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# THE EFFECT OF INCLUSION IN THE CLIMATE INDEX ON FINANCIAL PERFORMANCE: THE CASE OF GARANTI BBVA CLIMATE INDEX

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***Abstract***
*In addition to sustainability efforts to minimize environmental damage and create value in the long term, voluntary reporting of carbon emissions by companies is becoming increasingly widespread. The impact of these reports on the financial performance of firms is of interest as a research topic. This study examines the relationship between carbon emission reporting and financial performance of firms operating in Turkey after their inclusion in the Garanti BBVA climate index. The dependent variables in the study are Tobin's Q and Market Value/Book Value (MV/BV). Financial risk, leverage ratio, growth rate, current ratio and credit risk are used as control variables, while profit for the period and firm size are included in the model as independent variables. As a result of the study analysed using the Driscoll-Kraay robust estimator, it is found that profitability, leverage ratio and dummy variable as a proxy of index inclusion positively affect firm performance when measured by Tobin-q. In the case where firm performance is measured by market capitalization/book value, only the dummy variable for index inclusion has a statistically significant effect. As a result of the study, it can be said that the inclusion of firms in the Garanti BBVA climate index positively affects their financial performance.*

***Keywords*** ***:*** *Carbon Disclosure, Climate index, Financial Performance, Profitability*
***JEL Classification*** ***:*** *G10, G11, G12*

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# İKLİM ENDEKSİNDE YER ALMANIN FİNANSAL PERFORMANSA ETKİSİ: GARANTİ BBVA İKLİM ENDEKSİ ÖRNEĞİ

***Öz***

*Çevresel zararı minimize ederek uzun vadede değer elde etmek için yürütülen sürdürülebilirlik çalışmalarının yanında firmaların gönüllü olarak karbon emisyonlarını beyan ettikleri raporlamalar giderek yaygınlık kazanmaktadır. Bu raporlamaların firmaların finansal performanslarına etkisinin ne yönde olduğu ise araştırma konusu olarak ilgi çekmektedir. Bu çalışma Türkiye'de faaliyet gösteren firmaların Garanti BBVA iklim endeksine dahil olmaları ile karbon emisyon raporlamalarının finansal performansları ile ilişkisini incelemektedir. Çalışmada bağımlı değişkenler Tobin's Q ve Piyasa Değeri/Defter Değeri (MV/BV)'dir. Finansal risk, kaldıraç oranı, büyüme oranı, cari oran ve kredi riski kontrol değişkenleri olarak kullanılırken, dönem karı ve firma büyüklüğü bağımsız değişkenler olarak modele dahil edilmiştir. Driscoll-Kraay robust tahmincisi kullanarak analiz edilen çalışma neticesinde karlılık, kaldıraç oranı ve endekse alınmayı temsilen kukla değişkenlerin Tobin-q ile ölçülen firma performansını pozitif yönde etkilediği tespit edilmiştir. Firma performansının piyasa değeri/defter değeri ile ölçülmesi durumunda ise sadece endekse alınmayı dikkate alan kukla değişkenin istatistiksel olarak anlamlı bir etkiye sahip olduğu sonucuna ulaşılmıştır. Firmaların Garanti BBVA iklim endeksine alınmalarının finansal performanslarını olumlu yönde etkilediği çalışma neticesinde söylenebilir.*

***Anahtar Kelimeler*** ***:*** *Carbon Disclosure, Climate index, Financial Performance, Profitability*
***JEL Sınıflandırması*** ***:*** *G10, G11, G12*

## INTRODUCTION

Today, there are serious problems such as increasing greenhouse gas effect and changing climate characteristics due to global warming and related climate change. The fact that these changes cause an increase in various natural events on earth is seen as one of the most important risks the world is exposed to. Climate change is therefore recognized as a process of cooperation involving governments and a process of struggle that must be sustained with determination. Important international protocols are being signed to raise public awareness and to ensure that necessary measures are taken, especially by industry. The Kyoto protocol, which is an important step to reduce greenhouse gases and carbon emissions, is one of the important steps taken internationally (Türkeş, Sümer, Çetiner, 2000). The Paris Agreement, signed in 2015, was then put into force to create a more equitable and sustainable climate change adaptation, preventable policies and financing program (Paris Agreement, 2015). Since climate change is a global problem that concerns the whole world, states, institutions, organizations and individuals have serious responsibilities for a sustainable solution. Especially with the decisions taken in these protocols, the costs of climate change have affected the companies that are responsible for carbon emissions and profit from them (Alvarez, 2012).

In recent years, the increasing pressure on companies to carry out their activities in a more environmentally sensitive manner, especially the demands of consumers and investors in this direction, has become a priority for company management. Increased awareness of corporate environmental management, especially in developed countries, can directly or indirectly affect the financial performance of firms (Iwata & Okada, 2011). For this reason, firms' disclosure of their environmental policies and reporting of carbon emission costs has become an important information system for the investment world. Investors, creditors, the government and the public in general closely monitor how firms that do not act responsibly on carbon emissions will be financially affected (Pahuja, 2009). Today, if a company causes an environmental violation, it may not only be legally prosecuted, but it may also lose its social reputation and its products may be boycotted. Wittneben and Kiyar (2009) mentioned that measuring, reporting and comparing the

carbon emissions arising from the activities of enterprises and even reporting the emissions arising from the value chain, including suppliers, will reduce the impact of climate change on firms. Therefore, both the decisions taken at the country level and the increase in social awareness and the demand for environmental protection force companies to make new regulations and implement new practices regarding carbon emissions (He et al., 2022).

