyze the relationships in short-, medium-, and long-term cycles. The findings of the Wavelet coherence analysis allow to reveal and interpret the favorable and unfavorable results of the implementations in the Turkish health system for the analyzed time interval. When the results of the study are evaluated, it is determined that the relationship between health expenditures and inflation variables differs in the short, medium and long run in seven regions of Türkiye. The result obtained is similar to the results of the studies in the literature (Hayaloglu & Bal, 2015; Ankara & Zeybek, 2021; Turgut et. al, 2017; Dunn et. al, 2018; Teimourizad et. al, 2014; Russell, 1975; Dikmen, 2004; Taskaya & Demirkiran, 2016; Ilgun et. al, 2023; Akobi et. al, 2021). This finding supports the variables such as geography, culture, lifestyle and economic status as well as differences in diseases, disease risks and health literacy across regions. Interdependence effects between health expenditures and PPI are observed in almost all provinces, however, both contagion and interdependence effects are observed between CPI. In particular, while there is a negative relationship from health expenditures to PPI in the medium term between May 2006 and May 2008, there is a positive relationship in the long term from January 2013 for Adana and Van, September 2014 for Gaziantep and July 2015 for Istanbul. This result supports some studies in the literature (Hayaloglu & Bal, 2015). However, it is not equivalent to some studies (Ankara & Zeybek, 2021; Kubar, 2016; Akobi et. Al, 2021). While there is a negative relationship from CPI to health expenditures in the short run between 2010-2015, there is a positive relationship in the medium run between 2008-2012 for all provinces. In the long run, there is a relationship from health expenditures to CPI. The significant relationship between the variables is also supported by the studies in the literature (Hayaloglu & Bal, 2015; Ankara & Zeybek, 2021; Teimourizad et.al, 2014; Akobi et al. 2021). In the long run, the relationship between variables differs across regions. There is a continuous relationship in Istanbul as

of July 2010; in Samsun, Izmir, Adana and Van as of April 2012; in Gaziantep as of November 2013; and in Ankara as of July 2015.

Differences between regions in the relationship between health expenditures and PPI reveal the role of PPI on health expenditures. On the other hand, the differences between provinces support the fact that the policies designed for the effective management of health services and the improvements made in the system cannot achieve the expected results in the same manner in each region. Therefore, it is believed that the results determined for the provinces representing the seven regions will be instructive for policy makers. Furthermore, the results obtained between health expenditures and the CPI provide a general framework for interpreting the changes and transformations in the Turkish health system. Particularly, it is observed that the services that were introduced at certain dates, especially in the area of health financing, and which are now being implemented in the health system in that way, have a different impact on each province, especially in long-term cycles. This makes it possible to monitor the positive/negative results of the practices in the system that differentiate services, together with the differences between regions. In line with the results obtained in this respect, it is envisaged that improvements can be made in the system by examining the health systems of other countries.

Based on the results obtained in the study, the following suggestions can be made for future studies:

- The health literacy level of each province/region can be determined and its role in health expenditures can be analyzed.
- Studies on the relationship between health expenditures and inflation can be conducted comparatively before and after the pandemic.
- Comparative evaluations can be made with countries with similar health policies in terms of health financing.

Ethics Committee approval was not required for this study.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors declare that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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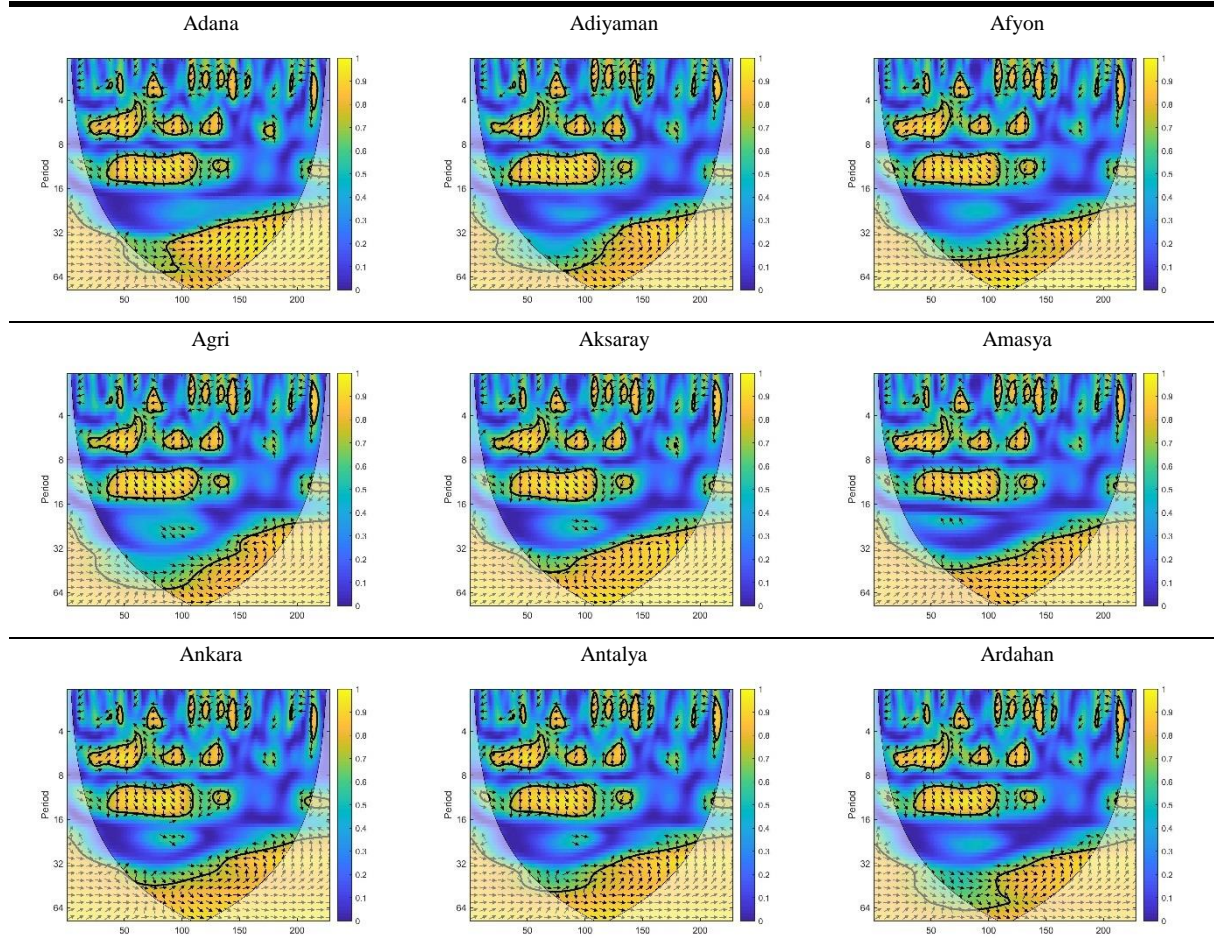
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Appendix 1. Descriptive Statistics of Variables

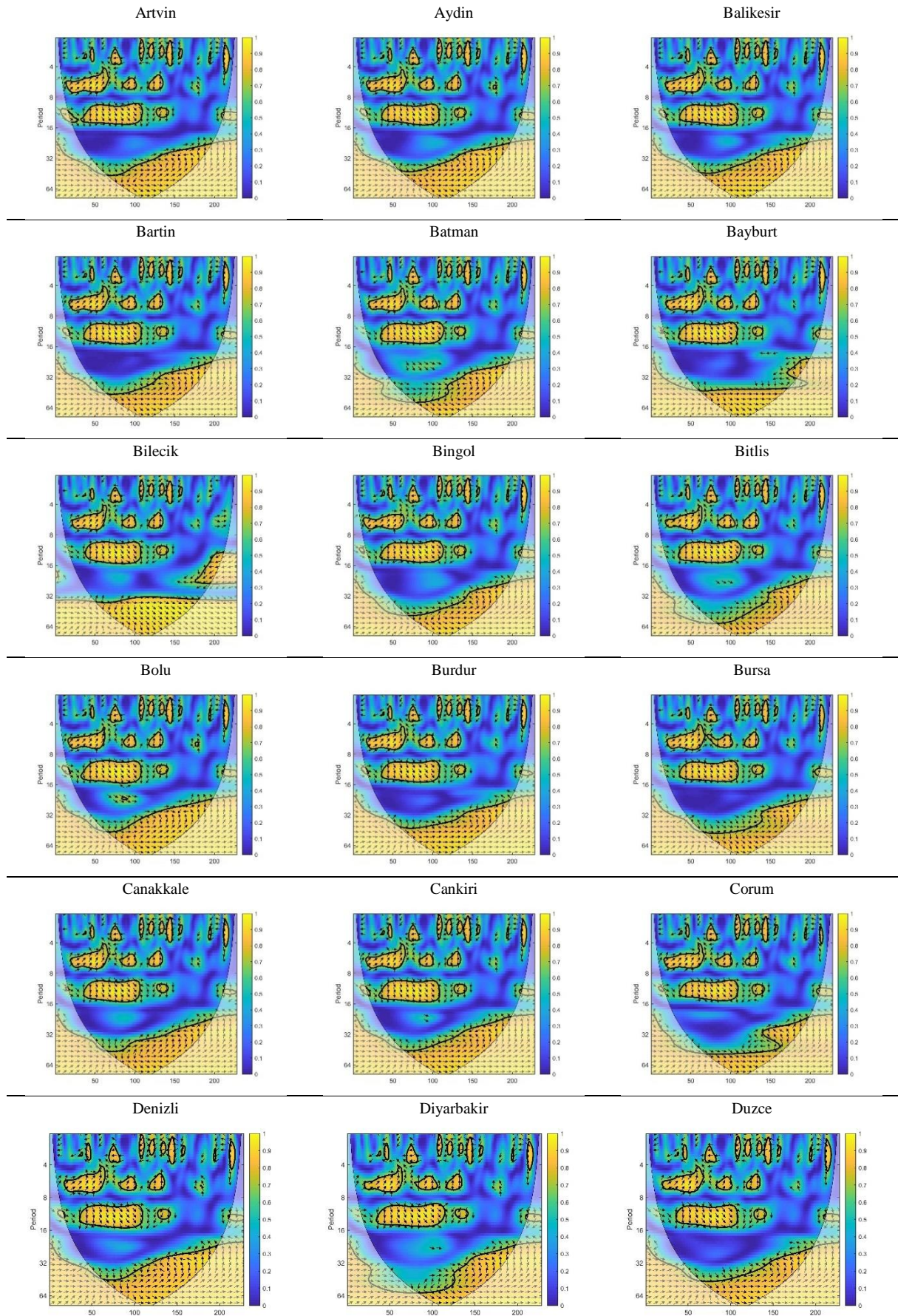
Variable	Mean	St. Dev.	Min.	Max.
TUFE	0, 010608	0,015482	-0,0144	0,1358
UFE	0,01344	0,023978	-0,0354	0,1908
Adana	549160,8	777334,5	10278	5192185
Adıyaman	140057	160867	2922	1182198
Afyon	140444,1	170207,6	4336	1238551
Agri	88290,87	102875,9	1187	772977,3
Aksaray	71873,03	92596,59	1909	678407
Amasya	84051,21	97219,74	2750	707411
Ankara	1523655	2375624	26748	1,78E+07
Antalya	365293,4	463567,6	10557	3330126
Ardahan	27305,25	33761,96	551	237645,5
Artvin	49638,75	58010,45	1981	420500,3
Aydin	209128,6	257447,8	6541	1867791
Balikesir	231225,5	292300,9	7090	2090870
Bartın	39792,45	48771,02	1069	353599,6
Batman	113001	145138,1	825	1058764
Bayburt	26770,29	35645,54	597	245877,8
Bilecik	55701,58	93922,88	746	625221
Bingöl	76463,15	89610,54	1615	656359,9
Bitlis	79236,25	98527,98	1150	722003,7
Bolu	72146,27	91308,48	2447	659004,5
Burdur	71257,83	95447,93	2473	761646,3
Bursa	522106,5	812112,5	7445	5548699
Canakkale	117629,6	15898,4	3244	1170277
Cankiri	46657,36	58231,15	1725	432905,9
Corum	122698,1	145130,7	3633	1067232
Denizli	185483,5	233242,1	4707	1737677
Diyarbakır	329453,9	383935,8	6391	2847918
Düzce	64918,76	84253,41	1424	616135,7
Edirne	98416,74	120152,3	3118	865937,8
Elazığ	240785,8	363798,7	4344	2363090
Erzincan	61219,35	78084,99	1648	567509,9
Erzurum	230898,9	270169,6	4228	1943168
Eskişehir	268924,7	422969,2	5219	2722440
Gaziantep	273357,9	350801,9	3620	2535007
Giresun	110825	141460,4	3769	1048154
Gümüşhane	40972,93	52599,36	1262	407796,5
Hakkari	57878,11	70642,06	921	548016,9
Hatay	238355,2	303343,5	3160	2212885
Iğdir	37934,52	44857,55	699	329430,6
Isparta	200792,1	290024,6	4805	1849268
İstanbul	2060082	3186608	37893	2,29E+07
İzmir	753475,3	905596,5	25560	6677298
Kahramanmaraş	218693,9	252168	2757	1791926
Karabük	56380,87	70796,52	1534	511049,5
Karaman	51214,42	66498,79	1221	489039,7
Kars	65533,79	80113,72	1014	578154,2
Kastamonu	84581,16	100629,1	2852	731242,8
Kayseri	384346,4	659721,4	6680	4391263
Kırıkkale	77458,19	85387,58	2982	629897,3
Kırklareli	71827,5	149552,5	1805	1901593
Kirşehir	59353,05	72575,37	1369	531935,4
Kilis	39843,19	60860,74	567	468207,7
Kocaeli	254565,1	341829,4	5155	2447419
Konya	469815	731203,3	8917	5143339
Kütahya	113409,2	140611	2857	1007813
Malatya	200607	237479,2	3969	1736869
Manisa	308100,5	436971,5	6556	2940877

Mardin	142473,8	182182,9	2452	1340710
Mersin	444440,8	624906,1	6566	4138135
Mugla	159388,1	202622,7	5774	1477731
Mus	76282,72	88256,69	1000	643993,7
Nevşehir	62300,65	75414,68	2185	548950,3
Nigde	72083,59	85973,98	2184	633860,4
Ordu	150035,6	182898,5	4383	1336605
Osmaniye	96385,17	118042	2778	900004,4
Rize	74710,74	91886,68	1770	671485,6
Sakarya	147988,2	208406,5	3315	1513310
Samsun	294060,2	355386	9450	2623097
Siirt	677727,78	83009,6	1281	607978,4
Sinop	55140,06	69513,41	1708	505226,9
Sivas	162474,6	209958,7	3309	1557767
Sirnak	84363	112062,3	771	837656,2
Tekirdag	159312,3	267450,1	3142	1878278
Tokat	146141,6	164920,7	4263	1204339
Trabzon	212432,5	254785,2	6919	1865589
Tunceli	31772,24	39131,35	106	292609,7
Urfa	287483,1	368949,8	3428	2661606
Usak	75445,2	91759,18	2472	668160,5
Van	209342,2	243539,8	2907	1775728
Yalova	44207,91	61141,96	961	446380,4
Yozgat	153054	212641,8	2423	1371842
Zonguldak	116233,3	137881,5	2648	999819,6

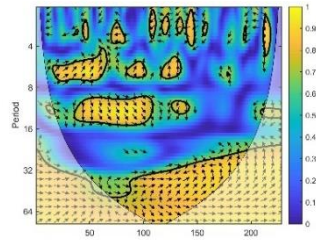
Appendix 2. Health Expenditure and TUFEE Relationship WTC Results for All Provinces of Türkiye



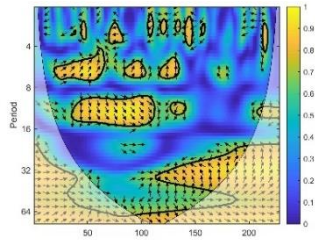
The Relationship Between Health Expenditures and Inflation by Provinces in Türkiye: Wavelet Coherence Analysis



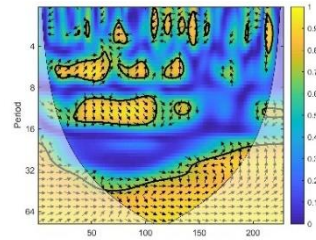
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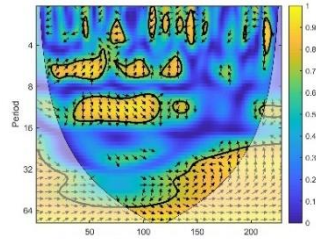
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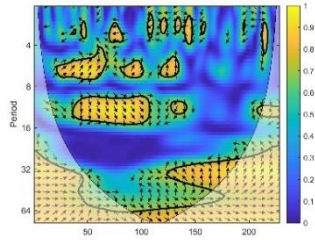
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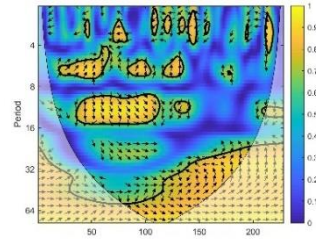
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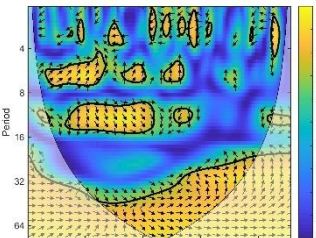
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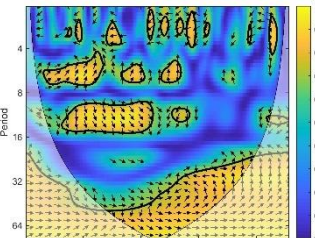
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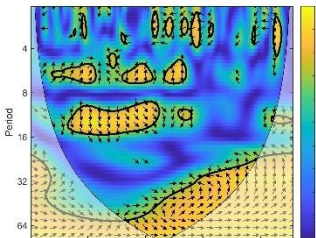
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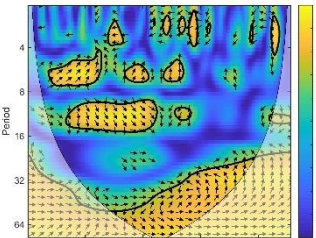
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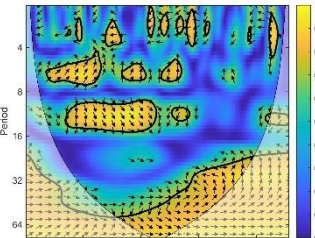
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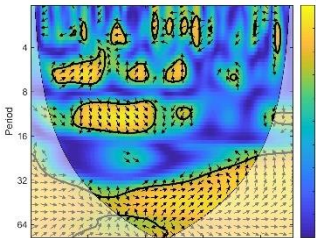
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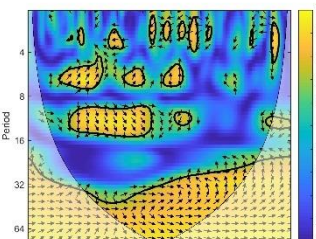
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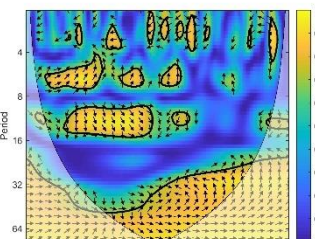
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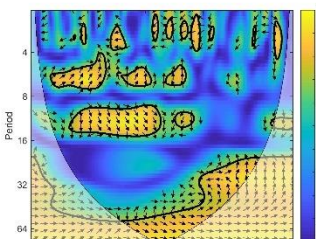
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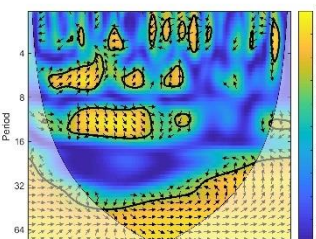
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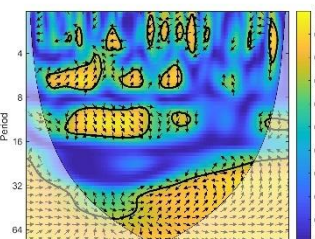
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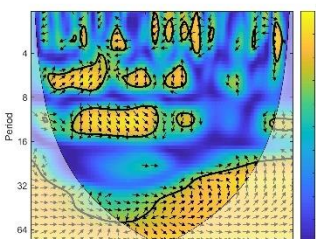
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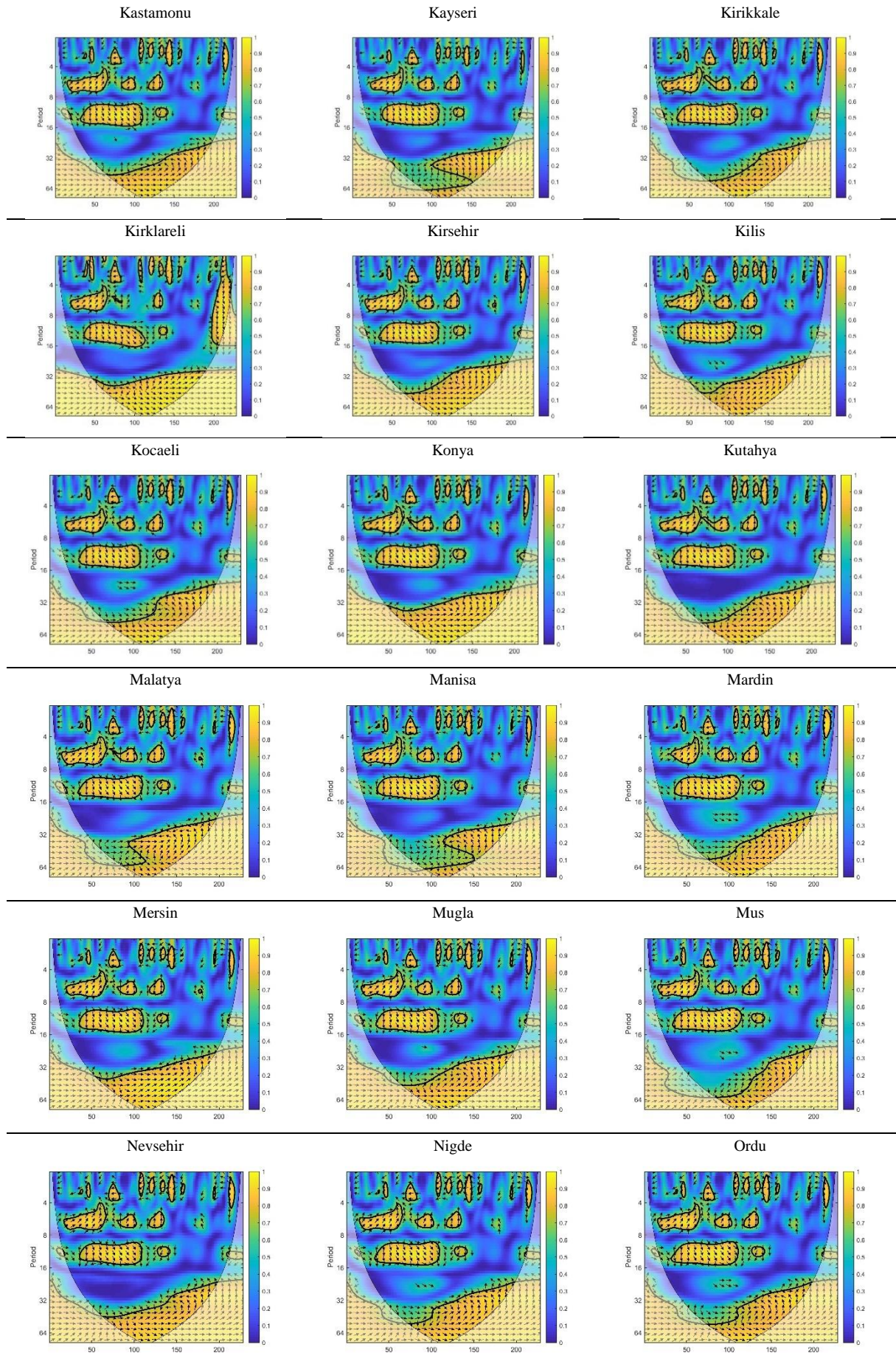
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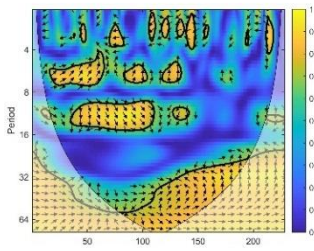
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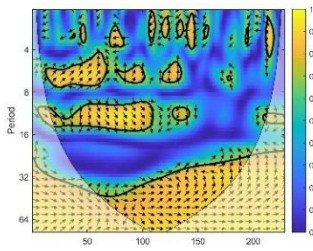
The Relationship Between Health Expenditures and Inflation by Provinces in Türkiye: Wavelet Coherence Analysis



