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INVESTIGATING THE RELATIONSHIP BETWEEN ADR, STOCK PRICES AND MACROECONOMIC INDICATORS: THE CASE OF TÜRKİYE

ADR ve Hisse Senetleri Fiyatlarının Makroekonomik Göstergeler ile Arasındaki İlişkinin Belirlenmesi: Türkiye Örneği

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ADR, Macroeconomic Indicators, Arbitrage

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Abstract

American Depositary Receipts (ADRs), which are traded through depositary receipt management by accepting the stock as an underlying asset, have become a frequently used investment instrument today. Since ADRs are linked to the underlying stock, there are multiple variables in determining their price. The effects of these variables on the ADR price may lead to an arbitrage gain between the underlying stock and the ADR return. The aim of the study is to identify the indicators affecting the Turkish ADR prices and to reveal the existence of arbitrage opportunities in ADRs. In the study, economic indicators affecting the price of Turkish ADRs were identified. Exchange rate, CDS premium, and various stock market indices were selected as economic indicators to be used in the analysis. Regression analysis was used in the study, where daily data were used between 2014 and 2024. As a result of the study on eight different ADRs, it is determined that the return differences between ADRs and stocks are affected by various economic indicators. Moreover, the fact that this difference does not follow a random walk, i.e., it is predictable, provides evidence that the ADR market is inefficient within the framework of the efficient market hypothesis.

Anahtar Kelimeler:
ADR, Makroekonomik Göstergeler, Arbitraj

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Öz

Hisse senedini dayanak varlık olarak kabul edip depo sertifası yönetimiyle işlem gören American Depositary Receipts (ADR) günümüzde sık kullanılan bir yatırım aracı haline gelmiştir. ADR' lerin dayanak hisse senedine bağlı olması nedeniyle fiyatının belirlenmesinde birden çok değişken mevcuttur. Bu değişkenlerin ADR fiyatına etkileri temel hisse senedi ile ADR getirisi arasında bir arbitraj kazancına yol açabilme olasılığı taşımaktadır. Çalışmanın amacı, Türkiye ADR fiyatlarına etki eden göstergelerin tespit edilerek ADR' lerin arbitraj fırsatlarının mevcudiyetini ortaya koymaktır. Araştırmada Türkiye ADR' lerinin fiyatını etkileyen ekonomik göstergeler tespit edilmiştir. Analizde kullanılmak üzere ekonomik gösterge olarak; döviz kuru, CDS primi, çeşitli borsa endeksleri seçilmiştir. 2014-2024 yılları arasında günlük verilerin kullanıldığı çalışmada Regresyon yöntemi kullanılmıştır. Sekiz farklı ADR üzerine yapılan çalışma sonucunda ADR ile hisse senedinin getiri farklılıklarının çeşitli ekonomik göstergelerden etkilendiği tespit edilmiştir. Ayrıca bu farklılığın rastgele bir yürüyüş izlememesi yani tahmin edilebilir olması, etkin piyasa hipotezi çerçevesinde ADR piyasasının etkin olmadığına yönelik kanıtlar sunmaktadır.

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1. Introduction

With the increase in globalisation and the advancement of technology, financial markets, like all other areas, have become global. The effect of physical borders on financial markets has decreased, and the parties have the opportunity to trade in the capital markets of their choice within the market opportunities by using technological facilities. In this context, new investment instruments have emerged with the global development of financial markets. In fact, in recent years, new investment instruments derived from existing investment instruments have been frequently used. American Depositary Receipts (ADR) are one of these investment instruments.

From a general perspective, ADRs are investment instruments that represent stocks traded in the United States of America (USA) markets with underlying assets in another country. ADRs, which have similar characteristics to any stock, are transferable certificates issued by US banks and represent the ownership of shares in non-US companies (Fang and Loo, 2002). An ADR is a security that represents the shares of a non-US company but has the added convenience of being traded as a typical US share (Mitra et al., 2019). The main purpose of ADRs is to facilitate the trading of companies, especially international firms, in the US capital markets. In other words, ADRs are an easy way for a foreign firm to trade its shares in the US or to raise international capital. Being traded in a foreign stock exchange reduces the capital costs of firms due to the resources raised from abroad (Peterson and O'Shaughnessy, 2016).