On the other hand, the fact that factors such as uncontrolled use of resources, waste causing environmental and air pollution have been reacted by the public has led the business to move towards more holistic goals with the environment rather than profit maximization. For this reason, companies develop strategies such as green research and development, carbon footprint calculation, investing in green financial instruments and reporting carbon emissions (Güneysu & Atasel 2022). One of the most important of these strategies is the publication of environmental reports within the framework of sustainability principles. There are different reporting systems that stand out worldwide for sustainability reporting (borsaistanbul.com, 2014). A widely used one is the Carbon Disclosure Project (CDP), run by a London-based non-profit organization. CDP helps businesses disclose to the public their use of natural resources, the impact on natural resources as a result of their economic activities, and the way they manage the risks arising from climate change. Although there is no obligation, companies voluntarily make this reporting and disclose their relations with the environment, how much carbon they emit to the environment as a result of their activities and what solutions they implement to reduce greenhouse gas emissions. Such reporting not only helps firms maintain their corporate image but is also important for compliance with regulations (Ganda & Milondzo, 2018).

It is debated whether firm-cantered efforts to reduce carbon emissions actually contribute to the financial performance of the firm and whether these firms have to bear this cost. The answer to this question is very important for company management. Although some have argued in the past that environmental investments do not provide a financial benefit to the firm as expected, many researchers today argue that environmental compliance policies can be a win-win for both the firm and the environment (King & Lenox, 2001). Russo and Fouts (1997), Konar and Cohen (2001), Iwata and Okada, (2011), Busch and Hoffmann (2011) found a positive relationship between efforts to reduce carbon emissions and financial performance. However, there have been some studies in the literature that examine market returns by constructing a portfolio of environmentally friendly firms. Cohen et al. (1995) found that investing in a portfolio of two industry-balanced firms using environmental performance measures has a positive return on investment.

Examining the relationship between firms' carbon emissions and their financial performance in Turkey has recently become of interest. The fact that carbon emissions are encouraged by both government policies and voluntary efforts constitutes an important research area. Research in this field not only helps to determine the environmental attitudes of firms, but also provides social and economic benefits. This may be an important opportunity for firms to improve their reputation and may be a factor affecting investment decisions for environmentally conscious investors (Hoffmann, 2005). In this sense, Garanti BBVA has created a climate index to develop the sustainable finance market for companies that voluntarily disclose their environmental policies and to encourage companies to increase their transparency on climate risks and opportunities. Since the prerequisite for companies to be included in the index is that they have responded to CDP surveys, it is known that the companies in the index have low carbon emissions.

This study examines the impact of low carbon emissions on the financial performance of firms included in the Garanti BBVA climate index. Analysing the index in this sense fills an important gap in the literature in terms of determining the return of the costs incurred by firms in climate efforts and achieving the goal of sustainable finance. The introduction of the study provides information on the relationship between climate risk, CDP reporting and financial performance. In the first section, information about the Garanti BBVA climate index created within the scope of CDP reporting is provided. In the second section, studies examining the relationship between carbon emissions and financial performance in national and

international literature are included. Then, methodology, data set and methodology, and findings are presented respectively. The last section provides the conclusion of the study.

## I. GARANTİ BBVA CLIMATE INDEX

CDP sends companies a questionnaire with question sets on climate change, water pollution, forest and urban sustainability, and supply chain, and calls on them to disclose their environmental policies. These issues are listed under three main headings; company management in terms of climate change, management's view on the risks and opportunities arising from climate change for the business area Greenhouse gas emission accounting (CDP, 2021). CDP, which carries out its activities in a wide geography, continues its activities in Turkey in cooperation with Sabancı University Institutional Investment Forum. CDP Turkey calls on BIST100 listed companies to announce their environmental policies by sending them surveys. Depending on the requests from customers or investors, companies can select some or all of these topics to answer the questionnaire or decline the questionnaire altogether. Companies that answer the questionnaire are graded from A to D according to CDP's rating system.

In the 117 countries where CDP carries out its activities, the number of companies that answered the survey questions over 80% was 33%. Since Turkey is on this rate, it was among the first 20 countries that made a transparent and comprehensive statement (CDP, 2021). In the perspective of sustainable development, companies that present their environmental policies to the public show that they can bear the necessary costs for sustainable solutions to climate change. These companies not only increase Turkey's reputation globally, but also become companies preferred by investors and customers. Firms that publish not only financial data, but also non-financial reports attract a lot of attention from investors. Various steps are being taken in the finance sector in order to ground this investment approach and ensure financial sustainability. The most important of these is the Garanti BBVA Climate Index, which was created with the initiative of Garati BBVA, calculated in partnership with CDP Turkey and Borsa Istanbul, and managed by the Sabancı University Corporate Governance Forum (Garanti BBVA, 2021).