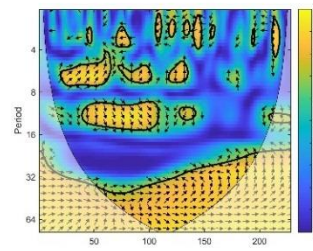
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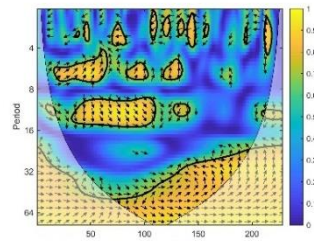
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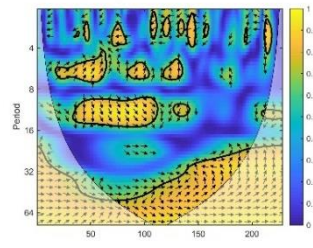
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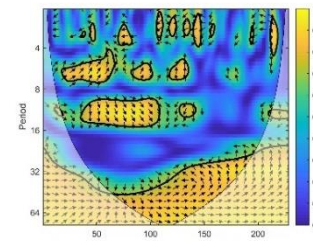
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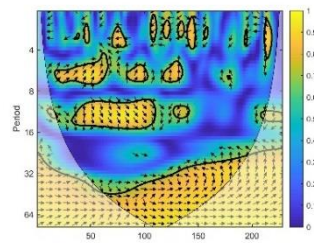
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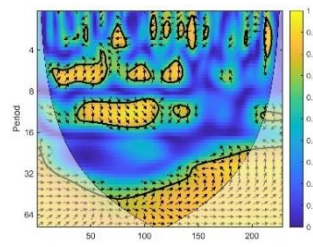
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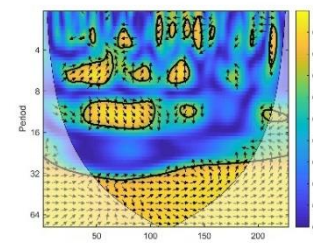
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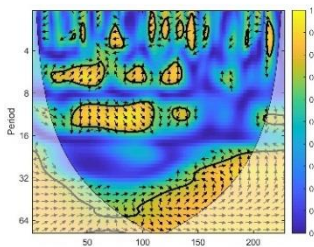
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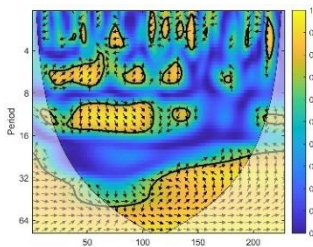
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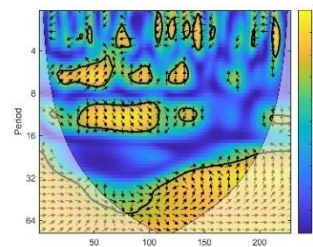
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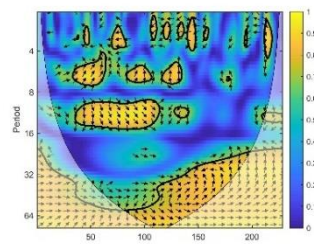
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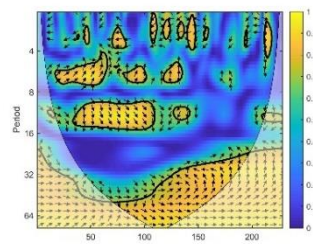
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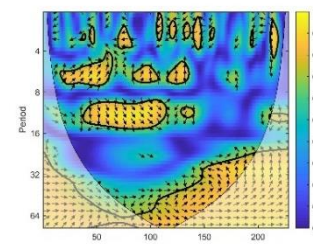
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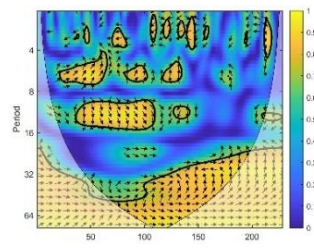
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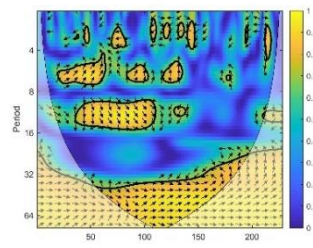
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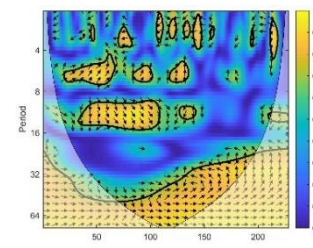
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International Transfer of Ecological Footprint: An Analysis for the Countries with Different Income Levels

Erdal ALANCIOĞLU¹, Yusuf BAYRAKTUTAN², Maya MOALLA³

Abstract

Environmental repercussions driven by economic activities have caused developed nations to incur higher costs depending on the adherence to environmental standards adopted along with public pressure. Because of their lower environmental standards, developing countries have secured a competitive cost edge in polluting sectors, attracting foreign direct investment and triggering debates about pollution havens. Such a scenario poses a potential risk of amplified carbon releases (CR) in developing nations. However, foreign direct investments originating from developed nations can enhance management practices, disseminate environmentally friendly advanced technologies, and ultimately reduce CR in developing nations. The primary aim of this study is to examine the effects of economic variables that seem to contribute to the carbon footprint, utilizing data from 10 developed and developing countries. This study investigates the impacts of foreign direct investment, national income, and export variables on the ecological footprint during the period spanning from 2000 to 2022, making use of the CS-ARDL method. The results revealed that the ecological footprint is affected by foreign direct investments, increased national income, and the expansion of exports. It is essential to raise environmental standards to an international level and promote eco-friendly production and growth approaches to reduce the ecological footprint and protect environmental values globally, not just in developed countries. Moreover, policymakers must ensure considering environmental values in foreign direct investments in developing countries, supporting this through regulations, and preventing the exploitation of low environmental quality for export advantages.

Keywords: *Ecological Footprint, Economic Growth, Foreign Direct Investment, Export.*



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1. INTRODUCTION

The environmental drawbacks accompanying foreign investments is one of the commonly debated issues related to foreign direct investment. It is crucial to assess the environmental impacts of foreign direct investment to achieve contemporary environment friendly economic growth. Many developing countries changed their strategies from import substitution to export-oriented growth, which led to a new international trade and investment model based on the comparative advantages of both developed and developing countries concerning productivity and production costs. The correlation among economic growth, environmental pollution, and foreign direct investment has been thoroughly discussed. The literature emphasized two different approaches investigating the environmental impacts of foreign direct investments. The first one is the pollution haven hypothesis (PHH) which posits the existence of a positive relationship between foreign direct investments and environmental pollution (Al-mulali & Foon Tang, 2013). In accordance with the assumptions associated with this hypothesis, developing economies attract foreign investments in environmentally harmful production processes under global conditions where different environmental standards are in practice, leading to an escalation in CO₂ levels in these nations (Musah et al., 2022).

The national strategies in terms of environmental regulation differ between developed and developing countries. While companies in developing countries often specialize in high-pollution-intensity manufacturing sectors, those in developed ones tend to move away from pollution-intensive sectors (Cole, 2004, p. 73). In developing countries, increases in foreign investment inflows are commonly linked to multinational companies seeking access to a cheap workforce and ample natural resources. Nevertheless, according to the PHH, developing countries' attractiveness for foreign direct investment stemmed from their more lenient environmental regulations compared to developed ones (Destek & Okumus, 2019, p. 23689). In this context, even as foreign direct investments stimulate growth, developing economies experience adverse effects attributable to a rise in energy demand and associated environmental impacts (Liobikienė & Butkus, 2019). As a result of variable environmental regulations, developing countries gain a competitive advantage, causing pollution-intensive industries to migrate from developed to developing nations to reduce production costs (Bayraktutan, 2022, p. 89).

The second approach is the pollution halo hypothesis, which posits the existence of an adverse nexus between foreign direct investments and environmental pollution, indicating that the production structure of multinational companies is generally based on clean technology. As a result, the increase in such investments will aid in the propagation of universal environmental standards in host nations through the implementation of high-tech and eco-friendly technologies (Destek & Okumus, 2019, p. 23689; Terzi & Pata, 2020). The environmental quality will be enhanced domestically if foreign firms carry out foreign direct investments in accordance with implementing cleaner and energy-efficient technologies along with advanced ecological management (Balsalobre-Lorente et al., 2019).

The primary goal of this paper is to investigate the validity of the pollution haven hypothesis for selected 10 countries, including both developed and developing nations, over the period spanning from 2000 to 2022. This study has the potential to contribute to the existing literature in the following ways: 1) examining the validity of the pollution haven hypothesis through the ecological footprint, with a sample including both developed and developing nations which vary in terms of environmental regulations and standards; 2) differentiating the validity of this hypothesis in both the short and the long terms, thanks to its empirical methodology, i.e., making use of the CS-ARDL boundary test.

This paper is organized as follows: following the introduction, the second section provides a summary of the pertinent literature. In the third section, the methodology and model are introduced, and empirical findings are presented. Lastly, the findings are examined, and policy recommendations are presented.

2. LITERATURE REVIEW

There are various empirical studies concerning the direct link between foreign direct investment and environmental factors in the literature. Aliyu (2005) assessed the pollution haven hypothesis by utilizing data over the period from 1990 to 2000, encompassing 11 OECD countries and 14 non-OECD countries and employing panel data analysis. The results revealed no significant connection between foreign direct investments and pollution levels in non-OECD countries and a positive relationship between foreign direct investments and environmental policy in OECD countries. He (2006) revealed that the pollution haven hypothesis holds true for 29 cities in China using data from the period 1994-2001 and the Generalized Method of Moments (GMM). Shahbaz et al. (2011) also confirmed the validity of the pollution haven hypothesis from 1985 to 2006 utilizing data from 110 developed and developing nations and employing the Pooled, Fixed, and Random Effects methods for the analysis. Shahbaz et al. (2015) confirm the validity of the PHH during the period spanning from 1975 to 2012, utilizing data from 99 countries and employing the Fully Modified Ordinary Least Squares (FMOLS) and Pedroni cointegration test. Moreover, the results indicated a reciprocal causation between CO₂ emissions and foreign direct investments, identified on a global scale. Neequaye & Oladi (2015) investigated foreign direct investments' impacts on the environment during the period spanning from 2002 to 2008, focusing on a selected sample of 27 developing countries, revealing that while environmental aid helps reduce emissions in these countries, foreign direct investment inflows adversely impact the environment. Sapkota & Bastola (2017) revealed that the pollution haven hypothesis holds true for 14 Latin American nations from 1980 to 2010, using the Fixed and Random Effects method. The mutual nexus between foreign direct investment, institutional factors, financial development, and sustainability have been investigated by Singhanian & Saini (2021). They tested the validity of PHH with the context of 21 developed and developing nations with high carbon releases during the period spanning from 1990 to 2016, utilizing the GMM and System Generalized Method of Moments (Sys-GMM), revealing that foreign direct investments exhibit a notable positive impact on environmental deterioration. In the

context of Türkiye, Mike (2020) confirmed the validity of the PHH since foreign direct investments demonstrate an increasing impact on CO₂ releases, utilizing annual data of 1971-2015 for the carbon dioxide model, and that of 1970-2012 for the nitrogen oxide and total greenhouse gas models.

Recent studies conducted by Arslan et al. (2021) and Farooq et al. (2021) shed light on the potential adverse effects stemming from investments by advanced economies on environmental quality in developing economies, indicating that foreign direct investments contribute to extended impact on environmental deterioration in developing countries. In opposition to the pollution haven hypothesis, there are studies demonstrating a significant positive impact on the environment from foreign direct investors. For instance, Haisheng et al. (2005) asserted that, based on data related to trade, foreign direct investment, economic development, and environmental conditions in 30 provinces of China from 1990 to 2002, neither trade nor foreign direct investment had a distinct impact on the environment, indicating that foreign direct investment shows a positive impact on economic evolution and helps in inventing new technologies to reduce pollution. Honglei et al. (2011) delve into foreign direct investment's impact on environmental pollution for 30 regions in China utilizing data covering the period from 1993 to 2007 and incorporating variables such as economic growth and foreign trade, revealing that foreign direct investment did not have a destructive impact on the local environment. The result drawn from the simultaneous equation model indicated that China was not acting as a pollution haven for developed countries. Rafindadi et al. (2018) delve into the relationship between foreign direct investments and environmental pollution, aiming to investigate the influence of global economic integration on environmental quality, specifically for the Gulf Cooperation Council (GCC) nations, employing the Pooled Mean Group method for the period spanning from 1990 to 2014, revealing that foreign direct investment inflows significantly reduce environmental deterioration.

To summarize, mixed results with different specifications and datasets have been observed in the literature.

3. EMPIRICAL ANALYSIS

3.1. Methodology

3.1.1. Dependence Across Sections and Homogeneity of Slopes

The analysis should focus on whether all cross-sectional units uniformly impacted when a shock occurs in a series in panel data scrutiny. Standard panel data approaches presume the absence of dependence among cross-sectional units and homogeneity in slope coefficients. However, neglecting cross-sectional dependence can lead to inaccurate interpretations (Chudik & Pesaran, 2013). Furthermore, estimated coefficients may exhibit variation across cross-sectional units. Accordingly, the presence of cross-sectional dependence and slope homogeneity will be scrutinized as a first step. Pesaran's (2004) CDLM and Pesaran et al.'s (2008) Bias Adjusted LM test are applied to achieve this objective. These methods remain applicable when the number of cross-sectional units (N) is greater than

the time periods (T), as well as when the time periods are more significant than the number of cross-sectional units. CDLM and Bias Adjusted LM (LMadj) tests and the corresponding statistics can be computed in the following manner:

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

$$LM_{adj} = \sqrt{\frac{2}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \frac{(T-k) \hat{\rho}_{ij}^2 - \mu_{Tij}}{V_{Tij}} \quad (2)$$

Equations-1 and 2 respectively present the statistical formulas for Pesaran's (2004) Cross-Section Dependence Lagrange Multiplier (CDLM) test and Pesaran et al.'s (2008) Bias Adjusted LM test. $\hat{\rho}_{ij}$, which denotes the correlation between cross-sectional units, μ_{Tij} denotes the cross-sectional averages and V_{Tij} denotes the variance. For both tests, the null and alternative hypotheses are shown as follows:

H_0 : the absence of dependence across cross-sections.

H_1 : the presence of dependence across cross-sections.

In panel data analysis, heterogeneity testing seeks to check whether other nations are influenced to the same extent by a shock that occurs in one of the nations involved in the analysis. Whether or not variables exhibit homogeneous influences determining the appropriate unit root tests to be utilized. With this respect, the homogeneity/heterogeneity inquiry is implemented by applying the Delta test introduced by Pesaran & Yamataga (2008). The hypothesis is as follows:

$$H_0: \beta_i = \beta$$

$$H_1: \beta_i \neq \beta$$

The null hypothesis' rejection signals the heterogeneity of slope coefficients within panel data approaches. After these preliminary scrutinizations, the stationarity levels of the variables will be inspected utilizing the Cross-sectionally Augmented Dickey-Fuller (CADF) test.

3.1.2. Testing for the Presence of Unit Roots

It is crucial in econometric explorations to conduct a stationarity or unit root examination to avoid spurious regression consequences. Several panel unit root tests exist in the literature, and each of them has some advantages and disadvantages depending on the sample size (Narayan & Narayan, 2010). As well, the existence or nonexistence of cross-sectional dependence in the series employed in the analyses also determines the unit root test to be applied. After the detection of cross-sectional interdependence among units in the countries covered by this analysis, second-generation unit root tests that account for cross-sectional dependence have been utilized. With this respect, the CADF test

developed by Pesaran (2007) has been employed. The statistics for CADF are estimated utilizing the following equation:

$$\Delta y_i = a_i + b_i y_{i,t-1} + c_i \bar{y}_{t-1} + \sum_{j=0}^p d_{ij} \Delta \bar{y}_{t-j} + \sum_{j=1}^p \delta_{ij} \Delta y_{i,t-j} + e_{i,t} \quad (3)$$

Equation-3 represents \bar{y}_t which denotes the means of all N cross-sections at time T. The outcomes of the CADF investigation are employed to detect the stationarity of each series within its respective cross-section, not for the whole panel data. Moreover, the arithmetic mean of the estimated CADF t statistics for each cross-section is calculated to identify the stationarity of the entire panel. The estimated arithmetic mean is the CIPS (Cross-Sectionally Augmented IPS) statistic. The CIPS statistic is estimated as follows:

$$CIPS = N^{-1} \sum_{i=1}^N CADF \quad (4)$$

To decide whether to refute the null hypothesis suggested that the series contains a unit root, the CADF and CIPS test statistics obtained through equations 3 and 4 are compared with the critical values in Pesaran's table (2007). The series is stationary, meaning it does not contain a unit root, if the estimated test statistic is greater in absolute value than the critical table value. Thus the null hypothesis is rejected.

3.1.3. Durbin-Hausman and Edgerton Cointegration Test

The Durbin-Hausman (DH) cointegration test, developed by Westerlund (2008), has several advantages. Firstly, it facilitates the scrutiny of a large number of independent variables without considering the stationarity levels of them, thanks to the utilization of the standard normal distribution. Secondly, it considers both cross-sectional dependence and heterogeneity. However, for the DH cointegration test to be applicable, the dependent variable should be integrated of order 1 (I(1)).

$$DH_{panel} = \hat{s}_n(\varphi_1 - \varphi_2)^2 \sum_{i=1}^N \sum_{t=2}^T \hat{e}_{i(t-1)}^2; DH_{group} = \sum_{i=1}^N \hat{s}_n(\varphi_1 - \varphi_2)^2 \sum_{t=2}^T \hat{e}_{i(t-1)}^2 \quad (5)$$

DH_{panel} test supposes that the autoregressive parameter is the same across the panel, while the DH_{group} test supposes that the parameters are heterogeneous. For both test statistics, the null hypothesis suggests no cointegration. In this study, the relationship between the series has also been scrutinized utilizing the LM test, considering cross-sectional interdependence. The LM statistic is as follows (Westerlund & Edgerton, 2007, pp.187-188):

$$LMN^T = \frac{1}{N \cdot T^2} \sum_{i=1}^N \sum_{t=1}^T w_i^{-2} s_{i,t}^2 \quad (6)$$

w_i^{-2} and $s_{i,t}^2$ respectively symbolize the long-run variance and the partial sums of error terms.

The null hypothesis (Ho) signifies that the cointegration nexus occurs for all countries in the panel.

3.1.4. Coefficient Estimation: CS-ARDL Model

To estimate the long and short-term coefficients, the Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL) model developed by Chudik & Pesaran (2015) was employed in this investigation. The principal benefit of the CS-ARDL estimator is that it maintains the consistency of predictions, irrespective of whether the series exhibits cointegration and stationarity at different levels. Likewise, functioning as the ARDL version of the Dynamic Common Correlated Estimator (CCE) and utilizing lagged dependent variables and lagged cross-sectional means, it incorporates cross-sectional dependence (Chudik & Pesaran, 2015). An additional advantage lies behind its allowance for average group predictions in the presence of heterogeneity in slope coefficients. The CS-ARDL model's average group version rests on enhancing the ARDL predictions for each section, incorporating cross-sectional averages to represent unobserved common factors and their respective lags (Chudik et al., 2016). Another advantage of this method is that it effectively tackles the weak externalities problem that arises when introducing lagged dependent variables into the model. The CS-ARDL investigation is formulated based on the following regression model:

$$y_{i,t} = \alpha_i + \sum_{l=1}^{p_y} \lambda_{l,i} y_{i,t-l} + \sum_{l=0}^{p_x} \beta_{l,i} x_{i,t-l} + \sum_{l=0}^{p_\varphi} \varphi'_{i,l} \bar{z}_{i,t-l} + \varepsilon_{i,t} \quad (7)$$

where, y_{it} denotes the dependent variable, $x_{i,t}$ denotes the function of the independent variables. $\bar{z}_{i,t-1}$ denotes the delayed horizontal cross-sectional means. The equation below is utilized in the long-term coefficient approximation of average group predictions:

$$\hat{\theta}_{CS-ARDL, i} = \frac{\sum_{l=0}^{p_x} \hat{\beta}_{l,i}}{1 - \sum_{l=1}^{p_y} \hat{\lambda}_{l,i}}, \hat{\theta}_{MG} = 1/N \sum_{i=1}^N \hat{\theta}_i \quad (8)$$

3.2. Model and Variables

In this paper, the impact of foreign direct investment, national income, and exports on environmental pollution (ecological footprint) in the economies of 10 developed and developing nations, namely Germany, the United Kingdom, France, Italy, Brazil, China, India, Colombia, Mexico, and Vietnam is investigated utilizing annual data for the period spanning from 2000 to 2022. The logic behind the sample is to have a representative group of countries with inflow and outflow of FDIs in polluting industries due to their differentiating environmental standards. The time period preferred, on the other hand, provides quite sufficient observation to reach at convincing empirical findings.

Equation-9 presents the model which was designed to identify the above-mentioned nexus:

$$\ln EF = \beta_0 + \beta_1 \ln Y_t + \beta_2 \ln FDI_t + \beta_3 \ln X_t + \varepsilon_t \quad (9)$$

The explanation of variables, and the sources from which the dataset was obtained are shown in Table-1.

Table 1. Explanatory Information for the Utilized Variables

Abbreviation	Variable	Unit	Source
EF	Per Capita Ecological Footprint	Gha	GFN
Y	Per Capita GDP	Current Prices, \$	WDI
FDI	Foreign Direct Investment Inflow	Current Prices, \$	UNCTAD
X	Total Exports	Current Prices, \$	WDI

Table 2 presents descriptive statistic.

Table 2. Descriptive Statistics

Variables	Observations	Median	Std. Dev.	Minimum	Maximum
EF	230	3.384609	1.673723	.75	8.82
Y	230	18655.49	16646.62	442.0348	51203.55
FDI	230	2.03e+09	2.65e+09	-8.96e+09	9.58e+09
X	230	6.27e+11	6.52e+11	1.45e+10	3.71e+12

3.3. Empirical Findings

Both cross-sectional dependence and homogeneity conditions were investigated initially to obtain consistent predictions. Table-3 presents the outcomes of the Pesaran (2004) CDLM and Pesaran et al. (2008) Bias Adjusted LM tests investigating cross-sectional interdependence, along with the outcomes of the Pesaran & Yamagata (2008) Delta test examining homogeneity.