In the ADR system, in order to be traded in the US markets, firms enter into an agreement with a bank in the US, which can be used as a depository bank, and issue their shares to the US markets under the name of ADR through this bank. In other words, firms entrust their shares to the depositary bank, and the depositary bank issues the shares in the relevant markets in dollars using a certificate logic. ADRs are used by investors as a practical tool to avoid the stock costs of companies located in foreign countries and to diversify their portfolios (Bandopadhyaya et al., 2008). In addition, firms with ADRs are not subjected to the reporting and accounting policies of the US, with all the conditions compared to the initial public offering. Investing in ADRs, like other equities, provides two types of income: dividend income and capital gains (Callaghan and Barry, 2003).

ADRs are affected by different indicators, just like ordinary stocks. These indicators may consist of firm-specific issues as well as external micro or macroeconomic parameters. In other words, while the price of a stock is affected by the financial structure of the firm, it may also be affected by market and economic conditions. In other words, the price of a stock includes variables such as the assets, capital structure, investment opportunities, profitability, dividend policy, sectoral structure, and cyclical fluctuations (Ercan and Ban, 2016). Since ADRs reflect the concept of an existing stock being issued and traded by the depositary bank in the US capital market, every factor affecting the existing stock plays a role in ADR price and return. The same is also true for the variables affecting the ADR market. This is also the case for Turkish ADRs traded in Türkiye and traded in the US capital market. In fact, the prices of Turkish ADRs may also be affected by factors affecting the underlying stock and variables specific to the ADR market. In this context, an ADR linked to a stock traded in Borsa Istanbul is likely to be affected both by the current stock and the factors affecting it and by the conditions of its own market. In other words, it is important whether a price prediction can be made for the ADR by looking at the underlying stock and the underlying stock market, and whether a return can be achieved. The fact that the ADR price is affected by the local stock and its specific variables creates arbitrage

opportunities for investors. In this context, investors can predict the ADR price according to the movements of the underlying stock and local economic indicators and generate returns by making a purchase or sale decision. At the same time, it is thought that a comprehensive analysis using the existing ADR market variables can increase the arbitrage opportunity. This may also be the case for Turkish ADRs, and it is thought that Borsa Istanbul and local stock variables may have an impact on ADR prices. This study attempts to answer the question of whether the existing Turkish ADRs have an arbitrage opportunity. In other words, it aims to determine the existence of an arbitrage formation by revealing how much the price and, accordingly, the return of Turkish ADRs are affected by the local stock price and the main economic indicators of the local country and the ADR market indicators.

This study analyses the relationship between the performance of Turkish ADRs and various economic indicators between 2014 and 2024. The main objective of the study is to determine the impact of the economic effects in the home countries of ADRs on the value of the ADR. In other words, it tries to determine the reflection of various economic effects in the country where the underlying asset is located on the price of the ADR. Thus, it is made to understand whether an arbitrage opportunity exists or not. The study aims to contribute to the literature by determining the probability of Turkish ADRs to provide returns by being affected by local market conditions and underlying stock price. In other words, it is thought that determining whether Turkish ADRs contain arbitrage opportunities by being affected by the variables used in the study will contribute to the studies on Turkish ADRs in the literature.

The increasing number of ADRs issued by Turkish firms and the limited number of studies on Turkish ADRs in both domestic and foreign literature make it important to investigate this issue. The extent to which local economic changes affect ADR price discovery is important in determining whether bilaterally traded stocks have arbitrage opportunities. At the same time, the correct flow of information in the price discovery process is also important in terms of investor protection and market efficiency. The globalisation and accessibility of financial markets with technological developments and the desire of international firms to trade in different markets by turning to ADRs emphasise the timeliness of the study.

In the second part of the study, ADRs, price discovery processes, arbitrage opportunities, and their evaluation in terms of efficient market hypothesis are discussed conceptually. In the third section, existing literature studies on ADRs are mentioned. Data and the methodology used in the study are explained in the fourth section. In the fifth section, research findings are presented. In the last part of the study, research results, opinions, and suggestions are given.

2. Conceptual Framework

There are multiple factors that constitute security prices. In publicly traded enterprises, the share price is calculated by dividing the market capitalisation of the firm by the number of shares. In other words, the market value of the firm is the price at which the stock is traded in the market (Ercan and Ban, 2016). The market value of the firm is determined by external factors as well as internal factors. In this context, macroeconomic evaluations are also taken into consideration in stock valuation. Factors such as country economic analysis, political analysis, and market analysis can be examples of these indicators. In fact, the value of a stock, with its high beta value, may be directly dependent on the movement of the market in which it is located, or it may be vulnerable

to fluctuations in the country's basic exchange rate. These issues may vary depending on the company structure and/or sector.