The Index aims to increase transparency and encourage companies to disclose their environmental policies within the perspective of sustainable finance. In addition, firms' disclosure of their environmental policies offers new investment opportunities to stock market investors. Borsa İstanbul undertakes the calculation and publication of the index determined in line with the data of CDP Turkey. The companies to be included in the index consist of companies with a B- and above score among the companies scored in the CDP Turkey Climate Change Reporting. According to the applied liquidity rule, stocks with a daily trading volume of 10 million TL and above in the last 6 months are included in the index. The weight of the shares in the index is determined according to the market value of the ones in active circulation (Cömert, 2021). The index started to be calculated on July 14, 2021 and is updated once a year.

## II. LITERATURE

The relationship between corporate environmental disclosure, environmental performance and financial performance has been the subject of significant research since the 1970s. Many researchers have been following and investigating the financial returns of firms' improvements in their environmental performance with increasing interest. The first thing that comes to mind for firms that make improvements in environmental factors is that carbon emission investments impose costs on firms and distract firms from

profit maximization (Friedman, 1970). Some studies have found a positive relationship between financial performance and carbon emissions, while others have found a negative relationship.

King and Lenox (2001) examined the relationship between environmental and financial performance of 652 manufacturing companies in the US from 1987 to 1996. They considered Tobin's Q as an indicator of firms' financial performance. They use longitudinal data and a fixed effect model to reduce the potential for unobservable differences across firms to create a spurious relationship. They find that there is a relationship between high environmental sensitivity and high financial values. However, they emphasized that inter-firm differences in environmental performance are a very important factor. Therefore, they recommend that these differences should be well understood in order to make profitable environmental improvements and that further studies should be conducted to explore how they affect the relationship between environmental performance and financial performance.

Murray et al. (2006) analysed two different datasets of the United Kingdom together to examine whether there is a relationship between environmental reporting and financial market performance of UK companies. They used the CSEAR database of UK companies for environmental reporting data and the stock market returns of UK companies listed by The Times 1000 for financial performance data. Using longitudinal and cross-sectional data and five different techniques, they found that although there was no direct relationship between stocks and environmental disclosure, longitudinal data revealed that environmental reporting and firm returns were correlated with each other.

Iwata and Okada, (2011) examined the relationship between environmental performance and financial performance from two different perspectives: waste and carbon emission reduction. They analysed the data of Japanese manufacturing firms between 2004-2008 with fixed effects model. As a result of the study, they found that waste emissions do not have a significant effect on financial performance in general. On the other hand, they evaluated the effect of greenhouse gas emissions on financial performance by differentiating between industries. They found that greenhouse gas emission investments have a high contribution to the financial performance of enterprises whose field of activity is cleaner, whereas they do not contribute to financial performance in dirty industries.

Busch and Hoffmann, (2011) developed a survey covering firms' carbon emissions and carbon management strategies to examine the relationship between corporate social performance and financial performance. This survey was applied to the 2,500 largest companies by market capitalization in the Dow Jones Global Index. Return on assets (ROA), return on equity (ROE) and Tobin's Q variables were used as financial performance indicators in the study. As a result of the study analysed with the least squares method, they found a positive relationship between an outcome-based carbon emission measure and financial performance.

Alvarez, (2012) investigated the carbon emission amount of firms in different countries for the period 2006-2008, its change over the years and the effect of this change on the performance of firms. They analysed return on assets (ROA) and return on equity (ROE) variables as financial performance measures by regression method. It was found that there was a significant and negative relationship between carbon emissions and financial performance in the 2006-2007 period when carbon emissions started, and a positive relationship between emissions and financial performance in the 2009 period due to the economic recession. According to the study, it takes some time for firms to make a profit from their investment in emissions. Apart from this, another reason for the positive correlation in the 2008-2009 period is that they claimed that profitability may have increased due to the cancellation of environmental projects due to the recession.

Luo et al. (2012) analysed 291 firms in the energy, health, industry, information technology, materials, telecommunications, telecommunications and utilities sectors among the Global 500 companies, excluding financial institutions, to investigate their responses to climate change risk. In 2009, it was stated that factors such as social pressure, financial market pressure, economic pressure and institutional pressure

were effective in the voluntary disclosure of CDP reports by firms. It is also stated that social pressure is more dominant in the disclosure of the analysed firms, and if there is economic pressure, the probability of disclosing environmental policies is high.

Chithambo and Tauringana, (2014) investigated whether there is a relationship between GHG disclosures and firm-specific factors using the least squares method on 210 firms in the FTSE 350 index. They find that firm factors such as firm size, financial recession and consumer services are associated with environmental policy disclosures, but not with factors such as profitability, liquidity and capital expenditures. They also provide evidence that this relationship may differ depending on whether GHG disclosures are quantitative or qualitative.