Table 3. The Outcomes of Cross-Sectional Dependence and Homogeneity Tests

		CDLM	LMadj
$\ln EF = (\ln Y_t, \ln FDI_t, \ln X_t)$		59.874* (0.000)	18.625* (0.000)
Homogeneity Test $\ln EF = (\ln Y_t, \ln FDI_t, \ln X_t)$			
$\hat{\Delta}$ test	p-value	$\hat{\Delta}_{adj}$ test	p-value
13.854	0.000	14.810	0.000

Note: * Indicates the 1% significance level.

In both CDLM and LMadj tests, the null hypothesis positing no cross-sectional dependence has been rejected at a significance level of 1% as shown in Table-2, signifying the presence of cross-sectional dependence. Moreover, the Delta test-based null hypothesis of homogeneity has been rejected at the 1% significance level, indicating heterogeneity in slope coefficients in the panel data model. Accordingly, in the subsequent inquiries, methods permitting for cross-sectional dependence and slope heterogeneity were utilized. Table-4 presents the variables' stationarity properties investigated utilizing the CIPS unit root test, implying that both level I(0) and first difference I(1) values are provided by the test procedure.

Table 4. The Results of the Testing the Presence of Unit Root

Variables	I(0)	I(1)	Result
lnY	(t-bar: -2.319)**	-	I(0)
lnFDI	(t-bar: -2.610)*	-	I(0)
lnEF	(t-bar: -1.356)	(t-bar: -3.704)*	I(1)
lnX	(t-bar: -2.158)	(t-bar: -2.358)**	I(1)

Note: *, **, *** correspondingly signify the significance levels of 1%, 5%, and 10%. The critical CIPS values at levels -2.210 (10%), -2.330 (5%), and -2.570 (1%).

The series of lnY and lnFDI are stationary since the t-bar (CIPS) statistics series are significantly larger than the critical values given at 5% and 1% confidence levels. However, lnEF and lnX series become stationary when their first differences are taken. For the subsequent step of the analysis, the variables' different degrees of stationarity do not pose an issue. In the subsequent step, the long-term nexus between the investigated variables was scrutinized utilizing the DH and Westerlund & Edgerton cointegration tests, and the conclusions are offered in Table-5.

Table 5. The Results of the Cointegration Test

DH Cointegration Test	Statistic	p-value	Westerlund & Edgerton Cointegration Test			
dh_p	9.178 ***	0.000	LMNT	LM Statistic	asympt p-value	boost p-value
dh_g	279.156 ***	0.000		5.106	0.000	0.570

Table-4 represents the conclusions of the DH cointegration test, comprising both panel and group tests 'statistics and probability values, revealing that the null hypothesis is declined at the significance level of 1%. Consistent with the Westerlund & Edgerton cointegration test, bearing in mind the cross-sectional dependence in the panel, the bootstrap probability value was considered, revealing that the H0 hypothesis cannot be rebuffed at the significance level of 5%; thus the series are cointegrated. In the subsequent step, to explore short and long-term relationships, the CS-ARDL approach was utilized in light of the quantitative conclusions akin to CSD, heterogeneity, unit roots, and DH cointegration test. In the presence of cross-sectional dependence and varying degrees of stationarity, the CS-ARDL approach provides consistent outcomes. An average group CS-ARDL model was estimated to obtain country-specific coefficients in the cross-section, and the conclusions are afforded in Table-5. The coefficients in Table-6 express the elasticities of the ecological footprint concerning independent variables since the logarithmic values of the variables are borne in mind. According to the CS-ARDL conclusions, a 1% increase in per capita income increases the ecological footprint by 0.13% in the short term and 0.22% in the long term. The results revealed that the nations included in the analysis achieve economic growth in a way that harms the environment. A 1% increase in foreign direct investment is found to increase the ecological footprint by 0.007% in the short term and 0.01% in the long term. Ultimately, a 1% increase in exports increases the ecological footprint by 0.14% in the short term and 0.24% in the long term, based on the CS-ARDL conclusions.

Table 6. The CS-ARDL Forecast Results

<i>lnEF = (lnY_t, lnFDI_t, lnX)</i>			
Long run	coefficient	Std. Error	p-value
lnY	0.223**	0.091	0.015
lnFDI	0.010***	0.006	0.091
lnX	0.244**	0.113	0.031
Short run	coefficient	Std. error	p-value
L.lnEF	0.333*	0.068	0.000
lnY	0.134**	0.068	0.050
lnFDI	0.007***	0.004	0.075
lnX	0.143***	0.086	0.096
ECTt-1	-0.666*	0.068	0.000

4. CONCLUSION AND RECOMMENDATIONS

In the last decade, the motivation and outcomes of international direct investments have been at the forefront of popular research topics. In addition, and with efforts to maintain global competitiveness and the variability in environmental standards across countries, the geographical distribution of CO₂ emissions has become a more momentous determinant. In low and middle-income nations, economic evolution has the potential to have harmful impacts on the environment. In this paper, the impacts of national income, foreign direct investments, and exports on the ecological footprint were investigated for the period spanning from 2000 to 2022 utilizing annual data of 10 developed and developing nations. The investigation utilized unit root and cointegration methods, considering cross-sectional dependence, and the CS-ARDL test for short and long-term coefficient examination, revealing a positive nexus between economic growth and environmental deterioration in both the short and long term. Moreover, the results revealed that the increase in foreign direct investments increases environmental degradation, indicating that the pollution haven hypothesis holds true in this case. Ultimately, an increase in exports was also observed to contribute to environmental degradation. Our conclusions were supported by several studies from the literature such as He (2006), Shahbaz et al. (2011, 2015), Sapkota & Bastola (2017), Singhania & Saini (2021), Mike (2020), Neequaye & Oladi (2015), and the recent studies by Arslan et al. (2021) and Farooq et al. (2021) further corroborate this by showing that FDI exacerbates environmental harm, especially in developing nations. However, the results found by Aliyu (2005), Haisheng et al. (2005), and Honglei et al. (2011), Rafindadi et al. (2018) didn't align with our results. These opposing studies highlight the challenge to the notion that FDI universally leads to environmental degradation, indicating the complexity and variability of FDI impacts across different contexts.

While developed nations make efforts to curb environmental damage, such as implementing green agreements to restore ecological balance and reduce emissions, the low environmental standards of low and middle-income countries contribute to an increase in the ecological footprint during the growth process. Pollution havens result from foreign direct investments considering differences in

environmental regulations and related spatial cost differentials. As growth, foreign direct investments, and exports increase in low and middle-income countries, the global footprint increases. Solving global environmental issues will not be facilitated by the migration of polluting industries between countries. Thus, developing nations should immediately adopt higher environmental standards, as part of global solutions. International organizations, like related UN programs need to become more effective. Financial instruments aiming to protect environmental values have to be implemented to ensure pollution-related costs are uniform worldwide. Developing economies should increase their competitiveness by increasing productivity, renewable energy sources, human capital, etc, not relying on being pollution havens due to low environmental standards.

Beneficial outcomes can be achieved by developing growth strategies associated with sustainable development goals, providing incentives for foreign direct investments with universally harmonized environmental standards, addressing unfair competitive advantages gained from low environmental standards in exports through international sanctions, and establishing financing mechanisms with contributions from high-income nations to deal with short-term challenges for low and middle-income nations. Moreover, it is crucial to cherish the economic advantages associated with attracting eco-friendly foreign direct investments in developing nations.

Ethics Committee approval was not required for this study.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors affirm that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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Building a Technological Change Index for Developed and Developing Countries: A New Multidimensional Measure *

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Abstract

In the economics literature, many indicators are used as proxy variables for technological change. However, most of these indicators generally overlook the complex and multidimensional nature of technological change. In this context, we develop a new composite indicator by applying multivariate statistical methods to determine the level of technological development. This new index, called the Technological Change Index (TCI), reflects various dimensions of technology, including infrastructure, access and use, innovation, and impact. It has been calculated using 13 normalized indicators. Each indicator belonging to these dimensions was weighted using Principal Component Analysis (PCA), and the leading factors contributing to technological change were identified. The main purpose of building this index is to determine the level of technological change in countries and, thus, to reveal the gaps in technological development across the world. The scores of the TCI, which cover a total of 46 developed and developing countries, provide useful insights for researchers and policymakers focusing on development issues.

Keywords: *Technological Change, Economic Development, Principal Component Analysis.*

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1. INTRODUCTION

Technological change has significantly progressed over the past two decades while gaining importance in modern macroeconomics literature. Consequently, the analysis of technological change has become a fundamental part of both national economic policies and international competition.

When the economics literature is examined, the role of technological change in growth and development has been analyzed from various perspectives. Solow (1956), one of the neo-classical economists, defined technological development as a determinant of long-term growth and considered it as an exogenous variable. In Romer's (1990) Endogenous Growth Theory, similar to Neoclassical economics, technological change is at the heart of economic growth. According to this theory, where technology is assumed to be an endogenous variable, technological change and innovation both stimulate capital accumulation and increase the productivity of the factors of production. One of the most important economists of the Austrian School, Schumpeter (1980), argued that development is dependent on innovations and the technological changes that emerge from these innovations. Kondratyev (1935), on the other hand, accepted innovation and related technological change as a driving force of long-term growth cycles. Kuznets (1966), who made significant contributions to development, refers to the role of technological change in the stages of industrialization and development. Relatively recent studies by Grossman and Helpman (1991), Aghion and Howitt (1992) and Barro and Sala-i Martin (2004) have also emphasized that research and development (R&D) is a driving force for growth and development. As a result of a series of empirical studies carried out, technology that helps increase in productivity is accepted as a driving force of economic growth and development nowadays (e.g. Ayres, 1988; Steinmueller, 2002; McGuckin, et al., 2006; Acemoglu, 2023).

Innovative trends offer enormous economic potential for a country that can seize the opportunities offered by new technologies. For others, which largely include developing and least developed countries (LDCs), the rapid pace of overall technological change may pose a threat (Dahlman, 1989). Current trends between developed countries and the rest of the world show an increasing polarisation in competition between those that can successfully adapt to technological change and those that cannot. Research in this field shows that the innovation gap significantly affects differences in per capita income and levels of development among countries (Nepelski & Prato, 2020).

The success of technology policy at the country level can be determined by considering a realistic assessment of the current status of technological progress (Desai et al., 2002). In this context, it is important to measure technological change at the national level, and additionally to monitor the tendencies of technological change. To this end, drawing inspiration from existing studies in the literature, we have developed a new index to monitor technological change and more effectively demonstrate its multidimensional nature. The index differs from the methods in previous or existing studies because of its specific characteristics.

A detailed examination of the applied economics literature reveals that various proxy variables have been used to measure technological change. Although technology is multidimensional, studies in this field typically focus on only one dimension, relying on proxy variables such as infrastructure, R&D, innovation, or productivity indicators (e.g. Carlaw & Lipsey, 2003; Coccia, 2014; Pece et al., 2015). Upon reviewing the literature on measuring technological change, we found that weighting schemes for indicators are often either determined subjectively or lack sufficient observations to enable robust long-term empirical analysis. To fill this gap, we assign weights to 13 indicators reflecting various dimensions of technology by applying Exploratory Factor Analysis (EFA) based on Principal Component Analysis (PCA).

Our main motivations for using PCA are: (i) to reduce the complexity involved in representing technology-related indicators, (ii) to conduct a general evaluation of technological change, and (iii) to base analysis on a single composite measure rather than multiple different variables. Within this framework, this study presents a weighted composite index that reflects the various dimensions of technology as a whole. The index has several advantages: the most notable being its weighted composite structure and its ability to multidimensionally reflect technological change. Another advantage is that it provides a significantly larger number of observations compared to similar indices or indicators in the literature. Additionally, it generates annual scores for each of the 46 countries for the period 1991–2019. Thus, we can analyze the technological change trends of each country over approximately 30 years. We define this index as the Technological Change Index (TCI).

In this study, the TCI is designed to achieve three main objectives. Firstly, TCI measures technological progress at the country level, enabling the identification of technological gaps across countries. Secondly, the index scores indicate the trend of technological change at the country level. Thirdly, it provides a dataset suitable for econometric modeling due to the sufficient number of observations for empirical analysis. Thanks to these three key characteristics, technological gap can be identified, and empirical results relevant to policymakers can be obtained. TCI serves as a foundation for conducting a comprehensive evaluation of changes in technology, innovation, and science at the country level through distinctive variables.

The main purpose of this study is to measure the level of technological progress and examine trends in technological change in selected developed, and developing countries including the LDCs¹. This study consists of five remaining sections. The second section provides a brief summary of the literature on measuring technological change and explains how this study differs from previous research. The third section introduces the data used and provides general information about the sample. The fourth

¹ In this study, the term 'developing countries' includes both developing economies and least developed countries, as classified by United Nations Conference on Trade and Development (UNCTAD, 2023).

section describes the methods used in the calculation and presents the statistical findings, while the fifth section presents the index scores and empirical findings. The final section offers a general evaluation of the study's findings along with policy recommendations.

2. LITERATURE REVIEW

Technological change is considered an integral part of development because it enhances the economic and social structure of society. More specifically, technological change contributes to the economic growth and development of countries by reducing costs, increasing prosperity, and creating new markets and products. Historically, technological change has been the most decisive factor in the differences in development between countries. It is observed that countries which rapidly adapted to technological changes and fostered innovations over the last half century have achieved the status of industrialized and developed countries.

In the literature review, we categorize studies into two groups. The first group includes studies related to the impact of technology on growth and development. When analyzing empirical studies, Ulku (2004) found a positive relationship between innovation (measured by patent stock) and per capita income in a study on Organization for Economic Co- Operation and Development (OECD) and non-OECD countries. Mudronja et al. (2019) conducted an empirical analysis on the European Union (EU)-28 and found that R&D expenditures accelerate growth. Choi and Yi (2009) used panel data from 207 countries and provided empirical evidence that internet usage positively affects economic growth. Koutroumpis (2009) analyzed the economic impact of broadband in 22 OECD countries and provided evidence of a strong causality between broadband infrastructure and growth. Ghosh (2017) obtained similar findings for 15 Middle East and North Africa (MENA) countries. Dutta (2020) examined the impact of Information and Communication Technology (ICT) goods exports on Gross Domestic Product (GDP) using panel data from BRICS countries and concluded that ICT goods exports have a positive effect.

The second group of studies in the literature review focuses on the measurement of technological change. The literature review reveals numerous studies on the measurement and evolution of technological change. We observed that the index-type technology indicators have become relatively widespread over the last decade. In this context, Wagner et al. (2001) developed the Science and Technology (S&T) Capacity Index, which aims to measure national-level development in science and technology. Their study found that out of the 150 countries examined, 22—including the United States (US), Japan, Germany, Canada, and Taiwan—were scientifically advanced. Furthermore, when analyzing the methodology of the study, we observed that the indicators within the index were assigned specific weights based on the relative importance of each factor. Similar to the S&T Capacity Index, Desai et al. (2002) contributed to the literature on technological change by conducting a national-level analysis and developing the Technology Achievement Index (TAI), which assigned equal weight to its

indicators. Changes in technological achievement for both 1998 and 1999 were calculated for over 70 countries, yielding fairly consistent findings. According to their study, developed countries such as Finland, the US, Sweden, Japan, South Korea, the Netherlands, the United Kingdom (UK), and Singapore were classified as part of the 'leaders' group in both years.

The United Nations Industrial Development Organization (UNIDO, 2002) developed the Competitive Industrial Performance (CIP) Index to assess countries' ability to produce and export in the global economy. In the calculation of the CIP, four key indicators were taken into account without weighting. It was observed that the scores vary significantly across countries. In this context, the CIP rankings, from highest to lowest, were as follows: Singapore, Ireland, Japan, Switzerland, and Sweden.

The ArCo Technology Index is a well-known indicator for measuring technological capabilities. Developed by Archibugi and Coco (2004), the index was calculated only for the years 1990 and 2000 using a total of eight indicators, considering three dimensions of technology: creation, infrastructure, and human skills. In their analysis, Archibugi and Coco (2004) included both developed and developing countries. The results indicated that Nordic European countries performed exceptionally well in technological capability, with Sweden ranking first, Finland second, and Norway seventh.

In a recent paper, Khayyat and Lee (2015) studied technological change in developing countries between 2003 and 2008. The index, called TC, estimated technological levels for 61 countries around the world to analyze their innovation performance. PCA was used as a method for calculating the index. The findings of the study revealed that China, Estonia, and Malaysia had the highest level of innovation among developing countries. However, findings for other countries were not available, as the study focused exclusively on developing countries. Additionally, analyzing a six-year period limited making inferences that are long-term and more technical in nature.

Since its first publication in 2009, the ICT Development Index has been calculated annually by the International Telecommunication Union (2017) to measure the level of development in information and communication technology. It is a composite index that combines three groups (access, use and skills) and a total of 11 indicators. In the ITU's 2017 report, the index scores ranked Iceland, Korea, Switzerland, Denmark and the UK as the top-performing countries. In this sense, the report revealed that European countries demonstrated excellent performance in the field of ICT during the 2010s.

The Global Innovation Index, prepared in cooperation with the World Intellectual Property Organization (WIPO), INSEAD, and Cornell University, ranks economies based on their innovation capabilities. This annually published index is based on approximately 80 grouped indicators related to technology and innovation. According to the 2023 Report published by the World Intellectual Property Organization (2023), three of the five most innovative countries were from Europe (Switzerland, Sweden and the UK) while the others were the US and Singapore.

The Network Readiness Index (NRI), developed by researchers at Portulans Institute (2020) and published annually by the World Economic Forum (WEF), measures the degree of readiness of countries to take advantage of the opportunities offered by ICT. The NRI includes sub-indices related to technology, people, governance, and impact. According to the NRI scores in 2020, the top-ranked countries in terms of ICT readiness were Sweden, Denmark, Singapore, the Netherlands, and Switzerland.

The European Innovation Scoreboard (EIS), published annually by the European Commission (2023), measures the research and innovation performance of European Union (EU) member states and 11 non-EU European countries. Its purpose is to provide a relative assessment of national innovation systems in European countries and to identify their strengths and weaknesses. The index consists of four dimensions: framework conditions, investments, innovation activities, and impacts, which comprises a total of 32 indicators. In the index methodology, each dimension includes an equal number of indicators, all of which are weighted equally, similar to how the previously mentioned indicators are weighted. According to the 2023 report, Belgium, Denmark, Finland, the Netherlands, and Sweden performed above the EU average, ranking as 'Innovation Leaders.' Additionally, it has been observed that most EU member states have significantly improved their innovation performance over the past decade.

Another index published by the European Commission (EC) is the Digital Economy and Society Index (DESI), which is calculated exclusively for EU member states (European Commission, 2022). The purpose of DESI is to measure Europe's overall digitalization performance and assess the digital competitiveness of its member countries. DESI comprises four dimensions and ten sub-dimensions and is calculated using a total of 32 indicators. Similar to the EIS, each dimension in the index carries equal weight (25%), and the indicators within each dimension are also weighted equally. According to the latest report based on 2021 data, EU member states experienced significant progress in digitalization during the COVID-19 pandemic. However, they have yet to reach the desired level in terms of Small and Medium-Sized Enterprises (SMEs') digital performance and the widespread deployment of 5G networks. In country profile analyses, Scandinavian countries such as Finland, Denmark, and Sweden have demonstrated outstanding digitalization performance, with index scores well above the EU average.

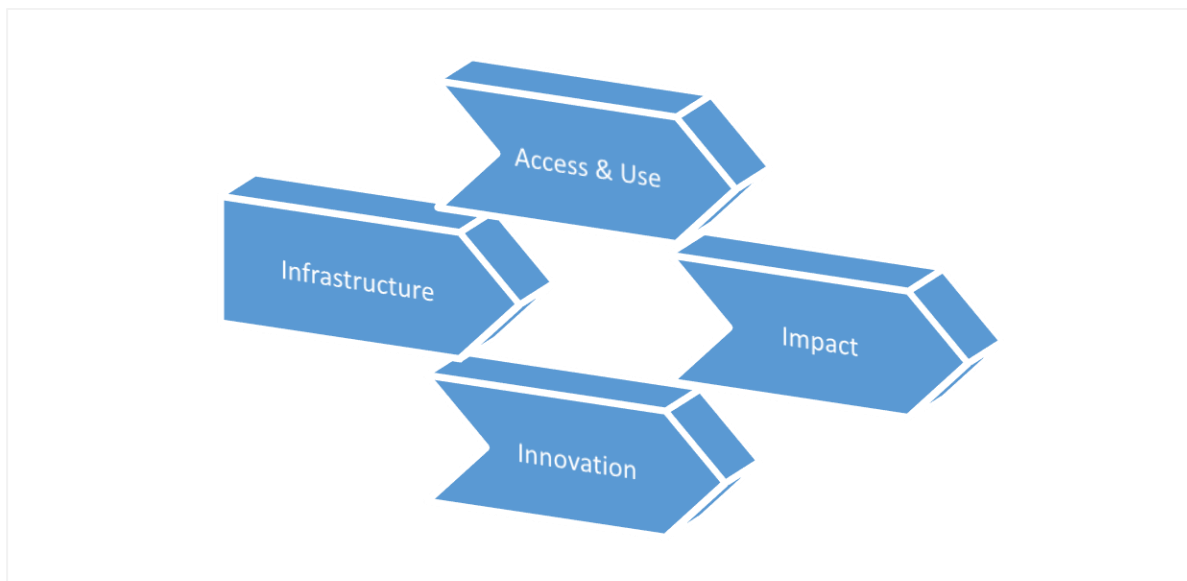
To summarize, the literature review shows that research on the measurement of technological change has largely been conducted using index-type approaches. Technology-related indicators were subjectively weighted; and as a result, each indicator was either assumed to have the same degree of importance or lacked sufficient observations to enable long-term empirical analysis. In other words, most of these studies have not been adequate in capturing technological trends. To address this gap, we have developed a multi-dimensional, composite, and weighted index called TCI. Thanks to the scores calculated for this index, we can analyze the trend of technological change worldwide, covering both developed and developing countries (including LDCs) and highlighting differences in technological

change between nations. An additional advantage is that index scores can be calculated for a large number of countries at different levels of development.

3. DATA AND VARIABLES

Technology is a complex concept that is difficult to define. For this reason, it is regarded a broad concept in the literature (Acemoglu et al., 2022). On the other hand, technological change is a more specific concept that encompasses a general process. The first step in constructing the level of technological change is to determine its dimensions and process. In this context, the dimensions of technological change are illustrated in Figure 1 below:

Figure 1. The Process and Dimensions of Technological Change



The index aims to capture a country's technological change across four dimensions. As seen in Figure 1, the dimensions of technological change, as determined by our study, are infrastructure, access and use, innovation, and impact. When compared with the Schumpeterian triad (invention-innovation-diffusion) proposed by Schumpeter (1980), these dimensions are found to be consistent. Each dimension essentially represents the components of technological change and contributes to a more effective analysis of technological progress. The second step is to assign proxy variables to these dimensions. The TCI has been developed using available and accessible data. In this regard, proxy variables were used for each dimension in our methodology. It is worth noting that almost all of the indicators used are proxy variables commonly employed in the literature to represent technology. Except for international bandwidth, all data for our index were obtained from the World Development Indicators (World Bank, 2023), which provide measures of social progress, economic development, physical infrastructure, and other related factors. The indicators listed in Table 1 offer more detailed information about the selected variables for each dimension.