Delmas et al. (2015) investigated the relationship between greenhouse gas emissions and short- and long-term financial performance of 1,095 firms operating in the United States for the period 2004-2008. They analysed the ROA variable as an indicator of short-term financial performance and Tobin Q values as an indicator of long-term financial performance by regression method. In the analysed period, a negative relationship was found between environmental reporting and return on assets (ROA) and a long positive relationship with Tobin Q.

Lewandowski (2017) investigated the relationship between carbon emissions and financial performance of 1640 international firms for the period 2003-2015. They tested the relationship between environmental reporting data and financial performance indicators such as return on assets (ROA), return on equity (ROE), return on sales (ROS) and Tobin's Q value with a non-linear modelling method. They found that there is a curvilinear relationship between reported carbon emissions and financial performance. The relationship tends to be positive for companies with high carbon performance, but negative for companies with low carbon performance. Therefore, they argue that it takes a certain period of time for firms to make a profit from environmental investment.

Trumpp and Guenther (2017) examined the profitability and financial performance of firms in terms of carbon emissions and waste intensity using data for 2361 firms between 2008 and 2012. Using the least squares panel regression method, they found that carbon emission performance is associated with both profitability and financial performance. They found that there is a negative relationship between carbon emissions and financial performance for firms with low corporate environmental performance, while there is a positive relationship for firms with high corporate environmental performance.

Ganda and Milondzo (2018) examined 63 South African companies that responded to the CDP survey to investigate the impact of carbon emissions on firms' financial performance. They analysed Return on Equity (ROE), Return on Investment (ROI) and Return on Sales (ROS) variables as indicators of financial performance and CDP report data classified as Scope 1, Scope 2, Scope 3 according to the answers given to the CDP survey with multiple regression methods. Although they reached mixed results in the study, in general, they found that environmental reporting of both clean enterprises and dirty enterprises is negatively related to ROE, ROI and ROS.

Güneysu and Atasel (2022) investigated the effect of carbon emissions on the financial performance of non-financial firms in the BIST100 Index for the period 2014-2021 with panel regression models. Using return on assets, return on equity, Tobin's Q, net profit margin and return per share variables for financial performance, they found that there is a significant and negative relationship between carbon emissions and return on assets and return per share, while there is no significant relationship with return on equity, Tobin's Q and net profit margin.

## III. METHODOLOGY

In this study, in order to examine the financial performance of the firms within the scope of GARANTİ BBVA Climate index, dynamic panel data analysis method is preferred. In panel data analysis, which is frequently preferred in many fields due to the combination of horizontal cross-section and time series data, the estimation method is preferred depending on whether the number of horizontal cross-section units (N) is greater than the number of periods (T) (N>T) or vice versa (T>N). In empirical studies, it is observed that many estimation methods have been developed and some methods are more widely used. Undoubtedly, panel data offers some advantages but also some limitations. The advantages of panel data analysis can be listed as follows Baltagi (2013): it provides more efficiency by controlling individual heterogeneity, less correlation between variables and more degrees of freedom. In addition, panel data analysis can better identify and measure effects that cannot be detected in pure cross-section or pure time series data and allows for more complex behavioural models than cross-section or time series data. On the other hand, panel data analysis has some limitations. These include model design and data collection problems, distortions due to measurement errors, short time series dimension, and most importantly, cross-sectional dependence.

Cross-section dependence refers to the correlation between the error terms calculated for each unit of the panel data model. In empirical panel data studies, the effects of excluded variables (unit and/or time) are assumed to be independently distributed across cross-sectional units. Especially when studying with units such as countries, firms and cities, inter-unit correlation is likely to be encountered. The results obtained from analyses that do not take cross-sectional dependence into account may be biased and inconsistent. Cross-sectional dependence in a panel data series should be tested as a priority and some measures should be taken in case of detection. Among the unit root tests that test the stationarity of the series, which test should be used is determined according to the cross-sectional dependence of the series. Panel unit root tests are divided into two as first and second-generation tests. First generation unit root tests assume that the cross-sectional units that make up the panel are independent from each other and that a shock to any of the units that make up the panel affects all horizontal cross-sectional units at the same level. However, given the fact that the economies of countries are closely interrelated due to the rapid movement of capital, it is more likely that a shock to any of the horizontal cross-sectional units that make up the panel will affect the units at different levels. To overcome this problem, second generation unit root tests that consider cross-section dependence have been developed (Yıldırım, Mercan, Kostakoğu, 2013). The second-generation panel unit root tests used in the case of cross-section dependence are based on modelling the factor structures of the error terms of the cross-section units. Pesaran (2007) developed a panel unit root test called CIPS (Cross-Sectionally Augmented IPS) test, which is widely preferred due to its ease of application compared to other tests and considers horizontal cross-sectional dependence. Therefore, in this study, the CIPS panel unit root test, which takes into account cross-sectional dependence, is applied to measure the stationarity of the series.

On the other hand, the basic assumptions in panel data models are that the error term should be homoscedastic, autocorrelated and cross-sectionally independent (uncorrelated across units). Given that the time dimension T is large, Driscoll and Kraay (1998) showed that standard nonparametric time series covariance matrix estimators can be improved to be robust to all general forms of spatial and periodic correlation. In the Driscoll and Kraay estimator based on cross-section averages, the standard error estimates provide consistent findings regardless of the cross-sectional size (N) of the units. Even in the case of large T and N, this estimator produces consistent standard errors in the presence of heteroskedasticity and robust standard errors in models with autocorrelation and cross-sectional dependence (Tatoğlu 2013). With this method, standard errors were corrected, and the models were estimated and interpreted in line with the final findings. In this study, the quarterly data of 20 companies included in the Garanti BBVA Climate Index

between March 2017 and September 2022 are analysed. The objective of the study is to determine whether the inclusion of companies in the Garanti BBVA Climate Index has an impact on their financial performance.

## IV. DATA SET AND MODEL

In this study, the financial performances of the firms included in the Borsa Istanbul (BIST) Climate Index are analysed considering the period of their inclusion in the index. The companies included in the Garanti BBVA Climate Index were selected for the analysis. Garanti BBVA Climate Index is created in cooperation with Sabancı University's institutional investment fund and calculated by Borsa Istanbul. The companies included in the climate index were selected from among the companies that answered the question sets in the climate change and water security group in the 2021 report of CDP Turkey, which has B-score and above. The condition for inclusion in the climate index, for which Borsa Istanbul provides calculation services, is to have a score of B- and above as an environmental report. At the same time, companies with an average daily trading volume of at least 10 million TL and above in the last six months are included as financial performance. Information on which companies are included in the index was obtained from https://finans.mynet.com/. Accordingly, the companies traded in BIST100 and included in the Climate Index are shown in the table below.

**Table 1. Companies in the Climate Index**

| BİST 100 COMPANIES IN THE CLIMATE INDEX | | | |
|---|---|---|---|
| 1 | Akbank Inc. | 17 | Mavi Clothing Industry And Trade Inc. |
| 2 | Akçansa Cement Industry and Trade Inc. | 18 | Migros Trade Inc. |
| 3 | Aksa Akrilik Chemistry Industry Inc. | 19 | Pegasus Air Transport Inc. |
| 4 | Albaraka Turk Participation Bank Inc. | 20 | Polisan Holding Inc. |
| 5 | Arçelik Inc. | 21 | Sabancı Holding Inc. |
| 6 | Aselsan Electronics Industry And Trade Inc. | 22 | Şekerbank Inc. |
| 7 | Aydem Renewable Energy Inc. | 23 | T.Garanti Bank Inc. |
| 8 | Borusan Mannesmann Pipe Industry Arid Trade Inc. | 24 | T.Halk Bank Inc. |
| 9 | Brısa Brıdgestone Sabancı Tyre Industry And Trade Inc. | 25 | T.İş Bank Inc. |
| 10 | Çimsa Cement Industry and Trade Inc. | 26 | T. Industrial Development Bank Inc. |
| 11 | Coca-Cola Beverage Inc. | 27 | Tekfen Holding Inc. |
| 12 | Enerjisa Energy Inc. | 28 | Turkish Airlines Joint S. C. |
| 13 | Enka Construction and Industry Inc. | 29 | Turkcell Communication Services Inc. |
| 14 | Ford Automotive Industry Inc. | 30 | Vakiflar Bank of Turkey S. C. |
| 15 | Karsan Automotive Industry and Trade Inc. | 31 | Yapı ve Kredi Bank Inc. |
| 16 | Kordsa Technical Textile Inc. | 32 | Zorlu Energy Electricity Generation Inc. |

The data set of the firms is obtained from the earliest common data in the BIST100 before the calculation of the climate index. In this context, the quarterly data of the firms between 2017-2022 are analysed and since the climate index is calculated as of April 2022, the periods after the 2nd quarter of 2022 are considered as the index inclusion period. Banks in the index are not included in the analysis since they have different financial statements and Aydem Renewable Energy Inc. is not included in the analysis since

it does not have available data. In this case, 20 firms out of 32 Climate Index firms were analysed. Information on the firms was obtained from https://www.kap.org.tr/. The variables taken for the profitability and risk measurements based on the literature of each firm to analyse the firm value are shown in the table below. The ratios of the variables are calculated from the data obtained from the balance sheets of the firms.

**Table 2. Variable Definitions**

| Variable Group | Definition | Abbreviation | Formula | Period (Observation) | Data Source |
|---|---|---|---|---|---|
| **Dependent Variable** | Tobinq Ratio | TOBINQ | (Total Debt + Market Value)/ Total Assets | 2017:1-2022:3 (506) | KAP Web site |
| | Market Value/Book Value | MV/BV | Market Value/Book Value | 2017:1-2022:3 (506) | KAP Web site |
| **Independent Variable** | Financial Risk Level | FINRISK | Foreign Resources / Total Liabilities | 2017:1-2022:3 (506) | KAP Web site |
| | Enterprise Size | SIZE | Total Assets (Thousand TRY) | 2017:1-2022:3 (506) | KAP Web site |
| | Growth Rate | GROWTHRATE | (Total Assets - Prior Period T. A.) / Total Assets | 2017:1-2022:3 (506) | KAP Web site |
| | Current Ratio | CURRENTRATIO | (Current Assets/ Short Term Liabilities) | 2017:1-2022:3 (506) | KAP Web site |
| | Leverage Ratio | LEVRATIO | (Total Debt/Total Assets) | 2017:1-2022:3 (506) | KAP Web site |
| **Control Variable** | Profit/Loss for the Period | PROFIT | Profit / Loss for the Period (Thousand TRY) | 2017:1-2022:3 (506) | KAP Web site |
| | Credit Risk | CREDITRISK | Non-Performing Loans/ Loans | 2017:1-2022:3 (506) | KAP Web site |