Table 1. Selected Indicators of the Technological Change Index

Dimension	Abbreviation	Indicator	Unit of measure	Source
Infrastructure	RDE	Research and development	% of GDP	World Bank (2023)
	RES	Researchers in R&D	Per million people	World Bank (2023)
	SCH	School enrollment, tertiary	% gross	World Bank (2023)
	IBW	International Bandwidth	In Mbit/s	International Telecommunication Union (2023)
Access & Use	INT	Individuals using the Internet	% of population	World Bank (2023)
	FBS	Fixed broadband subscriptions	Per 100 people	World Bank (2023)
	MCS	Mobile cellular subscriptions	Per 100 people	World Bank (2023)
	ATM	Automated teller machines	Per 100.000 adults	World Bank (2023)
Innovation	PAT	Patent applications	Number of residents	World Bank (2023)
	STJ	Scientific and technical journal	Number	World Bank (2023)
Impact	GDP	GDP per person employed	Constant 2017 PPP\$	World Bank (2023)
	ICT	ICT goods exports	% of total goods exports	World Bank (2023)
	MHT	Medium and high-tech manufacturing value added	% Manufacturing value added	World Bank (2023)

Infrastructure is crucial for accessing the opportunities provided by information and communication technologies. Additionally, it plays a key role in demonstrating human capital and supporting research and development efforts for the creation and adoption of technology. Infrastructure technologies enhance efficiency in technology-based economic activities and serve as leverage in the R&D, production, and market development stages of the process (Tassey, 1996). Here, we identify four key indicators of technological infrastructure: R&D expenditure, researchers in R&D, school enrollment (tertiary), and international bandwidth.

In the information society, the delivery and widespread sharing of technology have become a necessity in the modern world. Throughout history, access to technology and its effective use has enabled countries to achieve greater output with fewer resources. Therefore, the access and use dimensions play a major role in explaining technological change, which is considered the driving force of economic development. We selected four variables associated with access to and use of technology: individuals using the internet, fixed broadband subscriptions, mobile cellular subscriptions, and automated teller machines.

Innovation, defined as the improvement of existing technology in terms of commercial impact or social benefit, or the development of a completely new approach, lies at the heart of technological change (United Nations Conference on Trade and Development, 2019). We include patent applications and scientific and technical journal articles in the innovation dimension. Patent applications refer to filings made for developing new methods and generating novel solutions to existing problems. On the other hand, scientific and technical journal articles encompass research published in disciplines such as physics, chemistry, biomedicine, technology, earth sciences, and space sciences.

Ultimately, innovation serves as a means to enhance productivity and drive economic growth. Technological advancements are now widely recognized as the most significant drivers of economic progress, influencing productivity, industrial competitiveness, sustained improvements in living standards, and overall welfare (Gold, 1987). Therefore, the impact dimension of technology aims to explain its economic implications. In this dimension, we use three variables focusing on production, productivity, and exports: GDP per person employed, ICT goods exports, and medium- and high-tech manufacturing value added.

Table 2. Countries Included in the Index Calculation

Level of development	Countries	Classification by
Developed Countries (20)	Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, South Korea, Luxembourg, Netherlands, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States	International Monetary Fund (2023)
Developing Countries (17)	Brazil, China, Colombia, Costa Rica, Dominican Republic, El Salvador, Honduras, India, Indonesia, Malaysia, Panama, Paraguay, Peru, Russian Federation, Thailand, Türkiye, Uruguay	International Monetary Fund (2023)
Least Developed Countries (9)	Angola, Bangladesh, Gambia, Madagascar, Malawi, Mali, Rwanda, Tanzania, Uganda	United Nations Conference on Trade and Development (2023)

In the final stage, we classify countries based on their level of development. Our goal is to include as many countries as possible without compromising the consistency of data and resources. The index score was calculated for a total of 46 countries, 20 are developed, 17 are developing, and 9 are least developed, as shown in Table 2. Although the aim was to calculate scores for all countries worldwide, the calculation was limited to 46 countries due to data unavailability. According to the World Bank (2023), the total population of the countries in this sample was approximately 5 billion in 2021. This figure accounts for about 63.6% of the global population. Additionally, the total GDP of the countries in the sample was approximately 76.5 trillion USD, representing 78.4% of global GDP. In the light of this information, it can be clearly stated that the sample represents the statistical population well. The countries in the sample are classified according to their level of development. The International

Monetary Fund (2023) classification was used for developed and developing countries, while the United Nations Conference on Trade and Development (2023) list was considered for least developed countries.

4. METHODOLOGY AND STATISTICAL FINDINGS

The TCI is a composite indicator that assesses the overall technological development of a country and enables cross-country comparisons. The following three procedures are applied sequentially in the calculating TCI scores:

- Normalization of Indicators
- Weighting of Indicators
- Calculating of the Index Score

Since the variables shown in Table 1 are expressed in different units, each indicator of the TCI is normalized to facilitate comparison and aggregation. Similar to the HDI proposed by United Nations Development Programme (UNDP, 2020), the indicators of the TCI are normalized between 0 and 1 using the following standard formula:

$$z_i = \frac{x_o - x_{min}}{x_{max} - x_{min}} \quad (1)$$

where x_o is the variable to be converted for country i , x_{min} is the minimum value for variables of all countries, x_{max} is maximum value for the variables of all countries and finally z_i is the normalized variable.

To overcome the differences in the power of variables to reflect technological change, we use exploratory factor analysis, which aims to discover a small number of conceptually significant variables by combining a large number of interrelated variables. In index creation, exploratory factor analysis has advantages such as ease of visualization and interpretation, as well as size reduction (Ferguson & Cox, 1993; Morrison, 2017).

Table 3. Correlation Matrix

	ATM	FBS	GDP	ICT	INT	IBW	MHT	MCS	PAT	RDE	RES	SCH	STJ
ATM	1.00	0.65	0.52	0.24	0.64	0.32	0.53	0.52	0.25	0.58	0.53	0.68	0.36
FBS	0.65	1.00	0.83	0.24	0.95	0.24	0.73	0.76	0.13	0.88	0.91	0.79	0.23
GDP	0.52	0.83	1.00	0.20	0.84	0.21	0.60	0.77	-0.01	0.68	0.80	0.62	0.15
ICT	0.24	0.24	0.20	1.00	0.34	0.29	0.58	0.33	0.40	0.34	0.30	0.36	0.26
INT	0.64	0.95	0.84	0.34	1.00	0.26	0.75	0.81	0.09	0.86	0.91	0.84	0.22
IBW	0.32	0.24	0.21	0.29	0.26	1.00	0.40	0.15	0.58	0.30	0.22	0.27	0.81
MHT	0.53	0.73	0.60	0.58	0.75	0.40	1.00	0.64	0.23	0.79	0.74	0.74	0.33
MCS	0.52	0.76	0.77	0.33	0.81	0.15	0.64	1.00	-0.04	0.64	0.73	0.75	0.05
PAT	0.25	0.13	-0.01	0.40	0.09	0.58	0.23	-0.04	1.00	0.27	0.07	0.11	0.85
RDE	0.58	0.88	0.68	0.34	0.86	0.30	0.79	0.64	0.27	1.00	0.91	0.75	0.36
RES	0.53	0.91	0.80	0.30	0.91	0.22	0.74	0.73	0.07	0.91	1.00	0.78	0.17
SCH	0.68	0.79	0.62	0.36	0.84	0.27	0.74	0.75	0.11	0.75	0.78	1.00	0.27
STJ	0.36	0.23	0.15	0.26	0.22	0.81	0.33	0.05	0.85	0.36	0.17	0.27	1.00

In the first step of exploratory factor analysis, the appropriateness of the factor model is evaluated. The correlation matrix is examined at this stage, and the existence of a strong relationship between the selected variables is revealed. Detailed results are shown in Table 3.

Table 4. Kaiser-Meyer-Olkin Measure of Sampling Adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.76
Bartlett's Test of Sphericity	Approx. Chi-Square	687.811
	df	78
	Sig.	0.00

As seen in Table 4, the KMO^2 and Bartlett's tests were applied to assess the suitability of the sample for factor analysis. The KMO measure of sampling adequacy is 0.76, which satisfies the $KMO > 0.5$ criterion, indicating that the factor analysis is appropriate for the selected data. The results of Bartlett's test, which tests whether the correlation matrix is an identity matrix, are rejected at the 99% confidence level, indicating significant correlations between variables, supporting the potential use of multivariate analysis methods. Accordingly, the condition implying that the data originate from a multivariate normal distribution has been satisfied.

Table 5. Principal Component Analysis

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.418	57.063	57.063	7.418	57.063	57.063	6.887	52.978	52.978
2	2.461	18.934	75.997	2.461	18.934	75.997	2.992	23.019	75.997
3	0.916	7.049	83.046						
4	0.570	4.385	87.431						
5	0.485	3.733	91.164						
6	0.379	2.913	94.078						
7	0.276	2.123	96.201						
8	0.164	1.261	97.462						
9	0.127	0.976	98.438						
10	0.094	0.720	99.158						
11	0.063	0.487	99.644						
12	0.025	0.191	99.835						
13	0.021	0.165	100.000						

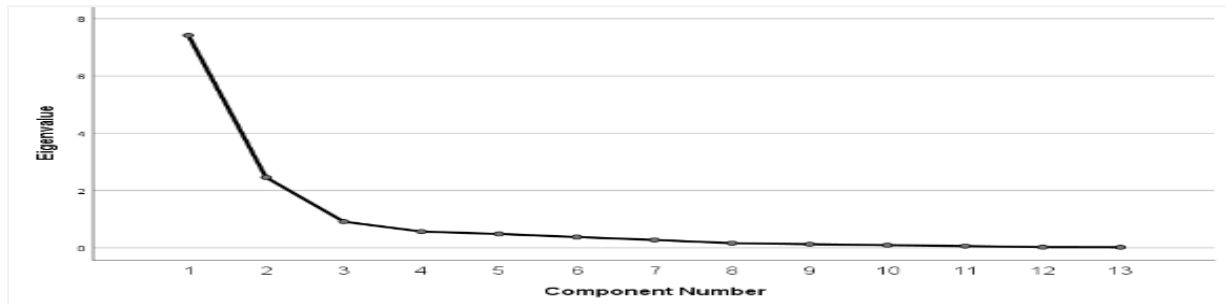
In the second step, the number of factors and the proportion of variance explained by the factors were determined by considering the results obtained from the Principal Component Analysis (PCA). Varimax rotation³ was applied in the analysis, and the results of this rotation were taken into account.

² The Kaiser-Meyer-Olkin (KMO) test is essentially a statistical measure that determines how suitable the data are for exploratory factor analysis. More specifically, the test measures the sample adequacy for each variable and for the entire model. KMO values greater than 0.5 are considered sufficient, indicating that component or exploratory factor analysis would be useful for these variables.

³ In exploratory factor analysis, rotation is performed to ensure clarity and meaningfulness in interpreting the factors. In other words, the purpose of rotation is to increase the interpretability of the retained factors. Through the rotation process, factors identify items that are highly related to themselves and become easier to interpret. The most commonly used rotation method is Varimax, which maximizes factor variances with fewer variables. Varimax rotation is the most widely used among orthogonal methods. This rotation method prioritizes the columns of the factor loading matrix to achieve simpler and more

In this analysis, components with eigenvalue greater than 1 are considered to explain a significant portion of the total variance in the dataset and are retained for analysis. Other components are excluded from the analysis. According to the results of the PCA in Table 5, two factors with eigenvalues greater than 1 have been identified ($\lambda_1 = 7.418$ and $\lambda_2 = 2.461$). It was observed that these two factors explain approximately 75% of the total variance.

Figure 2. Scree Plot



The scree plot is a graph of the eigenvalues against all the factors. This plot is one of the graphs that provides insight into determining the number of factors in exploratory factor analysis. In this plot, the points where the curve flattens are counted, and the factors to be included in the solution are identified. In other words, the point of interest is where the curve starts to flatten. In addition to Table 5, the scree plot curve shown in Figure 2 clearly indicates that there are two factors with eigenvalues greater than 1.

Table 6. Rotated Component Matrix

Indicators	Component			
	F_1	$\Sigma F_1 = 1$	F_2	$\Sigma F_2 = 1$
INT	0.967	0.120		
FBS	0.945	0.117		
RES	0.936	0.116		
MCS	0.869	0.108		
GDP	0.865	0.107		
RDE	0.864	0.107		
SCH	0.864	0.107		
MHT	0.787	0.097	0.349	0.092
ATM	0.652	0.081	0.316	0.083
STJ			0.944	0.248
PAT			0.912	0.240
IBW			0.831	0.218
ICT	0.326	0.04	0.452	0.119

meaningful factors. We used the Varimax method during rotation to maximize factor variances with fewer variables and thus minimize the complexity of the factors.

In the third step, the factor loadings of the indicators are determined. After the rotation process, the rotated component matrix clearly reveals which variables belong to which factor. Examining the rotated component matrix in Table 6 reveals that the factor loadings of the indicators (F_1, F_2) are greater than the 0.30 threshold value⁴. Therefore, it has been concluded that the indicators are suitable for model analysis. To ensure that the index score takes a value between 0 and 1, the factor loadings have been revised so that their sum equals 1 ($\Sigma F_1 = 1$ and $\Sigma F_2 = 1$). To summarize, higher weights are assigned to factors that contribute more to the direction of common variation. Then, sub-indices are combined into higher indices using the same procedure.

Table 7. Weights of Indicators

Indicators	Weight Ratio (w_i)
MHT	0.0957
INT	0.0834
FBS	0.0816
ATM	0.0814
RES	0.0808
STJ	0.0751
MCS	0.0749
GDP	0.0746
RDE	0.0746
SCH	0.0745
PAT	0.0726
IBW	0.0661
ICT	0.0641
Σw_i	1.0000

Taking into account the variance explained by the factors and the factor loadings of the indicators, the weight of the selected indicators within the index is calculated and is shown in Table 7. It is important to note that the scores of the factors are not calculated individually in our study; instead, the TCI score is calculated by considering the variance explained by the two factors as well as the factor loadings. The Weighted TCI formula is:

$$TCI = \sum_{i=1}^k w_i X_{ij} \quad (2)$$

where i refers to each indicator of the index, and j refers to the country included in the analysis. Therefore, w_i represents the weight of the i indicator in the index, and X_{ij} represents the value of i indicator for the j country.

⁴ Factor loadings indicate the relationship between a variable and a specific factor. A factor loading greater than 0.30 suggests that the variable is significantly associated with that factor and can be considered in explanatory factor analysis.

Table 8. Grading System of the Technological Change Index

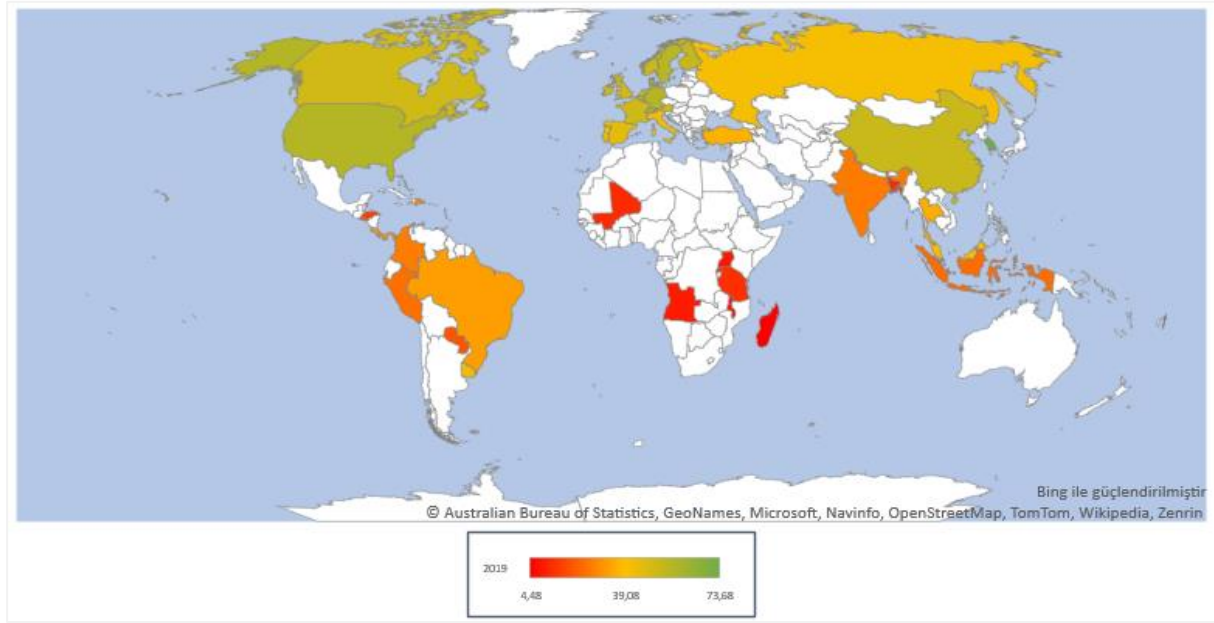
Score range	Score	Grade	Level
61-100	> 70	A+	Ultra-High
	65-70	A	
	61-65	A-	
46-60	56-60	B+	High
	51-55	B	
	46-50	B-	
31-45	41-45	C+	Upper Middle
	36-40	C	
	31-35	C-	
16-30	26-30	D+	Lower Middle
	21-25	D	
	16-20	D-	
Less than 15	11-15	F+	Poor
	6-10	F	
	0-5	F-	

In our method, a TCI score can be calculated annually for the period 1991-2019. Additionally, the index score can take a value between 0 and 100. If the score approaches 100, it indicates that technological change is at an advanced level, while a score closer to 0 indicates the opposite. A grade is then assigned to these scores to further communicate technological change in a manner easily understood by everyone. Grading system of the TCI is presented in Table 8. Each grade corresponds to a technological level: Ultra-High, High, Upper Middle, Lower Middle, and Poor, respectively. We assign a performance scale using “Ultra-High” for scores 61-100, “High” for 46-60, “Upper Middle” for 31-45, “Lower Middle” for 16-30, and “Poor” for scores less than 15.

5. SCORE AND RANKING

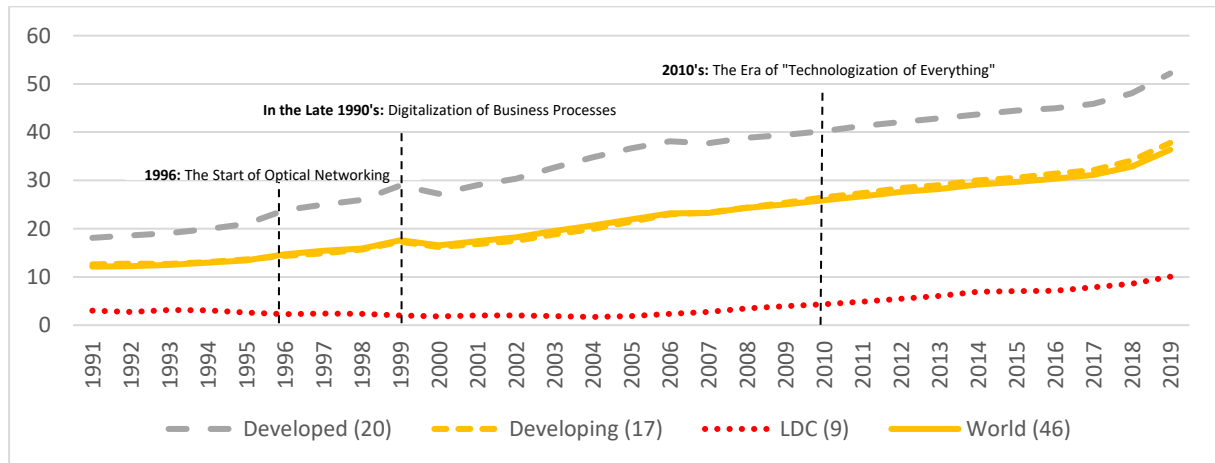
The TCI scores have been calculated for 46 countries for which data are available and of high-quality. Based on this calculation, the TCI heat map is presented in Figure 3. One of the most important benefits of constructing a heat map for technological change is that it allows us to see trends on a single map. The intensification of red or green colors in the heat map provides information on whether technological change is at an high or poor level, and also highlights the gap in technological progress both between regions and across countries. Consequently, the TCI score of a country with a near-green view is higher than that of one with a near-red view. The score could not be calculated for the countries in white on the map due to data unavailability.

Figure 3. Heatmap of the Technological Change Index, 2019



Examining the heat map, we find that technological progress varies significantly between the north and the south, especially in the Americas. Accordingly, TCI scores are relatively high in North America, Scandinavia, and the North Asia-Pacific region, where we can already observe quite a bit of green on the map. In contrast, in Latin America, Sub-Saharan Africa, and Asia-Pacific regions, we see that TCI scores are relatively low. Consequently, technological progress is also relatively low in these regions, which are characterized by a more intense reddish color.

Figure 4. Mean the Technological Change Index Scores by Level of Development



On the other hand, technological progress remained noticeably low in the least developed countries during the analyzed period (1991-2019), while the increase in developed and developing countries continued due to the acceleration of economic investment in ICT, especially broadband connectivity, education, digital literacy, and innovation. The mean scores of developed, developing, and least developed countries, shown in the time path graph in Figure 4, shed light on this inference.

As mentioned earlier, the TCI scores are classified and evaluated based on grades. Within this framework, the TCI scores calculated for the countries are shown in Figure 5, and the ranking is presented in Table 9. As can be seen in Figure 5, there are five grades for the countries, with TCI scores ranging from 73.67 for South Korea to 4.48 for Madagascar.

First, in our methodology, the “Ultra-High” level (Grade A) is considered the most advanced degree of technological change. We define countries that have reached the “Ultra-High” level as those that are able to create and successfully maintain innovation in technology. According to our findings, South Korea and Singapore, two of the Asian Tigers, occupy the top two in this ranking. South Korea and Singapore, which have attracted attention with their educational reforms and technological breakthroughs in the last 60 years, are considered among the world's largest economies at present. According to our grading system, South Korea, with an A+ (“Ultra-High”) grade of technology, has also been the leader in the ranking over the past 10 years. Singapore's TCI score has shown a remarkable increase in recent years and is approaching the leader. Thus, these countries have managed to rank among the two countries at “Ultra-High” level in terms of technological progress.

Among the grades, the “High” level (Grade B) refers to a certain level of maturity in terms of technology access and use, infrastructure, and their economic impact. In our study, a country with a B+ rating is particularly considered a candidate for the “Ultra-High” level. According to our findings, the largest number of countries in this grade comes from the EU. The US and China, the two global economic heavyweights that together account for more than 40% of the world’s GDP today, have a “High” level of technological development. The analysis shows that Denmark, the US, Switzerland, Germany, and Sweden are the most likely to transition to “Ultra-High” (Grade A) technological progress in the coming decades.