The econometric model established for the analysis is constructed as follows in light of the literature studies. The models are constructed as follows for two different dependent variables, respectively:

$$TOBINQ_{i,t} = \alpha + \beta_1\, TOBINQ_{i,t-1} + \beta_2\, I_{i,t} + \beta_3\, C_{i,t} + \beta_4\, D_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\mathrm{MV/BV}_{i,t} = \alpha + \beta_1\, \mathrm{MV/BV}_{i,t-1} + \beta_2\, I_{i,t} + \beta_3\, C_{i,t} + \beta_4\, D_{i,t} + \varepsilon_{i,t} \quad (2)$$

In both models, SIZE and PROFIT variables are in logarithmic form with i as a proxy for firms and t representing the time dimension. In both models, the dependent variables TOBINQ and MV/BV represent the financial performance of firms, while $TOBINQ_{i,t-1}$ and $\mathrm{MV/BV}_{i,t-1}$ represent the one-period lagged value of the dependent variables. $I_{i,t}$ denotes the independent variables of financial risk level, enterprise size, growth rate, current ratio and leverage ratio. In addition, $C_{i,t}$ represents the control variables included in the models. Besides, $D_{i,t}$ represents the dummy variable representing the periods in which firms are included in the climate index and it is the key point for the installation of models and the main motivation of the study.

## V. FINDINGS

In this section of the study, the findings related to the analysis of the model established in the previous section are given. In order to reduce the differences between the series to the same level, logarithms of the SIZE and PROFIT variables were taken. Descriptive statistics of the series included in the analysis are given in Table 3.

**Table 3. Descriptive Statistics**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| TOBINQ | 506 | 1.264415 | 0.7222359 | 0.300223 | 8.719296 |
| PDDD | 506 | 4.329252 | 23.95567 | 0.0008766 | 411.1849 |
| FINRISK | 506 | 0.648827 | 0.1869874 | -0.222173 | 0.998996 |
| SIZE | 506 | 7.145578 | 0.6222976 | 5.68951 | 9.06164 |
| PROFIT | 506 | 5.544445 | 0.832606 | 2.1038 | 7.434814 |
| GROWTHRATE | 506 | 0.1250802 | 0.4540737 | 6.34913 | 3.891566 |
| CURRENTRATIO | 506 | 1.268812 | 0.7145083 | 0.277685 | 9.694635 |
| LEVRATIO | 506 | 0.6324191 | 0.2227466 | -0.22217 | 1.179198 |
| CREDITRISK | 506 | 0.0869872 | 0.1609708 | 0.53705 | 1.571918 |

Descriptive statistics in Table 3 show that the standard deviation of MV/BV is high. On the other hand, it can be said that the other dependent variable, TOBINQ ratio, is more stable. Table 4 shows the correlations of all series.

**Table 4. Correlation Matrix**

| | TOBINQ | MV/BV | FIN RISK | SIZE | PROFIT | GROWTH RATE | CURRENT RATIO | LEV RATIO | CREDITRISK |
|---|---|---|---|---|---|---|---|---|---|
| TOBINQ | 1 | | | | | | | | |
| PDDD | 0.0358 | 1 | | | | | | | |
| FINRISK | 0.0535 | 0.2000 | 1 | | | | | | |
| SIZE | -0.1822 | -0.0146 | 0.1445 | 1 | | | | | |
| PROFIT | -0.0219 | 0.0214 | 0.0192 | 0.4783 | 1 | | | | |
| GROWTH RATE | -0.0398 | 0.1187 | 0.1580 | 0.0641 | 0.1012 | 1 | | | |
| CURRENT RATIO | -0.0932 | 0.0172 | -0.4138 | 0.0255 | 0.1582 | 0.0171 | 1 | | |
| LEVRATIO | 0.1850 | -0.2632 | 0.4510 | 0.0263 | -0.1323 | -0.1075 | -0.3620 | 1 | |
| CREDIT RISK | -0.0711 | -0.0385 | 0.0799 | 0.0678 | 0.0242 | -0.1003 | -0.1198 | 0.0197 | 1 |

In Table 4, the correlation between variables is analysed. In general, there is a low correlation between the variables. While the dependent variable TOBINQ has a relationship with FINRISK and LEVRATIO in the same direction, it has an opposite relationship with the other variables. MV/BV has an opposite relationship with SIZE, LEVRATIO and CREDITRISK. Besides, to decide which unit root test will be performed to determine the stationarity, the cross-sectional dependence of the variables should be examined.