Figure 5. Grades by Country, in 2019

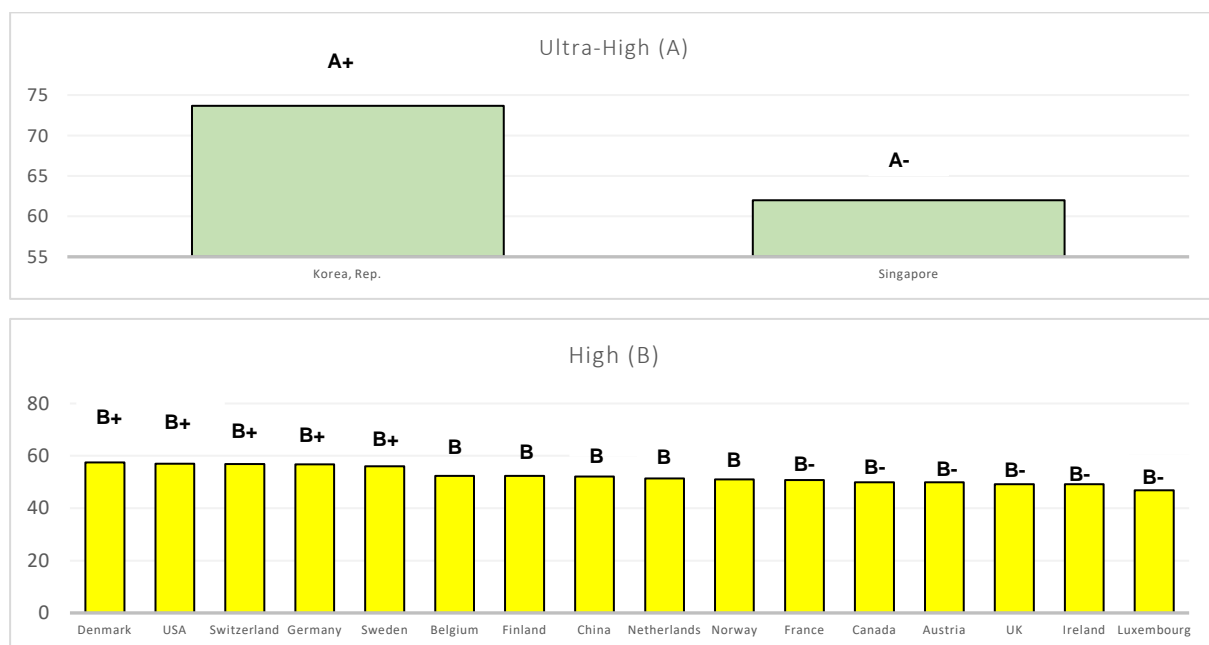


Figure 5 (cont.)

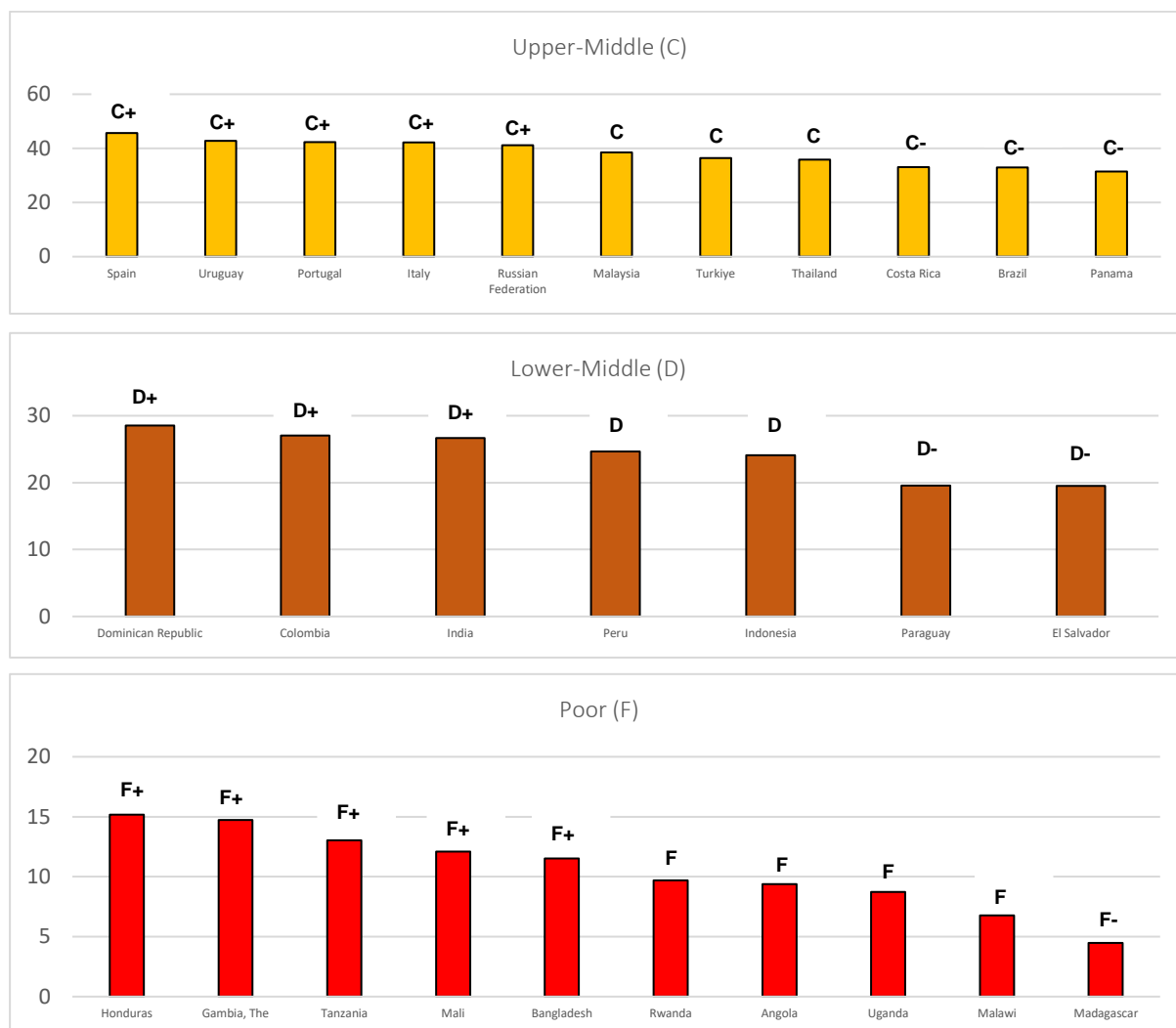


Table 9. Country Rankings

Country	2010			2015			2019		
	Score	Level	Rank	Score	Level	Rank	Score	Level	Rank
Korea, Rep.	54.39	High	1	60.19	High	1-	73.68	Ultra-High	1-
Singapore	47.81	High	4	50.66	High	3↑	61.99	Ultra-High	2↑
Denmark	45.46	Upper Middle	5	49.16	High	4↑	57.49	High	3↑
United States	48.66	High	2	57.79	High	2-	56.97	High	4↓
Switzerland	41.37	Upper Middle	10	47.92	High	6↑	56.93	High	5↑
Germany	43.60	Upper Middle	6	48.28	High	5↑	56.74	High	6↓
Sweden	43.39	Upper Middle	7	45.90	Upper Middle	8↓	56.08	High	7↑
Belgium	37.58	Upper Middle	16	43.31	Upper Middle	15↑	52.34	High	8↑
Finland	48.01	High	3	44.21	Upper Middle	12↓	52.31	High	9↑
China	27.36	Lower Middle	22	40.89	Upper Middle	17↑	52.16	High	10↑
Netherlands	41.02	Upper Middle	11	45.13	Upper Middle	10↑	51.34	High	11↓
Norway	42.75	Upper Middle	8	44.45	Upper Middle	11↓	51.07	High	12↓
France	40.10	Upper Middle	13	43.43	Upper Middle	14↓	50.72	High	13↑
Canada	40.58	Upper Middle	12	43.08	Upper Middle	16↓	49.95	High	14↑
Austria	36.01	Upper Middle	18	43.92	Upper Middle	13↑	49.95	High	15↓
U.K.	42.37	Upper Middle	9	47.40	High	7↑	49.22	High	16↓

Table 9 (cont.)

Country	2010			2015			2019		
	Score	Level	Rank	Score	Level	Rank	Score	Level	Rank
Ireland	39.98	Upper Middle	14	45.15	Upper Middle	9↑	49.14	High	17↓
Luxembourg	38.76	Upper Middle	15	40.79	Upper Middle	18↓	46.90	High	18–
Spain	35.72	Upper Middle	19	37.59	Upper Middle	19–	45.62	Upper Middle	19–
Uruguay	19.20	Lower Middle	28	26.05	Lower Middle	25↑	42.74	Upper Middle	20↑
Portugal	36.21	Upper Middle	17	35.44	Upper Middle	22↓	42.26	Upper Middle	21↑
Italy	34.63	Upper Middle	20	37.56	Upper Middle	20–	42.24	Upper Middle	22↓
Russian Fed.	25.04	Lower Middle	23	36.29	Upper Middle	21↑	41.11	Upper Middle	23↓
Malaysia	27.87	Lower Middle	21	32.62	Upper Middle	23↓	38.47	Upper Middle	24↓
Türkiye	19.39	Lower Middle	27	23.80	Lower Middle	27–	36.41	Upper Middle	25↑
Thailand	23.97	Lower Middle	24	25.48	Lower Middle	26↓	35.83	Upper Middle	26–
Costa Rica	16.34	Lower Middle	30	22.80	Lower Middle	28↑	33.07	Upper Middle	27↑
Brazil	21.86	Lower Middle	26	29.35	Lower Middle	24↑	32.94	Upper Middle	28↓
Panama	22.80	Lower Middle	25	21.85	Lower Middle	29↓	31.46	Upper Middle	29–
Dom. Rep.	16.00	Lower Middle	31	19.48	Lower Middle	31–	28.55	Lower Middle	30↑
Colombia	16.66	Lower Middle	29	20.72	Lower Middle	30↓	27.04	Lower Middle	31↓
India	11.78	Poor	36	15.18	Poor	35↑	26.67	Lower Middle	32↑
Peru	13.42	Poor	35	17.65	Lower Middle	33↑	24.66	Lower Middle	33–
Indonesia	13.94	Poor	33	19.07	Lower Middle	32↑	24.10	Lower Middle	34↓
Paraguay	13.49	Poor	34	15.49	Poor	34–	19.57	Lower Middle	35↓
El Salvador	14.12	Poor	32	14.86	Poor	36↓	19.52	Lower Middle	36–
Honduras	10.74	Poor	37	9.28	Poor	39↓	15.17	Poor	37↑
Gambia, The	6.28	Poor	38	10.73	Poor	37↑	14.72	Poor	38↓
Tanzania	4.69	Poor	41	7.46	Poor	42↓	13.02	Poor	39↑
Mali	4.47	Poor	43	9.46	Poor	38↑	12.09	Poor	40↓
Bangladesh	3.44	Poor	44	7.42	Poor	43↑	11.52	Poor	41↑
Rwanda	4.64	Poor	42	7.65	Poor	40↑	9.68	Poor	42↓
Angola	4.93	Poor	40	7.61	Poor	41↓	9.39	Poor	43↓
Uganda	5.19	Poor	39	5.34	Poor	44↓	8.74	Poor	44–
Malawi	2.89	Poor	45	4.27	Poor	45–	6.77	Poor	45–
Madagascar	2.45	Poor	46	3.40	Poor	46–	4.48	Poor	46–

The “Middle” level represents countries that are lagging behind in terms of technological development due to lack of education, infrastructure, and poor legislation. These countries need to focus on the infrastructure, use and access dimensions in their technology policies, aiming to bring them to a more advanced stage. According to the results, three of the five countries likely to transition from the “Upper-Middle” group to the “High” level in the near future are from Europe: Spain, Portugal, and Italy. Two others, Uruguay and the Russian Federation are also mentioned. The vast majority of countries in the middle level, both “Upper” and “Lower”, are from Latin America.

Finally, the “Poor” level refers to the performance of countries that have limited access to technology and inadequate infrastructure to take advantage of new technologies. These countries have a long way to go in terms of the spread of technology and the establishment of their infrastructure. As can be seen in Figure 5, most of these countries are from the African continent, except for Bangladesh

and Honduras. Among the African countries, Gambia, Tanzania, and Mali are better performers than the others. Madagascar ranks the lowest, 46th, with a TCI score of 4.48.

6. CONCLUSION

Technological change is considered one of the most important driving forces behind production efficiency. Technological change not only increases productivity but also spreads economic development to broader segments of society, thereby raising the welfare levels of communities.

The increasing focus on the technological development of countries has the potential to lead to more productive decision-making, whether at the policy level, in markets, or for the public as a whole. Building broader technological change indices could play a leading role in enabling the success of development policy and increasing growth and prosperity. Within this framework, a technological change index is constructed for developed and developing countries including least developed countries (LDCs), by considering the multidimensional nature of technology in this study. This new index is presented as a composite measure that includes the infrastructure, access and use, innovation, and impact dimensions of technology. We also use Principal Component Analysis, which has become increasingly popular in the applied economics literature in recent years, to weight the indicators of the index. TCI fills a significant gap, due to the absence of a weighted and multidimensional index in the literature that enables long-term technological development analysis for a large number of countries with varying levels of development.

According to the findings of this study, as expected, developed countries have received higher TCI scores. However, it has been observed that the TCI score is gradually decreasing in developing and least developed countries. The findings of the study support the argument in the literature that technology is the driving force of growth and development. In addition, the findings of this study lead to conclusions similar to those in the relevant literature. Indeed, the studies conducted by Ulku (2004), Mudronja et al. (2019), Choi and Yi (2009), Koutroumpis (2009), Ghosh (2017), and Dutta (2020) have demonstrated a strong relationship between various indicators representing technology and development indicators.

Technological change has accelerated around the world in the last three decades. When the TCI is analyzed at the national level, it has been revealed that South Korea and Singapore have the highest scores. These countries have achieved the most advanced level of technology, which we have defined as “Ultra High”. The success of the Asian Tigers in technology allowed them to reach a significant level of economic strength during this period. In fact, the Asian Tigers experienced a successful development process at the end of the 20th century and the beginning of the third millennium, particularly due to their comprehensive technology policies and increased technological advancements during the late 20th century.

Examining the trend of TCI scores as a whole, it is seen that most countries have reached the “High” level of technology from 1991 to 2019. During this period, while productivity, growth, and welfare significantly increased in technologically advanced countries, the other side of the coin was the widening technological gap between these countries and others. As a matter of fact, while technological progress has been accelerating in developed countries during the 2000s and developing countries have experienced reasonable technological change, the least developed countries have made little to no progress. While the strong economies of South Korea, Singapore, the US, and the EU have gained momentum in technology, the gap with low-income countries has been widening. In other words, there has been a 'technological polarization' between the developed countries and LDCs. Nine LDCs analyzed in the study were still at the “Poor” level of technology in 2019.

Developed countries achieve higher efficiency in production processes by utilizing advanced technologies, whereas least developed countries remain dependent on low-tech production methods. This situation contributes to increasing welfare levels in developed countries by reducing production costs and enhancing value-added output, while in least developed countries, a lack of productivity constrains economic growth and results in relatively lower welfare levels. The estimates of Comin and Hobijn (2010) for 166 countries over the period 1820–2003 support this finding. According to their study, cross-country differences in technology adoption account for approximately 25% of the disparities in per capita income, which is one of the most significant indicators of welfare. Furthermore, access to technology is more readily available in developed countries due to well-established infrastructure and sufficient financial resources, whereas in least developed countries, infrastructure deficiencies and financial constraints significantly limit such access. This polarization in technological advancement deepens economic and social inequalities, reinforcing disparities in welfare levels and making them more persistent. This technological gap, particularly affecting the development process of LDCs, hinders the equal distribution of economic growth, productivity increase, and welfare levels on a global scale. Bridging this gap is crucial for global prosperity, and in this context, various policy measures are necessary.

The technological gap is gradually widening because developed countries are rapidly adopting frontier technologies in the third millennium, while less developed countries are failing to do so due to their distinctive structural problems. In this context, the least developed countries need partnerships to develop and strengthen their technologies. Current international norms on technology and innovation indicate that protectionism, rather than proliferation, is at the forefront. For this reason, a global partnership led by developed countries should contribute to the development of these regions by providing technology transfer to LDCs. A strengthened international partnership for least developed countries will play a key role in expanding productive capacity and promoting sustainable development in these countries. However, regardless of the level of development, policymakers should support their technology policies that prioritize increasing productivity and welfare, with education policies that focus

on establishing human capital capable of quickly adapting to and meeting new technological developments.

The least developed countries (LDCs) face significant challenges in terms of technology access and infrastructure. In these countries, infrastructure deficiencies and difficulties in accessing technological resources are hindering the economic development process. In this context, technology transfer and infrastructure investments should be made by developed countries and international organizations. Through projects led by international organizations, strong infrastructure systems should be established in these regions, with a focus on areas such as broadband internet access and digital education. Without investment in infrastructure, reducing the existing technological divide and addressing increasing inequalities will not be possible. These policy recommendations will contribute to strengthening innovation and supporting industrialization, which help achieve Sustainable Development Goal 9 (SDG-9). Closing the technological divide will not only provide great opportunities for the least developed countries but also for more sustainable and inclusive economic growth and lasting increases in prosperity worldwide.

Future research can enhance the Technological Change Index (TCI) by integrating elements such as AI-driven innovations, digital transformation indicators, and big data analytics, thereby creating a more comprehensive framework. As technological change evolves rapidly in the Digital and Artificial Intelligence Era, traditional indicators may no longer fully capture the multidimensional nature of this transformation. In this context, with the availability of relevant data for countries, a TCI enriched with digitalization and artificial intelligence could provide future research with in-depth insights into how next-generation technologies shape socioeconomic transformation. Such an index would serve as a valuable reference for policymakers and scholars.

Ethics Committee approval was not required for this study.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors declare that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

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Measuring Türkiye's Fiscal Credibility and Transparency through Fiscal Balance and Debt Stock

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Abstract

Fiscal credibility and fiscal transparency affect many basic macroeconomic variables, especially economic growth, inflation and interest rates through expectations. Therefore, increasing credibility and transparency increase the effectiveness of fiscal policy by enabling better management of expectations. The aim of this study is to determine Türkiye's fiscal credibility and transparency. For this purpose, Türkiye's fiscal credibility and transparency were measured for the 2010-2023 period with the help of various indices, based on the International Monetary Fund's fiscal balance and debt stock expectations. According to the findings, it is possible to say that fiscal credibility decreased in Türkiye, the absolute deviation between fiscal balance expectations and official targets increased, and fiscal transparency decreased, especially in the 2019-2022 period.

Keywords: *Fiscal Credibility, Fiscal Transparency, Fiscal Opacity, Fiscal Balance, Debt Stock.*

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1. INTRODUCTION

Future values of a macroeconomic variable are the result of the decisions made by economic agents in the current period. However, uncertainties regarding the future influence these decisions, making the concept of expectations one of the most important factors in the decision-making process. Therefore, to make accurate predictions about the future and to determine appropriate economic policies, it is essential to incorporate the concept of expectations into the theories and models used.

While various expectation hypotheses exist in macroeconomics, it can be said that the rational expectations hypothesis proposed by Muth (1961) holds a dominant position among contemporary macroeconomic theories. This hypothesis assumes that economic decision-makers will use all available information effectively when forecasting the future value of a variable, believing that the factors influencing that variable's value will impact it. As a result of using the same information set, it can be assumed that economic agents will have similar expectations. However, differences in expectations may exist and can change over time (Mankiw et al., 2003, p. 209). This indicates the presence of uncertainty in the economy. Theoretical literature highlights several key reasons for these differences: i) variations in the models used to understand and evaluate economic conditions, ii) differences in the information sets, iii) discrepancies in interpreting new information presented to the public, and iv) differing views on the nature of changes occurring within the economic system (Lahiri & Sheng, 2008; Patton & Timmerman, 2010; Wieland & Wolters, 2011; Andrade et al., 2016; Oliveira & Curi, 2016; Montes & Acar, 2020).

In this context, the effectiveness of implemented policies depends on the management of economic agents' expectations. In recent years, many countries have adopted inflation targeting strategies that rely on expectation management. In this strategy, a central bank aiming to combat inflation shares a numerical inflation target with the public in advance, attempting to align expectations with this goal. If economic agents believe in the central bank's monetary policy, they will set their inflation expectations in accordance with the target and make decisions accordingly, leading to inflation occurring at the desired rate. Theoretically, this strategy allows for reducing inflation without any loss in real output or employment.

The key components of expectation management are credibility, transparency, and communication. As former Fed Chairman J. Yellen once said “*In government institutions and in teaching, you need to inspire confidence. To achieve credibility, you have to very clearly explain what you are doing and why*”. Communication and credibility go in tandem (End & Hong, 2022, p. 8). Thus, central banks and governments share not only numerical targets but also forecasts, changes in those forecasts due to developments, market expectations, risk scenarios, and more through various speeches, press releases, and reports. This is a necessary aspect of the communication and transparency strategy.

There is no universally agreed-upon definition of credibility. Cukierman and Meltzer (1986, p. 1108) define it as the absolute value of the difference between the government's plans and the public's belief in those plans, where a smaller difference indicates higher credibility. Significant changes in government plans can weaken this credibility. Conversely, if the public believes in the announced policy, it can be deemed credible (Blinder, 2000, p. 1422). Baxter (1985) and Hauner et al. (2007) relate credibility to the public's belief in how a policy's goals will be approached. Similarly, End (2023, p. 2) defines credibility as the anchoring of market expectations to official policy targets.

From the perspective of credibility, fiscal policy has certain disadvantages compared to monetary policy. For instance, the multiple objectives of fiscal policy and the potential for governments to shift priorities in the short term create significant time inconsistency problems, undermining the credibility of fiscal policies (End, 2023, p. 1). However, fiscal credibility plays a crucial role in stabilizing expectations, which can prevent increases in long-term interest rates and reduce default risk (de Mendonça & Machado, 2013, p. 10). While the importance of fiscal credibility may vary based on the and the nature of the problem, it should be built on a realistic, disciplined, prudent, and transparent fiscal policy to ensure long-term fiscal sustainability (Clark, 2011, pp. 103-104).

The literature includes studies that measure fiscal credibility through the general budget balance and the primary budget balance (Frankel & Schreger, 2013; de Mendonça & Tostes, 2015; Gaol et al., 2015; de Mendonça & da Silva, 2016; Kuncoro, 2017; End, 2020; Anzoátegui-Zapata & Galvis-Ciro, 2021; End & Hong, 2022). Additionally, there are studies directly relating fiscal credibility to expectations of public debt sustainability (de Mendonça & Machado, 2013; Montes & Acar, 2020). Empirical research indicates that fiscal credibility i) reduces the disparity in growth expectations among economic agents (Montes & Acar, 2020; Montes & Luna, 2022); ii) improves public financing conditions (End, 2023); iii) enhances the success of public debt management by preventing increases in long-term interest rates (de Mendonça & Machado, 2013); iv) contributes significantly to lowering inflation rates and inflation expectations (de Mendonça & da Silva, 2016); and v) serves as an effective tool in reducing the pass-through from exchange rates to inflation and inflation expectations (de Mendonça & Tostes, 2015).

Fiscal transparency improves financial indicators, increasing a country's credit rating and thereby reducing default risk (Arbatlı & Escolano, 2015). The absence of fiscal transparency, referred to as fiscal opacity means that economic agents are unable to accurately predict the consequences of budget deficits (Montes & Luna, 2022, p. 2361). Lack of fiscal transparency diminishes short-term growth expectations (de Mendonça & Calafate, 2021). Furthermore, discretionary fiscal policy increases the differences in economic growth forecasts among economic agents, thereby raising uncertainty (Montes & Luna, 2022).

Overall, fiscal credibility and transparency influence various macroeconomic variables, including inflation, growth, interest rates, and exchange rates, through expectations. Therefore, measuring and evaluating the credibility and transparency of fiscal policy is crucial for expectation management. This study assesses Türkiye's fiscal credibility and transparency from 2010 to 2023 using various approaches found in the literature. Bağdigen (2005); Atılgan-Yasa et al. (2020) and Pıçak (2022) calculate budget forecasting errors for Türkiye. However, these studies typically calculate forecasting errors based on the difference between the institution's budget targets and actual outcomes. In contrast, this study calculates expectation errors based on the difference between the forecasts of a different institution, such as the International Monetary Fund (IMF), and actual outcomes. It then transforms this into an index to measure fiscal credibility and transparency. Notably, no studies measuring fiscal credibility and transparency through an index were identified, suggesting that this research could contribute to the literature.

In this context, the study consists of five sections. The second section explains the methods for measuring fiscal credibility and transparency. The third section presents the relevant literature on fiscal credibility and opacity. The fourth section calculates Türkiye's fiscal credibility and transparency indices for the 2010-2023 period. The final section evaluates the obtained results.

2. MEASURING FISCAL CREDIBILITY AND TRANSPARENCY

2.1. Measuring Fiscal Credibility

In measuring fiscal credibility, an index with a value between 0 and 1 is generally created with the help of financial variables such as budget balance, primary budget balance and debt stock, and credibility degrees are determined according to the values of this index. In this direction, de Mendonça & Machado (2013) created a financial credibility index based on the public debt stock. This index is created with the help of Equation 1.

$$FCI_t = \begin{cases} 1, E_t(debt_{t+12}) \leq debt^{min} \\ 1 - \frac{[E_t(debt_{t+12}) - debt^{min}]}{debt^{max} - debt^{min}}, debt^{min} < E_t(debt_{t+12}) < debt^{max} \\ 0, E_t(debt_{t+12}) \geq debt^{max} \end{cases} \quad (1)$$

In Equation 1, $E_t(debt_{t+12})$ represents the expected public debt stock to Gross Domestic Product (GDP) ratio for the t+12 period created in period t. The values of $debt^{min}$ and $debt^{max}$ in this equation are set at 40% and 60%, respectively, based on IMF calculations and the Maastricht Criteria. However, later studies by de Mendonça & Tostes (2015), de Mendonça & Auel (2016), and Montes & Luna (2022) used the values of 30% and 70% for developing countries based on the literature. If the debt stock expectation for the t+12 period is below the lower limit, the index takes the value of 1, indicating full credibility. If the debt stock expectation exceeds the upper limit, the index takes the value of 0, indicating non-credibility. If the debt stock expectation falls between the lower and upper limits, the index takes a value between 0 and 1, indicating partial credibility.

Another fiscal credibility index was created by de Mendonça & da Silva (2016). The researchers derived a fiscal credibility index based on the primary budget balance variable. The calculation of the index is presented in Equation 2.

$$FCI = \begin{cases} 1, & FPS_{min}^{ideal} \leq E_t(FPS_{t+12}) \leq FPS_{max}^{ideal} \\ 1 - \frac{1}{FPS_{max}^{toler} - FPS_{max}^{ideal}} [E_t(FPS_{t+12}) - FPS_{max}^{ideal}], & FPS_{max}^{ideal} < E_t(FPS_{t+12}) \leq FPS_{max}^{toler} \\ 1 - \frac{1}{FPS_{min}^{toler} - FPS_{min}^{ideal}} [E_t(FPS_{t+12}) - FPS_{min}^{ideal}], & FPS_{min}^{ideal} > E_t(FPS_{t+12}) \leq FPS_{min}^{toler} \\ 0, & E_t(FPS_{t+12}) < FPS_{min}^{toler} \text{ ya da } > E_t(FPS_{t+12}) > FPS_{max}^{toler} \end{cases} \quad (2)$$

In Equation 2, FPS represents the primary budget balance. It is a fact that expectations will deteriorate more rapidly if the primary surplus falls below the target. Thus, using different ranges creates an asymmetric framework that is useful for measuring credibility. In this context, FPS_{min}^{ideal} and FPS_{max}^{ideal} represent an ideal range corresponding to the government's strong performance in achieving the primary surplus. FPS_{min}^{toler} and FPS_{max}^{toler} indicate a tolerance range representing acceptable performance, determined using Equations 3 and 4.

$$[FPS_{min}^{ideal}, FPS_{max}^{ideal}] = [FPS^* - 0.05, FPS^* + 0.1] \quad (3)$$

$$[FPS_{min}^{toler}, FPS_{max}^{toler}] = [FPS^* - 0.15, FPS^* + 0.3] \quad (4)$$

If the expected primary surplus is within the ideal limits, the credibility index takes the value of 1, indicating full credibility. If it falls outside the tolerance range, the index takes the value of 0. In other scenarios, the credibility index falls between 0 and 1, indicating a move away from full credibility.

Another study calculating the fiscal credibility index was conducted by Montes and Acar (2018), who derived the index using the intertemporal budget constraint approach for fiscal sustainability, as presented in Equation 5.

$$FCI_t = \begin{cases} 1, & E_t(ps_{t+12}) \geq ps^{ideal} \\ 1 - \left\{ \frac{[E_t(ps_{t+12}) - ps^{ideal}]}{ps^{toler} - ps^{ideal}} \right\}, & ps^{ideal} > E_t(ps_{t+12}) > ps^{toler} \\ 0, & E_t(ps_{t+12}) \leq ps^{toler} \end{cases} \quad (5)$$

In Equation 5, $E_t(ps_{t+12})$ represents the expected primary surplus to GDP ratio for the t+12 period created in period t. The ideal and tolerance values for the primary surplus are obtained using Equations 6 and 7.

$$ps^{ideal} = (Debt_t - \%50) + Debt_t \left[\frac{[E_t(r_{t+12}) - E_t(g_{t+12})]}{1 + E_t(g_{t+12})} \right] \quad (6)$$

$$ps^{toler} = (Debt_t - \%70) + Debt_t \left[\frac{[E_t(r_{t+12}) - E_t(g_{t+12})]}{1 + E_t(g_{t+12})} \right] \quad (7)$$

In Equations 6 and 7, $Debt_t$ represents the ratio of gross debt stock to GDP in period t, $E_t(g_{t+12})$ denotes the expected growth rate for twelve months ahead, and $E_t(r_{t+12})$ indicates the expected real interest rate for the same period. Montes and Acar (2018) state that acceptable limits for

the gross public debt stock ratio to GDP for developing countries are 50% and 70%. In this context, ps^{ideal} represents the primary surplus needed to reach 50% of the gross public debt stock ratio to GDP in the next twelve months, while ps^{toler} represents the surplus required to reach 70%.

End (2020) considers the difference between government budget targets and market expectations as an indicator of fiscal credibility. This approach is based on the idea that credible governments can manage market expectations through official forecasts, leading expectations closer to targets. In this context, the deviation (bias) between official budget forecasts and market expectations is calculated as follows (End, 2020: p. 3):

$$Bias_t = E_t^o b_{t+1} - E_t^p b_{t+1} \quad (8)$$

In Equation 8, $E_t^o b_{t+1}$ represents the government's target for the general budget balance to GDP ratio for the $t+1$ period; $E_t^p b_{t+1}$ indicates the market experts' expectations for the same ratio. If the market's budget deficit expectation exceeds the official target, the bias will take positive values. However, this perceived measure of bias implies that a government predicting higher deficits may be seen as more credible than one predicting lower deficits. Due to the uncertainty regarding whether it is better for governments to be more or less optimistic than market experts, a symmetric indicator measuring market distrust in government targets is needed. End (2020) expressed this distrust through the absolute deviation between government and market forecasts, calculated using Equation 9.

$$Mist_t \equiv |Bias_t| = |E_t^o b_{t+1} - E_t^p b_{t+1}| \quad (9)$$

In other words, $Bias_t$ includes the signs of the deviation and represents the degree of optimism or pessimism of the private sector regarding official figures. In contrast, $Mist_t$ serves as a more direct measure of the perceived certainty of the official plans.

End and Hong (2022) further developed the approach initially used by End (2020) by adding an unanchoring measure, which reflects the distribution of market forecasts around official targets, in addition to the bias and distrust metrics. It is expected that managing expectations will reduce the distribution of credibility among private sector forecasts. Although the distribution of expectations among market participants is interpreted as internal expectation uncertainty, a lack of confidence in policy announcements is believed to increase this uncertainty. Thus, the more credible the government is perceived to be, the closer the expectations of market participants will converge. In this context, the measure of unanchoring is calculated using the following equation:

$$\delta_{t,f}^{(h)} \equiv E_t^f b_t^h - E_t^o b_t^h \quad (10)$$

$$Bias_t^{(h)} \equiv \left\langle \delta_{t,f}^{(h)} \right\rangle_{f \in F} = E_t^p b_t^{(h)} - E_t^o b_t^h \quad (11)$$

$$Unanc_t^{(h)} \equiv \sqrt{\left\langle \left[\delta_{t,f}^{(h)} \right]^2 \right\rangle_{f \in F}} \quad (12)$$

In these equations, b represents the budget balance, h denotes the forecasting horizon, f indicates the expectations of market participants, p is the average expectation of market participants, and o represents the official forecast. As seen, fiscal credibility is measured either through an index derived from specific fiscal variables or by the difference between official targets and market expectations.

2.2. Measurement of Fiscal Transparency

Fiscal opacity, indicating a lack of fiscal transparency, is based on budget forecast errors and is measured by the difference between financial market experts' expectations of the budget deficit and the actual budget deficits. To develop an index measuring fiscal opacity, a four-step method is followed (de Mendonça & Calafate, 2021; Montes & Luna, 2022):

In the first step, a series of forecast errors (FE) is obtained by analyzing the difference between actual budget deficits and the expectations of economic actors regarding the budget deficit. The magnitude of this difference reflects the level of information deficiency among those making forecasts about the fiscal situation. It is believed that informative developments will reduce this difference and consequently decrease forecast errors. The forecast error series is obtained using Equation 13.

$$FE_t = B_t - B_t^e \quad (13)$$

In Equation 13, FE_t represents the forecast error for period t , B_t indicates the actual budget deficit for t period, and B_t^e reflects the budget deficit forecasts made by economic actors 12 months prior. The notation $B > 0$ represents a primary surplus, while $B < 0$ indicates a primary deficit. If $(B_t < B_t^e)$ the forecast error is negative, and if $(B_t > B_t^e)$ it results in positive values, which are interpreted as overestimation and underestimation of the budget deficit, respectively. However, fiscal opacity pertains not to the over- or underestimation of deficits but rather to the insufficiency of information or projections for accurately forecasting the budget deficit. Therefore, both positive and negative forecast errors signify opacity, making the mean square error (MSE) an appropriate measure for this context.

In the second step, the mean square error (MSE) is calculated using Equation 14. In this equation, N represents the number of observations made for period t .

$$MSE_t = \frac{1}{N} \sum_{n=1}^N (FE)^2 \quad (14)$$

In the third step, the signal-to-noise ratio (SNR) is calculated using Equation 15. To do this, the variance of the actual budget data series, represented as (σ_B^2) , is first computed as a measure of

uncertainty. The SNR is then obtained by dividing the mean square error (MSE) by this calculated variance:

$$SNR = \frac{MSE_t}{\sigma_t^2} \quad (15)$$

When $SNR \geq 1$, ($MSE_t > \sigma_t^2$), it indicates that forecasting economic actors have no information about the final value of the budget deficit. Conversely, when $SNR = 0$, ($MSE_t = 0$), it means that forecasters possess sufficient information to accurately predict the budget deficit, indicating the absence of fiscal opacity. Therefore, a value approaching zero for SNR is desirable.

In the fourth step, a fiscal opacity (FO) index is created based on the SNR values. The SNR values are normalized using Equation 16, resulting in FO values that range between 0 and 1. This normalization allows for a standardized measure of fiscal opacity, where lower FO values indicate greater transparency and higher values suggest increased opacity.

$$FO_t = \begin{cases} 1, & MSE_t \geq \sigma_t^2 \\ \frac{MSE_t}{\sigma_t^2}, & 0 < MSE_t < \sigma_t^2 \\ 0, & MSE_t = 0 \end{cases} \quad (16)$$

A fiscal opacity (FO) index value approaching 0 indicates that the government provides sufficient information about its primary budget surplus or deficit, suggesting government transparency. Conversely, an FO value nearing 1 signifies that the government is inadequate in providing enough information to mitigate the uncertainty in forecasts, resulting in greater informational deficiencies regarding future primary budget surpluses or deficits.

3. LITERATURE REVIEW

The density of studies focusing on the Brazilian economy is striking on the literature on fiscal credibility and transparency. This is largely due to the Brazilian Central Bank's monthly household and market surveys, which include questions about expectations regarding fiscal indicators. As a result, data can be obtained at a monthly frequency, allowing for the construction of credibility and transparency indices. Subsequently, the relationships between these indices and other variables are investigated in the literature. In this context, it is possible to list some studies in the literature as follows:

De Mendonça and Machado (2013) adopted the debt stock approach to measure the fiscal credibility of the Brazilian economy for the period 2002-2011. According to the index scores obtained, 2002 was the year with the lowest fiscal credibility. However, starting from 2003, there was a trend of increasing credibility, peaking in 2008. The period from 2008 to 2011 was identified as a time when fiscal credibility was fully established. Montes et al. (2019) measured Brazil's fiscal credibility during the period from December 2001 to February 2016 using a similar approach.

Montes and Acar (2020) analyzed the fiscal credibility of Brazil for the period 2003M1-2017M5. According to the findings, there is a period of credibility building, which occurs between early 2004 and goes until 2014, despite the drop in 2009 due to the Global Financial Crisis. Credibility-building phase starts a bit before 2004 and reaches its maximum value (equal to 1) at the end of 2008, and it stays practically unchanged until 2015. Also, Montes and Souza (2020), measured Brazil's fiscal credibility during the period from March 2004 to February 2016.

End (2023) measured the fiscal credibility of 27 European countries for the period 1995-2019 using the Mist approach. During this period, Spain was identified as the country with the highest average Mist values, while Austria had the lowest Mist values. This suggests that Austria can be considered the most successful country in establishing fiscal credibility. Anzoátegui-Zapata and Calvis-Ciro (2021) measured Colombia's fiscal credibility for the period 2004-2019 using the Mist approach. Findings shows that there was uncertainty about fiscal policy in the 2006-2008 period and fiscal credibility loss was high in that period. However, the loss of credibility was stable between 2012 and 2019. For the full period (2004-2019), the credibility loss was 0.9% on average.

De Mendonça and Baca (2022) investigated fiscal opacity for 13 OECD countries over the period 1980-2016. According to the findings, the opacity index trend suggests an increase in opacity during the 1980s with relative stability from the 1990s to the first decade of the 2000s. It is noticeable that there is a trend of fall at the end of the first decade of the 2000s. The findings refer that the measures to increase transparency adopted after the global financial crisis is effective. De Mendonça et al. (2024) investigated Brazil's fiscal opacity for the period from January 2010 to March 2023. According to their findings, fiscal opacity increased due to the inappropriate economic policies of 2013-2014 and the impact of the Covid-19 pandemic from 2020 to 2022.

Bağdigen (2005), analyzes the accuracy of budget forecasts in Türkiye for the 1981-2003 period. Data is based forecasted and materialized general budget revenues and outlays, the results show that there are statistically significant forecast errors and this significance, especially, indicates biases towards under-forecasting of outlays and over-forecasting of revenues. Atılğan-Yaşa et al. (2020) investigate the relationship between the deviations of budget forecasts and outlays and political instability in Türkiye for the period 1984-2018. They found that during periods of increased political instability, deviations in budget forecasts, particularly those related to budget expenditures, were more pronounced. Pıçak (2022) calculates annual forecasting errors for budget revenues and expenditures by using estimated and actual figures in Türkiye for the 1990-2020 period. This period is divided into two sub-periods: before and after 2006, when medium-term programs were first implemented. The impact of multi-year budgeting on forecasting errors is examined. According to the findings, forecasting errors for budget expenditures were statistically lower in the post-2006 period, whereas no such finding was observed for budget revenues.

4. MEASUREMENT OF TÜRKİYE'S FISCAL CREDIBILITY AND FISCAL TRANSPARENCY

4.1. Measurement of Fiscal Transparency

To measure Türkiye's fiscal credibility and fiscal transparency for the period 2010-2023, methods from de Mendonça and Machado (2013), Montes and Acar (2018), and End (2020) for fiscal credibility, as well as those from de Mendonça and Calafate (2021) and Montes and Luna (2022) for fiscal opacity, have been adopted. Explanations of all the variables used in the indices and information about the data sources are presented in Table 1.

Data regarding official targets is sourced from the Medium-Term Programs published by the Presidency of the Republic of Türkiye, Strategy and Budget Office. Meanwhile, expectations for the variables are compiled from the IMF's Fiscal Monitor and World Economic Outlook reports. In Türkiye, Medium-Term Programs are typically published in October, outlining both the realized forecasts for the current year and the program targets for the next three years. The IMF publishes the Fiscal Monitor and World Economic Outlook reports twice a year, in April and October, providing key fiscal and economic indicators for many countries. Since regular forecasts for Türkiye's fiscal indicators began with the April 2010 report, the study is set to start from the year 2010. In this context, Türkiye's budget targets for 2010 were included in the Medium-Term program published in October 2009, and the IMF's first expectation for 2010 was shared with the public through the April 2010 reports. Therefore, deviations between the official targets and IMF expectations are assessed by considering the expectations announced after the official targets were declared. The IMF's biannual reporting allows for the calculation of two index values for each year.

Table 1. Data Set

Variables	Symbol	Description	Data Source
General Budget Balance	b	General Government Balance, Budget Balance, Borrowing Need/ GDP, annual	The Presidency of the Republic of Türkiye, Strategy and Budget Office, Indicators and Statistics
Primary Surplus	FPS	General Government Balance, Primary Surplus, Borrowing Need Excluding Interest/ GDP, annual	The Presidency of the Republic of Türkiye, Strategy and Budget Office, Indicators and Statistics
Primary Surplus Target	FPS^*	General Government Balance, Primary Surplus/ GDP, annual	The Presidency of the Republic of Türkiye, Strategy and Budget Office, The Medium-Term Programs
Primary Surplus Expectation	$E(FPS)$	General Government Balance, Primary Surplus/ GDP, annual	IMF Fiscal Monitor
Debt Stock	$Debt$	EU Defined General Government Gross Debt Stock (% of GDP), annual	Republic of Türkiye Ministry of Treasury and Finance, Statistics
Debt Stock Expectation	$E(Debt)$	Gross Debt Stock Expectation (% of GDP)	IMF Fiscal Monitor
Nominal Interest Rate	r	Two-Year Bond Rate, April and October 1st, End of Day Rate, %, annual	investing.com
Real Interest Rate Expectation	$E(r)$	%, annual	$E(r)_t = \frac{1+i_t}{1+E(\pi)_t} - 1$
Inflation Expectation	$E(\pi)$	Consumer Prices, %, annual	IMF World Economic Outlook
Growth Expectation	$E(g)$	GDP, %, annual	IMF World Economic Outlook

In Montes and Acar (2018), the fiscal credibility index approach requires expectations of the real interest rate for the upcoming year to determine the ideal and tolerance limits for the primary surplus. However, while the Central Bank of the Republic of Türkiye (CBRT) publishes various maturities of inflation expectations in its monthly Market Participants Survey, data for the expectation of the one-week repo auction rate (the policy interest rate) is only available for 12 months ahead. Using the policy rate is not suitable, as it does not accurately reflect the government's borrowing costs.

Since the credibility index relates to fiscal sustainability and is based on the intertemporal budget constraint approach, an expectation for a relevant interest rate variable used in borrowing should be applied. Therefore, the study uses the two-year bond yield as a benchmark for Türkiye. However, there is no available data on the market's expectations for the two-year bond yield covering the study period. To address this, closing rates of the two-year bond yields on the first days of the IMF's report releases in April and October, along with the inflation expectations published in the same month, are utilized. The expectation for the real interest rate for the upcoming year is calculated using Equation 17.

$$E(r)_t = \frac{1+i_t}{1+E(\pi)_t} - 1 \quad (17)$$

In Equation 17, $E(r)_t$ represents the expectation for the interest rate for the upcoming year in period t ; i_t denotes the annual yield of the two-year bond rate in period t ; and $E(\pi)_t$ indicates the inflation expectation for the upcoming year in period t . This equation helps to derive the real interest rate expectation based on the nominal yield and inflation expectations.

4.2. Findings

The fiscal credibility index was derived using the approaches of de Mendonça and Machado (2013) and Montes and Acar (2018). To ensure internal consistency in the study, boundary values for the gross debt stock were set at 30% and 70%, referencing works by de Mendonça and Tostes (2015), de Mendonça and Auel (2016), and Montes and Luna (2022), due to differences in the boundary values in the two studies. Additionally, the method used by End (2020) was applied to measure fiscal credibility. The findings for Türkiye from 2010 to 2023 obtained from these measurements are presented in Table 2.

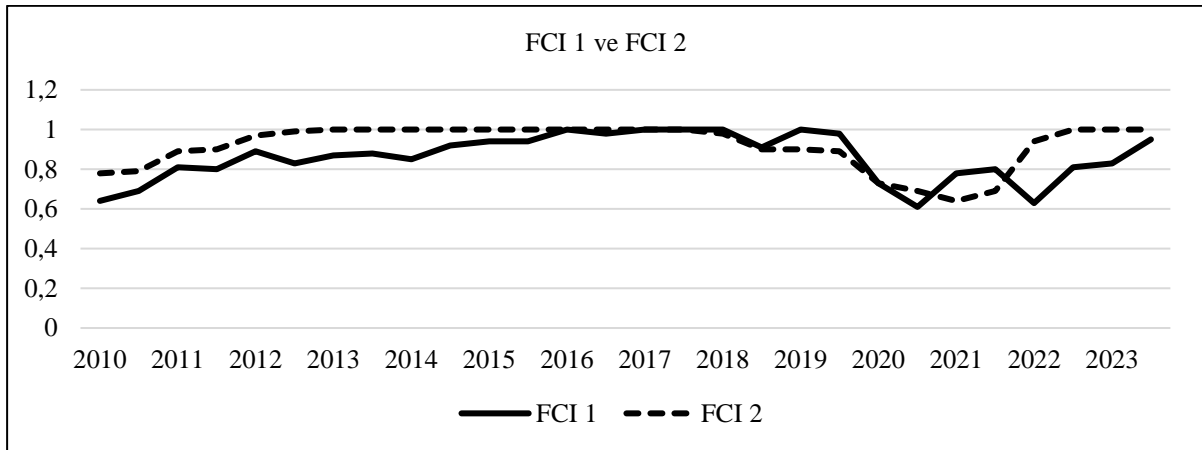
The FCI1 fiscal credibility index was derived using the approached of de Mendonça and Machado (2013) and the FCI2 fiscal credibility index was derived using the approached of Montes and Acar (2018). To ensure internal consistency in the study, boundary values for the gross debt stock were set at 30% and 70%, referencing works by de Mendonça and Tostes (2015), de Mendonça and Auel (2016), and Montes and Luna (2022), due to differences in the boundary values in the two studies. Additionally, the method used by End (2020) was applied to measure the Mist fiscal credibility. The findings for Türkiye from 2010 to 2023 obtained from these measurements are presented in Table 2.