Pesaran (2004) cross-section dependence (CD) test was performed to determine cross-sectional dependency. The CD test shows in table 5 that each series, except FINRISK, CURRENTRATIO and LEVRATIO, exhibits cross-sectional dependence.

**Table 5. Tests For Cross-Section Dependence**

| Variable | CD-test | p-value | corr | abs(corr) |
|---|---|---|---|---|
| TOBINQ | 15.34 | 0.0000 | 0.21 | 0.37 |
| PDDD | 14.93 | 0.0000 | 0.20 | 0.38 |
| FİNRİSK | 1.10 | 0.2720 | 0.02 | 0.28 |
| SIZE | 57.29 | 0.0000 | 0.79 | 0.86 |
| PROFIT | 14.43 | 0.0000 | 0.20 | 0.34 |
| GROWTHRATE | 15.83 | 0.0000 | 0.26 | 0.33 |
| CURRENTRATIO | -0.58 | 0.5640 | -0.01 | 0.21 |
| LEVRATIO | 0.99 | 0.3200 | 0.01 | 0.28 |
| CREDITRISK | 2.46 | 0.0140 | 0.03 | 0.28 |

The CD statistic is normally distributed under the null hypothesis of no cross-sectional dependence.

Based on these findings, it was decided to perform second generation unit root tests to investigate the stationarity of panel series under cross-sectional dependence. Some studies indicated that the existence of cross-sectional dependence poses a threat to the effectiveness of the standard panel unit root test (De V. Cavalcanti et al., 2015; Eberhardt and Presbitero, 2015), so that we carried out the Cross-Sectional Augmented Im–Pesaran–Shin (CIPS) test Pesaran (2007). CIPS test provides for the heterogenous unit process through augmented the ADF regression for each unit with cross averages. The unit root test results, which were represented considering the model structures in the study, are given in Table 6.

**Table 6. Panel Unit Root Tests**

| Variable | CIPS | | CIPS 1ST DIFF | |
|---|---|---|---|---|
| | Z(t-bar) | p-value | Z(t-bar) | p-value |
| TOBINQ | 0.91 | 0.8200 | -3.66 | 0.0000 |
| PDDD | 3.57 | 1.0000 | -2.84 | 0.0120 |
| FİNRİSK | 2.04 | 0.9790 | -2.57 | 0.0140 |
| SIZE | 7.74 | 1.0000 | -1.78 | 0.0220 |
| PROFIT | -5.87 | 0.0000 | -6.75 | 0.0000 |
| GROWTHRATE | -9.60 | 0.0000 | -2.85 | 0.0000 |
| CURRENTRATIO | -0.10 | 0.4600 | -2.43 | 0.0000 |
| LEVRATIO | 0.93 | 0.8250 | -3.96 | 0.0000 |
| CREDITRISK | 2.52 | 0.9940 | -5.52 | 0.0060 |

According to Table 6, all variables except size and profit have non-stationary characteristics while all variables were stationary at first difference. Thus, the analysis for the model involved taking the first difference of all variables except size and profit. Based on the models, before performing parameter estimation, the panel data analysis model must be determined. For this purpose, in order to determine the model, it is necessary to choose between the fixed effects model or the random effects model by using the Hausman (1978) test statistics. In testing stage of the fixed effects model, the F test, which is the test of the pooled model, performed. As seen in Table 7, it was carried out that the model is not suitable for the pooled model. According to the results of the Hausman test, it was confirmed that the model should be estimated

using the fixed effects model. Besides, after estimating the models established within the study with the fixed effects approach, the specification tests performed and the test results regarding whether the assumptions of heteroskedasticity, autocorrelation and cross-sectional dependency are checked in the models are included in Table 7.

**Table 7. Panel Estimation Approaches and Model Specification Tests**

| Tests | Model 1 | Model 2 |
|---|---|---|
| Panel Estimation Approaches | | |
| Hausman Test | 24.49 [0.0009] | 21.87 [0.0005] |
| F Test (Fixed Effect) | 39.02 [0.0000] | 29.98 [0.0000] |
| Heteroscedasticity (Wald Test) | 0.012 [0.0000] | 0.058 [0.0000] |
| Autocorrelation (Wooldridge Test) | 1.630 [0.2636] | 1.294 [0.1274] |
| Cross-sectional dependency (Pesaran CD Test) | 21.65 [0.0000] | 18.67 [0.0000] |

Values in square brackets show the p-values of the tests.

The validity of the pooled model (classical model) in panel estimator selection was tested with the F test and the fixed effects approach was found to be valid. According to the results of the Hausman test, which was subsequently performed to determine whether the fixed effects or random effects estimator was valid, it was understood that the most appropriate approach for both models was fixed effects. When the specification test results in Table 7 are examined, it has been determined that there is heteroscedasticity and cross-sectional dependency problem in both models created with the fixed effects approach, but there is no autocorrelation problem. Since heteroscedasticity and sectional dependency problems were found in both models estimated in the study, standard errors were corrected using the Driscoll-Kraay robust estimator and the relationships were interpreted in line with the concluding findings. The results of the Driscoll-Kraay robust estimator analysis of the models in the study are presented in Table 8.