Table 2. Fiscal Credibility Index (2010-2023)

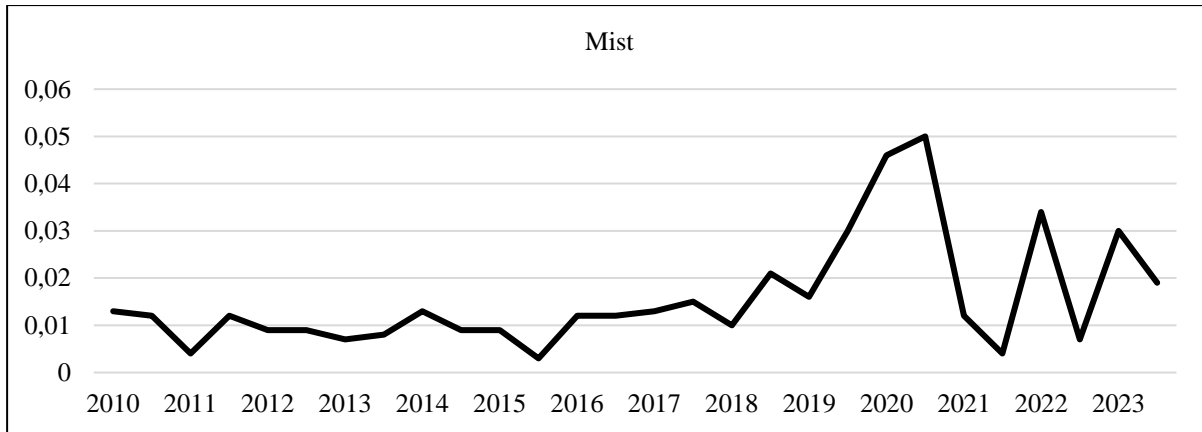
FCI1 (de Mendonça & Machado, Year Score Year Score				FCI2 (Montes & Acar, 2018) Year Score Year Score				Mist (End, 2020) Year Score Year Score			
2010	0.64	2017	1	2010	0.78	2017	1	2010	0.013	2017	0.013
	0.69		1		0.79		1		0.012		0.015
2011	0.81	2018	1	2011	0.89	2018	0.98	2011	0.004	2018	0.010
	0.80		0.91		0.90		0.90		0.012		0.021
2012	0.89	2019	1	2012	0.97	2019	0.90	2012	0.009	2019	0.016
	0.83		0.98		0.99		0.89		0.009		0.030
2013	0.87	2020	0.73	2013	1	2020	0.73	2013	0.007	2020	0.046
	0.88		0.61		1		0.69		0.008		0.050
2014	0.85	2021	0.78	2014	1	2021	0.64	2014	0.013	2021	0.012
	0.92		0.80		1		0.69		0.009		0.004
2015	0.94	2022	0.63	2015	1	2022	0.94	2015	0.009	2022	0.034
	0.94		0.81		1		1		0.003		0.007
2016	1	2023	0.83	2016	1	2023	1	2016	0.012	2023	0.030
	0.98		0.95		1		1		0.012		0.019

The Fiscal Credibility Index 1 (FCI 1) obtained using the method of de Mendonça and Machado (2013) showed values of 1 or very close to 1, particularly during the period of 2016-2018. Therefore, it can be stated that fiscal credibility was complete or nearly complete during this sub-period. According to this index, the lowest level of fiscal credibility occurred in October 2020, with an index value of 0.61. On the other hand, the Fiscal Credibility Index 2 (FCI 2) derived from the method of Montes and Acar (2018) maintained a value of 1 during the periods of 2013-2017 and after October 2022, indicating complete fiscal credibility. The lowest value for FCI 2 occurred in April 2021, at 0.64. According to the method of End (2020), which expresses the absolute deviation of budget balance forecasts from official targets through the Mist values, the highest absolute deviation was recorded in 2020, while the lowest was in 2015.

The changes in the credibility indices FCI 1 and FCI 2 from 2010 to 2023 are illustrated in Figure 1, while the changes in the Mist values are presented in Figure 2. Figure 1 shows that fiscal credibility has increased since 2010 and remained high until 2019. However, a notable decline in fiscal credibility occurred during the period from 2019 to 2022. Since 2022, fiscal credibility has begun to rise again.

Figure 1. Fiscal Credibility of Türkiye (2010-2023)

In Figure 2, it is observed that the absolute deviations between budget balance expectations and targets were relatively low during the period from 2010 to 2018. However, in the post-2019 period, these absolute deviations increased significantly, with considerable differences noted between the two forecasts made within the same year. These results suggest that fiscal credibility declined after 2019, leading to expectations moving further away from the targets.

Figure 2. Absolute Deviations Related to Türkiye's Fiscal Balance (2010-2023)

The Fiscal Opacity Index (FO) is derived using the actual values of the general government overall balance and the primary balance. Both current year and next year forecasts provided by the IMF for these variables, along with their actual values for the relevant year, were utilized to calculate the index. The use of two different variables related to the budget aims to test the consistency of the results. The obtained index values are presented in Table 3.

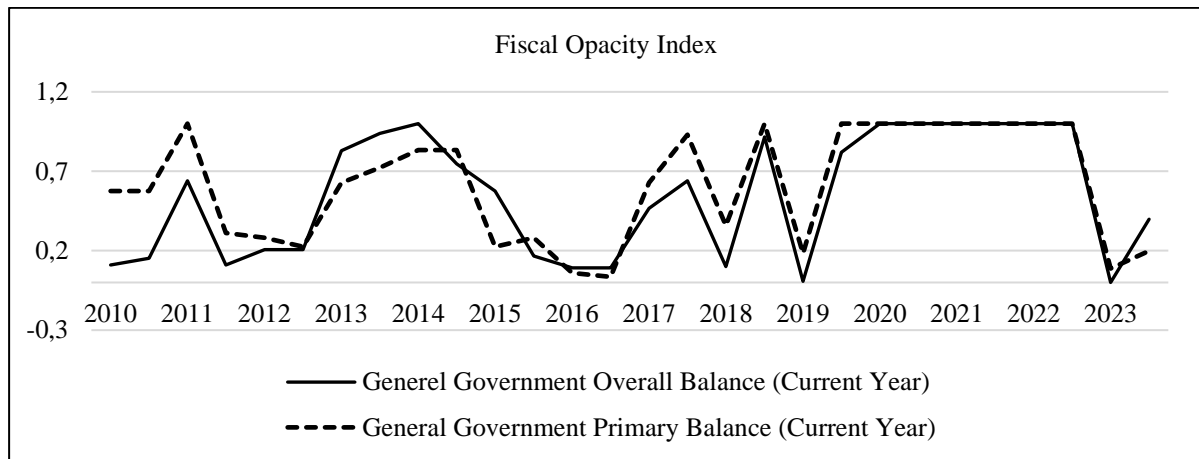
Table 3. Türkiye's Fiscal Opacity Index (2010-2023)

Year	General Government Overall Balance				General Government Primary Balance			
	Current Year		Next Year		Current Year		Next Year	
	B-BE	FO	B-BE	FO	B-BE	FO	B-BE	FO
2010	0.0057	0.11	0.0267	1	0.0133	0.58	0.0218	1
	0.0067	0.15	0.0227	1	0.0133	0.58	0.0208	1
2011	0.0137	0.64	0.0058	0.24	0.0208	1	0.0113	0.22
	0.0057	0.11	0.0008	0.00	0.0098	0.31	0.0043	0.00
2012	0.0078	0.21	0.0136	1	0.0093	0.28	0.0139	1
	0.0078	0.21	0.0126	1	0.0083	0.22	0.0109	1
2013	0.0156	0.83	0.0178	1	0.0139	0.63	0.0150	1
	0.0166	0.94	0.0178	1	0.0149	0.72	0.0160	1
2014	0.0188	1	0.0220	1	0.0160	0.83	0.0183	1
	0.0148	0.75	0.0180	1	0.0160	0.83	0.0183	1
2015	0.0130	0.58	-0.0048	0.16	0.0083	0.22	-0.0087	0.15
	0.0070	0.17	-0.0058	0.24	0.0093	0.28	-0.0077	0.22
2016	0.0052	0.09	-0.0053	0.20	0.0043	0.06	-0.0071	0.18
	0.0052	0.09	-0.0023	0.04	0.0033	0.04	-0.0061	0.03
2017	0.0117	0.47	-0.0036	0.09	0.0139	0.63	-0.0015	0.08
	0.0137	0.64	0.0004	0.01	0.0169	0.93	0.0035	0.01
2018	0.0054	0.10	0.0015	0.02	0.0105	0.36	0.0075	0.01
	0.0164	0.92	0.0205	1	0.0185	1	0.0165	1
2019	0.0015	0.01	-0.0114	0.91	0.0075	0.18	-0.0042	0.84
	0.0155	0.82	0.0076	0.40	0.0225	1	0.0138	0.37
2020	0.0356	1	0.0406	1	0.0358	1	0.0329	1
	0.0396	1	0.0526	1	0.0398	1	0.0439	1
2021	0.0306	1	0.0530	1	0.0329	1	0.0456	1
	0.0226	1	0.0480	1	0.0239	1	0.0396	1
2022	0.0610	1	0.0102	0.73	0.0526	1	-0.0018	0.67
	0.0340	1	-0.0088	0.54	0.0386	1	-0.0108	0.50
2023	0.0002	0.01			0.0052	0.09		
	-0.0108	0.40			-0.0078	0.20		

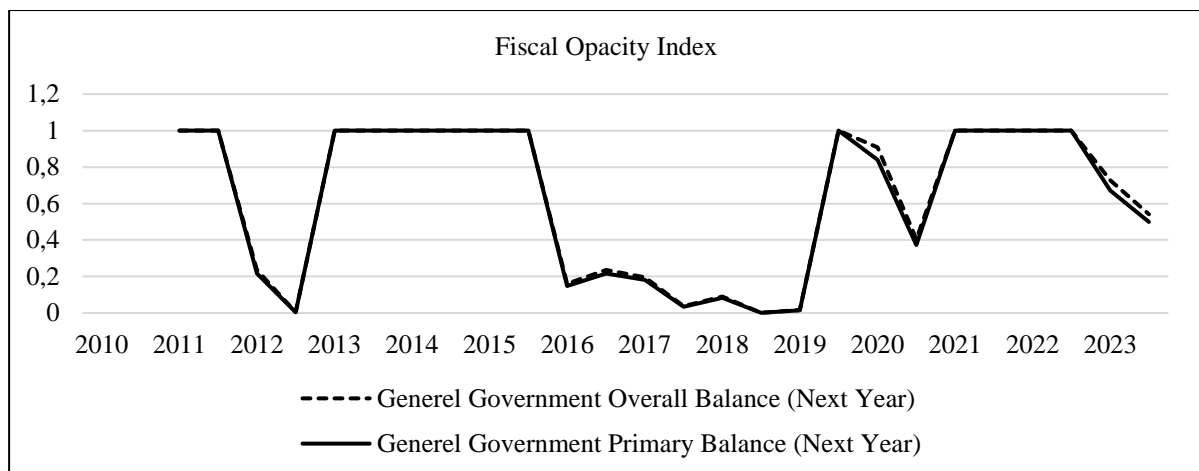
Note: As budget realization data for 2024 is not yet available, the budget forecast realization for 2024, corresponding to 2023, could not be calculated.

According to the data in Table 3, the IMF's budget balance forecasts tend to be excessively high, as evidenced by 27 out of 28 forecasts overestimating the budget deficit. Türkiye's fiscal opacity reached a value of 1, particularly during the 2020-2022 period, indicating a lack of fiscal transparency and insufficient information being provided to economic agents. The negative impacts on budget revenues and expenditures during the Covid-19 pandemic contributed to these forecasting errors, leading to an inability to accurately predict budget outcomes.

The results from both variables show similarities, supporting the consistency of the obtained data. Figure 3 visually presents these changes.

Figure 3. Türkiye's Fiscal Opacity Index (Budget Forecasts for the Current Year)

The changes in the opacity index derived from Türkiye's forecasts for the general government overall balance and the primary balance for the upcoming year are presented in Figure 4. As shown in Figure 4, uncertainty increases with longer time horizons, making it challenging for economic agents to form realistic expectations. Indeed, except for the years 2012 and the period from 2016 to 2019, the opacity index has mostly registered values close to 1, indicating a lack of fiscal transparency or very low levels of it.

Figure 4. Türkiye's Fiscal Opacity Index (Budget Forecasts for the End of Next Year)

5. CONCLUSION

Fiscal credibility and transparency enhance the effectiveness of fiscal policy by managing expectations. Therefore, measuring a country's fiscal credibility and transparency is crucial for formulating strategies that facilitate the acceptance of policies by economic agents and their incorporation into decision-making processes. This study evaluates Türkiye's fiscal credibility and transparency using the IMF's forecasts for various fiscal and economic variables alongside the government's budget and debt targets outlined in Medium-Term Programs.

Fiscal policies adopted in the 2000s has created different results in Türkiye subsequently yielded huge reductions in budget deficits, public debt ratios and interest payments, which have enabled Türkiye to create the fiscal space needed (Kasal & Özpençe, 2020, p.33). During the period from 2010 to 2018, Türkiye's gross debt-to-GDP ratio consistently declined, falling below the widely accepted threshold of 30% in the literature, which in turn led the IMF to lower its debt expectations for the following year. Consequently, fiscal credibility increased, achieving full credibility. A similar trend is observed in the index approach of Montes and Acar (2018), which measures fiscal sustainability based on intertemporal budget constraints. The decrease in the debt-to-GDP ratio alleviated concerns about fiscal sustainability during a period of relatively stable growth and real interest rate expectations, thereby enhancing fiscal credibility.

However, during the period from 2019 to 2021, there was a decline in fiscal credibility index values, indicating a weakening of Türkiye's fiscal credibility. One of the reasons for this development was the impact of the Covid-19 pandemic, which increased public spending and reduced budget revenues, thus harming fiscal balance. The rising budget deficits further increased the debt stock, pushing expectations for the debt stock beyond lower boundary values. Additionally, the partial lockdowns resulting from the pandemic negatively affected economic growth and growth expectations, leading to a significant decline in these expectations. This situation raised concerns about the sustainability of debt and weakened credibility. From 2022 onwards, index values began to rise again, indicating an increase in credibility. This improvement was due, on one hand, to a reduction in the debt-to-GDP ratio and, on the other hand, to a rapid increase in inflation expectations during this period, which significantly lowered real interest rate expectations, thereby alleviating concerns about fiscal sustainability.

The Mist values, derived from End (2020)'s approach and reflecting the absolute deviation between official budget targets and the IMF's budget balance expectations, were relatively low and stable during the 2010-2018 period. This indicates that the IMF had expectations closely aligned with official targets, suggesting high fiscal credibility during this time. However, from 2019 onwards, Mist values increased, and their volatility rose. In other words, the IMF's expectations diverged from the official targets, implying a lack of confidence in the government's budget goals and indicating low fiscal credibility.

Additionally, the need for the IMF to continuously update its expectations, resulting in significant differences between forecasts made within the same year, has contributed to this volatility. Factors contributing to this situation include the overly optimistic setting of budget targets, the inability to fully grasp the damages to fiscal balance caused by the pandemic during that period, leading to excessively cautious expectations from the IMF. Furthermore, the potential additional burden of monetary policy measures during this period and the financial impact of the February 2023 earthquake,

which was not fully understood, weakened the link between budget targets and budget balance expectations.

According to the fiscal opacity index, derived from the difference between the IMF's budget balance expectations and the actual budget balance, Türkiye's fiscal opacity was extremely high during the 2019-2022 period, indicating a lack of fiscal transparency. Furthermore, a comparison of budget expectations and actual budget values during this period reveals that the IMF tends to overestimate the budget deficit. This situation may stem from insufficient transparency regarding fiscal policy when forming expectations, a lack of information, overly cautious expectations from the IMF, and deviations from previous targets weakening confidence in official objectives.

In general, the higher a country's budget deficit and debt stock, and the more frequently and significantly it deviates from fiscal targets or changes those targets, the lower its fiscal credibility tends to be. In such cases, fiscal rules and bodies can help increase credibility. Policymakers can enhance fiscal credibility by establishing better institutions, providing consistent forecasts, and maintaining regular communication regarding achieving targets. Historical performance of fiscal variables is crucial for building confidence in fiscal targets, as systematic optimism regarding targets can undermine fiscal credibility. Therefore, targets should be set realistically.

Additionally, a strong communication strategy and a clear accountability framework for fiscal policy should be established. Institutions that regularly monitor market expectations, such as central banks, can incorporate expectations regarding fiscal targets into their surveys, allowing for closer tracking of changes in fiscal target expectations. This way, the government can respond more swiftly to changing circumstances and implement necessary measures. Given the positive impact of political stability and multi-year budget plans on budget forecasting errors in the literature, the continuation of political stability and the implementation of medium-term programs are crucial for fiscal credibility and transparency, alongside fiscal and economic discipline.

Ethics Committee approval was not required for this study.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors declare that Artificial Intelligence (AI) tools were used solely to enhance spelling, grammar, and overall readability of the article.

The authors declare that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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A Research on the Relationship between ESG Performance of Companies and Systematic Risk

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Abstract

Today, companies have started to focus on sustainability efforts to maximize market value and reduce risks. One of the measures used to express the sustainability performance of companies is environmental, social and governance (ESG) scores. High ESG performance is expected to contribute to the systematic risk reduction by lowering the cost of capital, thereby increasing market value. This study aims to analyze this relationship for companies traded in Borsa Istanbul that possess ESG ratings. Findings reveal that ESG components have a long-term relationship with the Beta coefficient, which represents systematic risk. In addition, causality tests produce significant findings and a bidirectional causality relationship was detected between the corporate governance score and beta coefficient. When evaluating the results within the scope of environmental and social scores, the causality relationships from ESG environmental and social scores to the beta coefficient are determined. These results offer insights into how sustainability practices can contribute to firms' risk management processes.

Keywords: *Sustainability, Systematic Risk, ESG Performance.*

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1. INTRODUCTION

Today, global warming, famine, food crisis and exhaustion of natural resources remain at the forefront. The rapid increase in the demand for consumption by individuals encourages companies to be sustainable in environmental, social and corporate governance (ESG) issues. Galletta and Mazzù (2023, p. 274) define sustainability as ensuring development by satisfying the necessities of the current generation without reducing the capacity of future generations to fulfill their own demands. Socially responsible investing is integrating non-financial issues such as ESG and its sub-components into the portfolio selection process (Dorfleitner et al., 2015, p. 451). The concept of ESG is derived from the phenomenon sustainability and social responsibility in investment. Although environmental footprint is seen as a non-financial concept in relation to social responsibility and corporate governance concepts, it is becoming increasingly common to associate the performance of companies in these parameters with financial performance (Maiti, 2021, p. 199). The phenomenon of sustainability, which has expanded in scope over time, has accelerated the sustainability activities of companies and highlighted the importance of sustainability performance measurement. In this context, some organizations (Thomson Reuters, Bloomberg and MSCI) have started to measure the ESG performance of companies.

The phenomenon of sustainability, the measurement of sustainability performance and the increasing sustainability awareness of investors encourage companies to continuously adopt sustainable business practices. This increase in sustainability awareness changes the economic environment and involves fundamental changes in capital markets (Hübel & Scholz, 2020, p. 66). Within the scope of these changes, companies take ESG factors into account in their business decisions and in the evaluation phase of listed companies in order to meet the various needs of their shareholders, limit legal and operational threats, and catch the sustainable investment trend (Mikołajek-Gocejna, 2022, p. 598). In this context, companies are looking for ways to minimize possible risks since they know that they will have to allocate more resources to ensure a successful process at the stage of including ESG factors in their business processes. Because ESG investments, despite their inherent advantages, may weaken a company's financial stability and harm its corporate image if risks are ignored (Cohen, 2023, p. 16). Investors want to know the opportunities and risks in the context of sustainable investments, combating climate change and reducing carbon emissions, and want both financial and sustainability risks to be comprehensively articulated in their investment portfolios (Folqué et al., 2021, p. 876). In addition, investors recognize the competitive advantage of incorporating ESG factors into their investment strategies (Jin, 2018, p. 72). As a result, they may not focus solely on the financial returns but also favor stocks of companies with strong ESG performance (Cornell, 2021, p. 12). As a result, both firms and investors face certain risks while benefiting from the advantages of sustainability and question how these risks will affect their returns. Systematic risk concerns the entire economy and reflects a firm's sensitivity to broad market movements (Luo & Bhattacharya, 2009, p. 209). Systematic risks include industry-wide issues such as commodity prices, interest and inflation rates, regulatory changes,

technological developments and idle assets (Gregory et al., 2014, p. 635). In contrast, firm-specific risk stems from internal or external factors affecting only that particular firm's operations (Jo & Na, 2012, p. 441). The measure of systematic risk was shaped by the emergence of the Markowitz Portfolio Selection Model and the Capital Asset Pricing Model (CAPM), and the beta concept became a general measure to identify the degree of the systematic risk in financial markets (Martín-Cervantes & Valls Martínez, 2023, p. 2). A beta value higher than 1 indicates that the stock is riskier than the market index (Mikołajek-Gocejna, 2022, p. 597). The distinction between systematic and firm-specific risk is crucial for corporate valuation because firm-specific risk can be diversified but systematic risk cannot (Giese et al. 2019, pp. 2-3). In this context, when the environmental-systematic risk relationship is analysed, firms that meet environmental criteria or have high environmental performance have increased flexibility to cope with wide market shocks (Sharfman & Fernando, 2008, p. 586). According to Giese et al. (2019); Eccles et al. (2014); El Ghouli et al. (2011) and Gregory et al. (2014), firms with a strong ESG profile have better defenses against economic fluctuations and, therefore will exhibit lower systematic risk; low systematic risk reduces cost of capital; and finally, low cost of capital will lead to high valuation for firms. This study aims to contribute to the literature by analysing the postulated relationships. For this purpose the long run cointegration and causality relationships between firm performance in ESG sub-dimensions and systematic risks is analyzed for firms traded in Borsa Istanbul between 2013 and 2021. Results reveal both cointegration and causality relations among variables.

2. LITERATURE REVIEW

Studies examining the ESG performance-systematic risk relations are presented in this section. The findings obtained in the analysed studies vary. In this respect, some of the previous studies are briefly summarised below.

Sassen et al. (2016) analysed 8752 European firms between 2002 and 2014 and found that unsystematic and total risk decreased as firms' ESG scores increased. They also found that when the ESG dimensions are analysed individually, the social score has a significant negative impact on risk measures; the environmental score generally reduces unsystematic risk, while the corporate governance score doesn't have an impact on firm risk. Benlemlih et al. (2018) examined whether ESG is associated with systematic risk by using panel data analysis on stocks traded in the United Kingdom between 2005 and 2013 and found that firms' environmental and social performance is related to stock volatility and unsystematic risk, but not related to systematic risk. In a similar study, Annisa and Hartanti (2021) investigated the impact of ESG performance on firm risk factors. The authors used a sample of 145 firms from ASEAN-5 between 2011 and 2017. Results suggest that ESG scores don't affect systematic risk, but affects total risk and unsystematic risk significantly. Farah et al. (2021) examined 4004 international firms from 43 countries between 2005-2017. They found that the ESG-systematic risk relation is non-linear, and follows an inverted U-shaped course. In other words, as ESG performance increases, the systematic risk increases due to operating costs; after ESG performance reaches a moderately high level,

i.e. a threshold level, the systematic risk decreases as ESG scores increase. Similarly, Korinth and Lueg (2022) aimed to determine the ESG scores' relationships with different types of risks in their research examining 454 firms in the German stock market between 2012 and 2019. They found that ecological investments initially reduce systematic risk (beta), but increase systematic risk. Eratalay and Cortés Ángel (2022) focused on S&P Europe 350 stocks between 2016-2020. The study found that high ESG performance reduces systematic risk. Mikołajek-Gocejna (2022) examined the stocks of ESG-rated firms traded in the Polish capital market between 2019 and 2022. Results suggest that the risks of ESG-rated stocks are lower than those of the market portfolio. Aevoae et al. (2023) examine whether changes in banks' ESG scores affect systematic risk. They applied a dynamic panel analysis of 367 publicly traded banks from 47 countries from 2007 to 2020. The findings revealed that improved investments in corporate social responsibility (CSR) reduce both bank-specific and systematic risks. Similarly, Sharfman and Fernando (2008); Cerqueti et al. (2021); Jo and Na (2012); Giese et al. (2019); Jacobsen et al. (2019) are among the studies that detected the systematic risk-reducing effect of high ESG performance. In addition, Wamba et al. (2020); Salama et al. (2011) stated that positive environmental performance can reduce systematic risk by acting as insurance against the possible effects of adverse events. Albuquerque et al. (2019); El Ghouli et al. (2011) state that firms with high CSR performance are characterised by a lower cost of equity capital. Authors also reveal that responsible relations with employees, establishment of environmental policies and product strategies can lead to lower systematic risk.