**Table 8. Driscoll-Kraay Estimation Results**

| **Variables** | **Model 1 (TOBINQ )** | | | **Model 2 (MV/BV)** | | |
|---|---|---|---|---|---|---|
| | **Coefficient** | **T Statistic** | **P-value** | **Coefficient** | **T Statistic** | **P-value** |
| FINRISK | -1,087 | -1,45 | 0,1620 | 2,5260 | 1,26 | 0,2190 |
| SIZE | 0,529 | 0,72 | 0,4760 | 17,3930 | 1,18 | 0,2490 |
| PROFIT | 0,361 | 2,25 | 0,0035 | -0,0137 | -1,07 | 0,2970 |
| GROWTHRATE | -0,086 | -1,39 | 0,1780 | -0,1272 | -1,34 | 0,1950 |
| CURRENTRATIO | 0,009 | 0,61 | 0,5490 | -0,0062 | 0,12 | 0,9060 |
| LEVRATIO | 2,295 | 2,16 | 0,0042 | -1,3780 | -1,28 | 0,2120 |
| CREDITRISK | 0,316 | 1,70 | 0,1040 | 0,3266 | -1,49 | 0,1510 |
| DUMMY | 0,204 | 2,41 | 0,0026 | 0,3621 | 3,16 | 0,0051 |
| CONSTANT | -0,343 | -0,86 | 0,4000 | -0,1426 | -0,67 | 0,5110 |
| **Scalar** | **Coefficient** | | **P-value** | **Coefficient** | | **P-value** |
| F Test | $11,99^{***}$ | | 0,0000 | $5,69^{***}$ | | 0,0000 |
| $R^2$ | 0,6458 | | | 0,7461 | | |
| Nub.of Obs. | 506 | | | 506 | | |
| Nub.of Groups | 22 | | | 22 | | |

When Table 8 is analysed, it is understood that the F test coefficients are statistically significant in both models and therefore the established model patterns are valid. The high $R^2$ values of the models indicate that the power of the independent variables in the models to explain the dependent variable is

sufficient. When the findings are evaluated together, there are differences in the findings of the models analysing TOBINQ and MV/BV values. It is observed that PROFIT and LEVRATIO variables positively affect the TOBINQ variable, which expresses firm performance. Therefore, it can be said that the fact that firms cover the costs they incur in line with the CDP survey through borrowing by using less equity has a positive impact on the financial performance of firms. No relationship was found with the dependent variable MV/BV, which expresses firm value. In addition, the dummy variable is significant in both models, indicating that the inclusion of firms in the climate index positively affects firm performance and firm value. The positive effect of inclusion in the climate index on firms' financial performance may arise from firms becoming more transparent in their environmental policies in line with investors' demands and developing more environmentally friendly projects even though the costs they bear increase. When the estimation results of the models are compared with the studies in the literature, Safieddine and Titman (1999), Weill (2008), Margaritis and Psillaki (2010), Caba (2012), Ecer and Günay (2014), Edesiri (2014), Gümüş and Bolel (2017), Karkacier and Yazgan (2017) found a positive relationship between financial leverage and market capitalization and reached similar findings to our study.

## CONCLUSION

Global warming and climate change, the effects of which have become more pronounced in recent years worldwide, is an important risk factor that many policy makers and company managers should take into consideration. On the other hand, there are undoubtedly different opportunities for companies. As of 2021, CDP, which calls on a large number of companies operating globally in terms of environmental awareness, acts on behalf of 590 investors and directs capital on a very large scale. In the light of these developments, in our study, in addition to many studies based on climate data in the literature, the financial performance of firms is analysed in terms of the climate index created in April 2021. This study was conducted to examine whether the climate index is related to the financial performance of firms. The quarterly data of the firms between 2017-2022 before and after the climate index are analysed. Since the banks in the index were excluded from the analysis due to their different financial statements, the analysis was carried out with 20 firms in the index. After choosing the model and testing the assumptions, Driscoll and Kraay (1998) fixed effects regression was estimated for classical models, because heteroskedasticity and cross-sectional dependency were detected in the data to select the appropriate robust estimator.

When the findings obtained as a result of the Driscoll-Kraay estimation are evaluated, it is found that PROFIT, LEVRATIO and DUMMY variables positively affect firm performance which is measured by TOBİNQ. Also, if firm performance is measured by MV/BV, only DUMMY variable was found to have a statistically significant effect on firm performance. When the results of two models are evaluated together, it can be said that companies' inclusion in the climate index has a positive effect on company performance. In this regard, firms developing products that take climate conditions and environmental pollution into account and reflecting them into their activities can make positive contributions to firm performance.

The study is very important in terms of guiding future studies in terms of revealing the relationship between carbon emissions and financial performance of firms in Turkey. The study is based on a BIST100 index that includes firms that responded to the CDP survey. Researchers may be advised to make a comparative study on the relationship between carbon emissions and financial performance of clean industry and dirty industry firms operating in Turkey.

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