When studies related to Türkiye are analysed, to the best of our knowledge there is no study analysed the ESG performance of firms and systematic risk relationship. Borak and Doğanlı (2022) investigated the between CSR and systematic risk, unsystematic risk and total risk between 2009 and 2020 for firms traded in Borsa Istanbul and having a corporate governance rating. Within the scope of the aforementioned study, the authors found that CSR has no significant effect on unsystematic, systematic and total risk. This study differentiates from the existing literature both in terms of the sample and in terms of investigating the relationship between ESG and Beta.

3. DATA AND METHODOLOGY

The study aims to investigate the relationship between firms' ESG scores and systematic risk. For this purpose, firm ESG scores are analysed in three dimensions: Environmental Score (ESG1), Governance Score (ESG2) and Social Score (ESG3). The study covers 22 stocks included in the BIST30 index for the 10-year period between 2013 and 2022 and whose data can be accessed uninterruptedly during the relevant period. Although ESG scores were calculated starting from 2010, the backdating of the analysis period caused data loss. Since it was aimed to include as many firms as possible in the analysis, the period started in 2013.

Data on ESG scores were obtained from the Refinitiv database. Beta coefficients of firms' stock returns are utilised as the proxy of systematic risk. The relevant data are obtained from the Finnet database. Table 1 presents the descriptive statistics.

Table 1. Summary Statistics

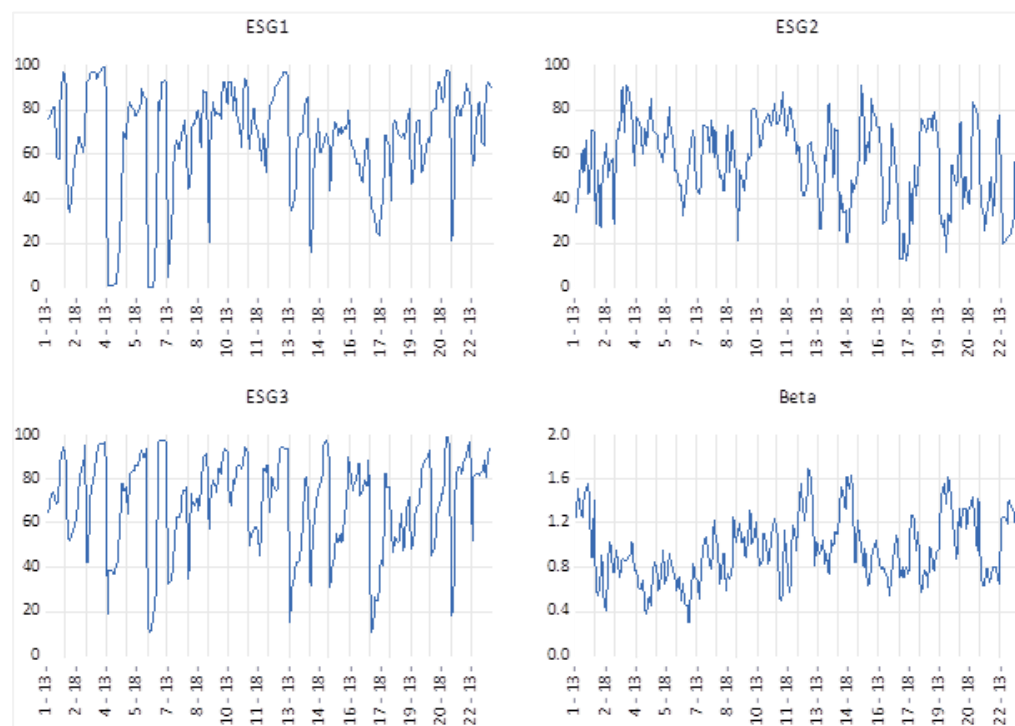
	ESG1	ESG2	ESG3	Beta
Mean	66.9224	56.0291	69.0962	0.9644
Median	71.685	56.915	74.72	0.9396
Maximum	99.22	91.1	98.61	1.6915
Minimum	0.00	11.5	10.21	0.3042
Std. Dev.	24.0686	18.5839	21.8265	0.3008
Skewness	-1.1493	-0.3586	0.7896	0.2943
Kurtosis	3.8904	2.2814	2.8441	2.3485
Jarque-Bera	55.7069	9.4487	23.0870	7.0661
Probability	0.0008	0.0088	0.0009	0.02921
Observations	220	220	220	220

Source: Own calculations from data

Table 1 shows that the lowest average score is found in the institutional dimension. The highest average is found in the social dimension. The fact that the averages are far from 1 in all three dimensions can be interpreted as the sustainability performance of the companies in the sample is not very good.

In Figure 1 graphical lines of the series are presented. Graphs show that the variables fluctuate around a constant mean. This gives a preliminary idea about the stationarity of the variables.

Figure 1. Graphical Line of Series



Source: Own calculations.

In this study, panel cointegration and panel causality tests are used to analyze the relationship between ESG scores and the Beta variable. In order to determine the appropriate tests, the model should first be examined for homogeneity and horizontal cross-section dependence. For this purpose Hisao (2003)¹ the homogeneity test is applied first. Breusch and Pagan (1980)² LM test, Pesaran et al. (2008)³ LMadj test, Baltagi et al. (2012)⁴ CDlmadj test and Pesaran (2004, 2021)⁵ CDlm test were used to detect horizontal cross-section dependence. For the determination of stationarity, Westerlund and Hosseinkouchack (2016)⁶ unit root tests that takes into account horizontal cross-section dependence were performed. Westerlund and Edgerton (2007, 2008)⁷ panel cointegration test is applied to analyze the long-run relationships between the series. As causality tests, Emirmahmutoglu and Kose (2011)⁸ and Dumitrescu and Hurlin (2012)⁹ panel causality tests are used. Detailed information on the methodology can be found in the footnotes.

Table 2. The Results of Hsiao (2003) Homogeneity Test

Hypotheses Variables	H ₁		H ₂		H ₃	
	F-Stat	P-Value	F-Stat	P-Value	F-Stat	P-Value
ESG ₁ -Beta	9.8892	1.26E-28	1.4888	0.0115	17.5117	1.98E-34
ESG ₂ -Beta	10.6021	2.57E-30	1.7083	0.0331	18.1271	2.38E-35
ESG ₃ -Beta	11.0485	2.35E-31	1.9735	0.0093	18.2314	1.67E-35

Source: Own calculations.

According to Table 2, the null hypotheses of hypotheses H₁, H₂ and H₃ are rejected. According to the related results, it is understood that the data are heterogeneous.

Due to the horizontal cross-section dependence and heterogeneity in the data, second-generation unit root tests were conducted.

Table 3. The Results of the Cross-Section Dependency Test

ESG ₁			ESG ₂		
Test	T-stat	P-Value	Test	T-stat	P-Value
LM (Breusch & Pagan, 1980)	426.525	0.0000	LM (Breusch & Pagan, 1980)	394.218	0.0000
LMadj (Pesaran et al., 2008)	8.828	0.0000	LMadj (Pesaran et al., 2008)	7.329	0.0000
CDlm (Pesaran, 2004, 2021)	9.097	0.0000	CDlm (Pesaran, 2004, 2021)	7.594	0.0000
CDlmadj (Baltagi et al., 2012)	7.874	0.0000	CDlmadj (Baltagi et al., 2012)	6.371	0.0000
CD (Pesaran, 2004, 2021)	13.460	0.0000	CD (Pesaran, 2004, 2021)	6.308	0.0000

¹ For a detailed formulation of homogeneity test, please see Hsiao (2003).

² For a detailed formulation of cross section dependency tests, please see Breusch and Pagan LM (1980).

³ For a detailed formulation of cross section dependency tests, please see Pesaran et al. (2008).

⁴ For a detailed formulation of cross section dependency tests, please see Baltagi et al. CDlmadj (2012).

⁵ For a detailed formulation of cross section dependency tests, please see Pesaran (2004, 2021).

⁶ For a detailed formulation of panel unit root tests, please see Westerlund and Hosseinkouchack (2016).

⁷ For a detailed formulation of cointegration tests, please see Westerlund and Edgerton (2007, 2008).

⁸ For a detailed formulation of panel causality test, please see Emirmahmutoglu and Kose (2011).

⁹ For a detailed formulation of panel causality test, please see Dumitrescu and Hurlin (2012).

(Table 3 cont.)

ESG ₃			Beta		
Test	T-stat	P-Value	Test	T-stat	P-Value
LM (Breusch & Pagan, 1980)	475.167	0.0000	LM (Breusch & Pagan, 1980)	566.663	0.0000
LMadj (Pesaran et al., 2008)	11.068	0.0000	LMadj (Pesaran et al., 2008)	15.616	0.0000
CDIm (Pesaran, 2004, 2021)	11.360	0.0000	CDIm (Pesaran, 2004, 2021)	14.394	0.0000
CDImadj (Baltagi et al., 2012)	10.137	0.0000	CDImadj (Baltagi et al., 2012)	8.1443	0.0000
CD (Pesaran, 2004, 2021)	32.985	0.0000	CD (Pesaran, 2004, 2021)	2.0327	0.0000

Source: Own calculations.

For ESG1, ESG2, ESG3 and Beta variables, H_0 hypothesis of no cross-sectional dependence was rejected and the alternative hypothesis could not be rejected and results were obtained indicating that cross-sectional dependence exists. Test results reveal the existence of horizontal cross-section dependence in ESG1, ESG2, ESG3 and Beta panel data. Accordingly, it is concluded that the ESG structures of the selected firms are not similar to each other.

Table 4. The Unit Root Test Results

Test	Constant					Constant and Trend				
	CADF	LM	M-CADF	pval	Lags	CADF	LM	M-CADF	pval	Lags
ESG1	-6.291	34.037	-5.531	0.063	0	-6.787	38.792	-7.271	0.064	0
ESG2	-4.976	23.779	-0.977	0.613	6	-4.987	23.986	-0.887	0.829	6
ESG3	-6.065	31.991	-4.788	0.091	0	-4.336	18.475	-0.328	0.955	5
Beta	-5.164	25.621	-1.048	0.592	7	-5.154	25.651	-0.916	0.822	7
	M-CADF Critical Values					M-CADF Critical Values				
	%1		%5		%10	%1		%5		%10
	9.210		5.991		4.605	11.345		7.815		6.251

Source: Own calculations.

The series was selected according to horizontal cross-section dependence. Westerlund and Hosseinkouchack (2016) conducted unit root tests (modified Pesaran CIP and CADF with standard limiting distributions), which are second-generation unit root tests. Based on the unit root test results, the H_0 hypothesis (unit root) couldn't be rejected for all variables. This result implies that all variables contain unit root processes. In other words, ESG1, ESG2, ESG3 and Beta variables are not stationary at level and contain unit roots. This situation can be interpreted as the environmental, social and corporate structures and systematic risks that are not sustainable for the selected firms.

After determining that all of the series are $I(1)$, Westerlund and Edgerton (2007, 2008) panel cointegration test, which is one of the panel cointegration tests, is applied to investigate the existence of a long-run relationship. Table 5 presents the cointegration test results.

Table 5. The Cointegration Test Results

Westerlund-Edgerton (2007, 2008)						
Variables	Bootstrap panel coint.			Panel data coint. with structural breaks		
	ImStat	bootst p-val	asympt p-val		t-Stat	P-Value
ESG ₁ -Beta	1.520	0.240	0.064	PD-Tau	0.033	0.513
				PD-Phi	0.303	0.619
ESG ₂ -Beta	1.903	0.090	0.029	PD-Tau	-1.787	0.062
				PD-Phi	-0.384	0.351
ESG ₃ -Beta	-1.207	0.990	0.848	PD-Tau	-5.118	0.000
				PD-Phi	-3.512	0.000
Critical Values						
					%1	%5 %10
				PD-Tau	-2.326	-1.645 -1.282
				PD-Phi	-2.326	-1.645 -1.282

Source: Own calculations.

Westerlund-Edgerton (2007, 2008) cointegration tests can be used when the dependent variable is I(1) or I(0) and the independent variables are I(1) or I(0). Therefore, bootstrap panel cointegration and structural break panel cointegration tests are used to investigate the long-run relationship between ESG1-2-3 and beta variables. In the case of horizontal cross-section dependence, critical values obtained by the bootstrap procedure are used. The null hypothesis of cointegration is accepted for all three relationships, by considering the bootstrap probability values. In this sense, it is accepted that the series is in a cointegration relationship. In conclusion, bootstrap panel cointegration results quantify the long-run relationship between ESG1, ESG2, ESG3 and Beta. According to the panel cointegration results with structural breaks, the asympt p value is less than 0.05 meaning that H_0 hypothesis could be rejected for the relationship between ESG3 and Beta variables. Thus, there is no evidence of a long-run relationship between the two variables obtained. On the other hand, H_0 hypothesis could not be rejected for ESG1 and Beta, and ESG2 and Beta variables and there was evidence of the existence of a long-run relationship between the variables. In summary, both cointegration test results confirm the existence of a long-run relationship between the variables.

After deciding that the relationships for all three groups of variables are cointegrated, panel causality tests were applied to investigate whether there is a causality relationship between the variables.

Both tests based on Emirmahmutoglu and Kose (2011) and Dumitrescu and Hurlin (2012) panel causality tests aim to detect the existence of a short-run relationship between variables in panel data analysis. These tests are preferred because they are frequently used in heterogeneous panels. The statistics of the tests that can obtain effective results in heterogeneous and homogeneous panels are given in Table 6.

Table 6. The Causality Test Results

H_0	Causality Test	Statistics			Critical Values		
		(W-Stat)	t-Stat (Zbar-Stat)	P-Value	%1	%5	%10
ESG ₁ =>Beta	EK		65.709	0.019	349.069	184.321	139.693
	DH	1.148	0.491	0.623	10.543	6.553	4.825
Beta=> ESG ₁	EK		55.783	0.110	395.286	185.486	143.941
	DH	1.518	1.718	0.186	9.788	5.281	4.025
ESG ₂ =>Beta	EK		137.134	0.000	325.687	169.374	140.493
	DH	1.836	2.774	0.006	8.674	5.660	4.213
Beta=> ESG ₂	EK		59.743	0.057	337.880	172.513	133.471
	DH	1.737	2.444	0.015	8.602	5.404	4.149
ESG ₃ =>Beta	EK		168.932	0.000	393.098	191.484	139.127
	DH	2.225	4.164	0.000	11.316	7.045	5.316
Beta=> ESG ₃	EK		162.405	0.000	289.092	179.836	141.250
	DH	1.448	1.485	0.137	10.877	5.634	4.475

Source: Own calculations.

According to the Emirmahmutoglu and Kose (2011) (EK in Table 6) results between ESG1 and Beta, there is a unidirectional relationship between ESG1 and Beta and this relationship is from ESG1 variable to Beta variable. As a result, while there is a short-term causality relationship from ESG1 to Beta, there is no causality relationship from Beta to ESG1. According to Dumitrescu and Hurlin (2012) (DH in Table 6) test results, no causality relationship between ESG1 and Beta was found.

According to the Emirmahmutoglu and Kose (2011) results between ESG2 and Beta, it is found that there is a bidirectional relationship between ESG2 and Beta. It is determined that there is a bidirectional short-term causality relationship between these two variables. Dumitrescu and Hurlin (2012) test results show the same results with Emirmahmutoglu and Kose (2011) results. Based on the results of both causality tests, it can be concluded that there is a bidirectional short-run causality relationship between ESG2 and Beta variables.

According to the Emirmahmutoglu and Kose (2011) results between ESG3 and Beta, it is determined that there is a bidirectional causality relationship between ESG3 and Beta. It is concluded that there is a short bidirectional causality relationship between these two variables. According to Dumitrescu and Hurlin (2012) test results, while there is a short-term relationship from ESG3 to Beta, there is no causality relationship from Beta to ESG3. These results provide evidence for the existence of a causality from ESG3 to Beta.

4. CONCLUDING REMARKS

Risk factors, another parameter influencing investors' firm preferences along with expected returns, have evolved and diversified over time. It is noteworthy that new threats to businesses include economic, social and governance issues. The rapid depletion of natural resources and sustainability concerns that have started to manifest themselves with climate change have brought environmental

factors to the agenda as a risk factor. Increased access to education as well as the strengthening of non-governmental organisations have increased the level of awareness of stakeholders, and laws have forced businesses to act more sensitively in terms of occupational safety, employee rights and consumer rights. According to Rai (2024), ignoring the issues of commitment to ethical values, transparent sharing of information and effective internal communication may expose firms to threats such as legal processes, scandals and loss of trust in the eyes of investors.

Ding et al. (2024), referring to the 'Major Global Risks' report prepared by the World Economic Forum organised in 2022, stated that eight of the top ten critical risks to which the world is exposed are related to economic and social issues. Therefore, it has become essential for businesses today to include ESG components in their risk management applications.

The views evaluating the impact of sustainable activities on firms' risk are divided into two. According to the stakeholder or risk management view, successful ESG practices can reduce the firms' risks by increasing their financial soundness as they focus on improving their relationships with stakeholders (Anwer et al., 2023). Giese et al. (2019) conclude that improvement in firms' ESG performance improves both systematic risks and firm-specific risks. According to the overinvestment theory, managers' focus on sustainability investments is either to gain fame or to divert attention from the firm's poor financial results or failures (Anwer et al., 2023). Landi et al. (2022) found that ESG assessments increase the systematic risks of firms, which they attributed to the possibility that sustainability investments create uncertainty for investors.

In this study, the Beta coefficient, which indicates the individual stock risk relative to the market, is used as a measure of systematic risk. Investors can diversify firm-specific risks; therefore, the risk component taken into account in the formation of expected return is systematic risk (Giese et al., 2019). According to Ding et al. (2024), who measure systematic risk with the Beta coefficient in a similar study, the larger the Beta coefficient, the more likely the firm is to be affected by the various external systemic risk factors. The authors stated that when a firm can effectively mitigate systemic risk, it is more likely to perform well in ESG (Ding et al., 2024). In another study, Pistolesi and Teti (2024) stated that the relationship between ESG scores and Beta is inverted U-shaped. This finding is interpreted as sustainability investments increase the risk of firms up to a certain threshold, but when this threshold is exceeded, high ESG investments contribute to the reduction of systematic risk.

The findings from this study show that all ESG dimensions exhibit a long-term relationship with Beta coefficients, which express the extent to which companies are affected by systematic risks. Causality tests also yielded significant results for all ESG dimensions. While causality relationships from ESG scores to Beta coefficient were determined for Environmental and Social scores, it was observed that the causality relationship between the ESG2 variable representing the Corporate

Governance score and the Beta coefficient was bidirectional. The results confirm the thesis that sustainability efforts can have an impact on companies' risks.

The causality relationship from the environmental score to Beta is consistent with Huang et al. (2018) view that increasingly adverse climate conditions create greater systematic risk for companies across the global economy. Companies with low environmental scores may face financial losses due to fines and penalties for not complying with current and future regulations due to their environmentally damaging activities (Safdie, 2024). At the same time, the company's image may be negatively affected. When social risks are not managed well, the company's relationships with its employees and customers may deteriorate. Failures in corporate governance may expose the company to scandals that will damage its image and finances (APlanet, 2023).

When the causality relationship from Beta to ESG2 is evaluated, it is seen that results consistent with the study of Ding et al. (2024) are obtained. Accordingly, companies with low Beta values are generally more robust in their management and operations. They can effectively deal with systemic challenges, thus supporting their financial performance as well as being more attentive to the environment, society and governance (Ding et al., 2024).

The findings from this study provide some policy implications. First, the long-run equilibrium relationship between ESG scores and systematic risk suggests that improved performance through environmental, social and corporate governance practices can act as a buffer against systematic risks for firms. Systematic risks, which include inflation, interest rate and exchange rate risks as well as market and political risks, are relatively difficult risks for firms to manage and may lead to higher capital costs. In this context, business processes based on ESG components can increase firms' resilience. It is important for policymakers to support firms' ESG practices through various incentives (e.g., tax benefits) and green financing products. In addition to environmental approaches related to products and production, the social dimension of firms also needs to be strengthened. In this sense, establishing and implementing the necessary laws in terms of factors such as occupational health and safety, employee rights, and equal opportunities in business life can be effective in reducing systematic risks. In the context of corporate governance, the concepts of transparency, ethical principles, accountability and corporate governance come to the fore. It is closely related to the reputation of the firm and the trust of shareholders and other stakeholders. Firms that adhere to corporate governance principles are expected to be more effective in risk management. In order to promote corporate governance, it is important to increase the quality and effectiveness of independent auditing and to complete the necessary legal regulations.

Considering the causality relationships, it is also possible to offer some policy recommendations. First, the environmental score is found to be the cause of beta. Since systematic risks are risks that the firm cannot eliminate by its own means, it is important to understand the dynamics of

the relationship between these two variables. While green production processes and the use of renewable energy are encouraged, the additional costs and risks of these processes should be kept under control. A bidirectional causal relationship is found between corporate governance and systematic risk. It is obvious that successful risk management is possible with good corporate governance. It may be useful to raise the awareness of company officials and stakeholders that corporate governance can increase the firm's robustness and resilience in the face of external shocks and perhaps to prepare training programs in this context. Regarding the social dimension, improving wage policies to provide better living standards, empowering employees, making them feel valued to increase their loyalty, and improving the quality of relations with suppliers, customers and all segments of society can positively affect investors' perception of uncertainty about the firm and stabilize shareholder returns. Steps to be taken by legislators, regulators and supervisory bodies to improve the cooperation of firms in achieving the Sustainable Development Goals may also improve ESG performance and mitigate the effects of systematic risks at the firm level.

Although the applied causality tests reveal a kind of cause-effect relationship between the variables, they cannot detect asymmetric effects regarding this relationship. Although it is understood that ESG scores are the cause of the Beta coefficient, no inference can be made as to whether the effect is positive or negative. When ESG risks are not managed well, they are likely to lead to significant impacts on the company's reputation, financial condition and long-term viability (APlanet, 2023). Therefore, ESG performance is expected to improve the firm's risk exposure. On the other hand, the fact that sustainability investments lead to higher costs and involve more uncertainty may increase the risks at the company level, as well as increase the level of exposure to systematic risks. In order to clarify this issue, it would be useful to expand the analyzes to reveal asymmetric effects in future studies. Additionally, studies can be conducted based on alternative measurements of systematic risk (conditional Value at Risk (CoVaR), expected shortfall (SES), etc.).

Ethics Committee approval was not required for this study.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors affirm that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all aspects of the research.

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