The concept of security price discovery, especially for equities, is important for investors, brokerage houses, and market makers. Market parties want to predict security prices in the earliest and most accurate way in order to minimise their risks and increase their earnings. In this context, they can use emerging analysis techniques and technological instruments. Price discovery involves the incorporation of all new information into the security price (Hasbrouck, 1995). The security price is determined as a result of the flow of information in financial markets and how market participants use this information (Howe and Ragan, 2002).

The requirement that stock prices should move within market boundaries in an efficient market is explained in the finance literature within the efficient market hypothesis. According to the efficient market hypothesis, market participants have access to all information in the market under the same conditions. Therefore, asset prices reflect all the information occurring in the market in an uninterrupted manner. Therefore, Fama emphasises that in the efficient market hypothesis, security prices already reach their fundamental value within the market. The efficiency of a market depends on how fast the asset price can react to new information coming to the market (Karan, 2004). The efficient markets hypothesis argues that changes in asset prices follow a random walk (Malkiel and Fama, 1970). In other words, efficient market hypothesis accepts the random walk hypothesis and states that asset prices in the markets move randomly and new information reaching the market affects prices instantaneously. In other words, the resulting price changes continue in an unpredictable series. For this reason, in efficient markets, future price forecasts cannot be made by using past information.

Like all securities, the price of ADRs depends on a number of factors. However, unlike others, since ADRs are dual-registered investment instruments, they are likely to be affected by the markets and economic conditions of their home countries in addition to their current markets. In addition, factors such as information flow and time difference between the US market and the local market are among the issues that may affect the ADR price. In this context, it is important to investigate whether both markets are efficient in the price discovery process from the perspective of the efficient market hypothesis. In addition, determining the extent to which ADRs specific to emerging financial markets are affected by local economic changes allows us to understand the market efficiency of these markets within the framework of the efficient market hypothesis. There are conflicting views on whether markets for cross-listed stocks are indeed fully efficient (Suarez, 2005). In the case of ADRs traded in an efficient market, market efficiency may be distorted by market conditions in the home country. Accordingly, arbitrage opportunities may arise. In other words, the ADR price may be predictable, and market parties may take positions accordingly. The persistence of such arbitrage opportunities for long periods is one of the indicators of low market efficiency (Gorbatikov and Dobrynskaya, 2019).

In general terms, arbitrage is the profit obtained by selling a product at different prices in different markets without assuming any risk. According to the arbitrage pricing theory, arbitrage opportunities arise from the violation of the law of one price. In other words, arbitrage opportunities arise when the law of one price, which states that the price of two securities should be the same even if they are in different markets, is violated (Ross, 1976). Arbitrage Pricing Theory argues that arbitrage opportunities that may arise in the markets for a short period of time will be used by market players in a short time, and the market will rebalance (Cihangir and

Kandemir, 2010). Arbitrage pricing theory is based on the idea that investors will always want to utilise arbitrage opportunities. According to the theory, there may be more than one factor affecting the expected returns of an asset. Factors such as interest rate, inflation, market index, gross domestic product growth, exchange rate, etc. can be examples of these factors. Arbitrage pricing theory assumes that the return of an asset is generated by a multi-factor model. Each factor can be seen as a specific beta coefficient for a given risk premium (Nguyen et al., 2017).

Under standard conditions, there should be no significant differences between the return distribution of locally traded equities and the return distribution of ADRs traded in the US. In other words, it should not harbour arbitrage opportunities. However, arbitrage opportunities may arise when the returns between ADRs and underlying stocks are significantly different (Koumkwa and Susmel, 2008). Since ADRs are issued linked to an underlying stock, there is a possibility that their correlation to the local market and the stock may be high. For example, sudden changes in the dollar exchange rate in the home country may create a buying or selling opportunity for the ADR traded in dollars. Or, an increase in the risk premium of the home country and unfavourable economic conditions in the country may decrease the value of stocks with high export volume, and therefore, fluctuations in the ADR price may occur. Especially in times of crisis, there may be large return differences between stocks and ADRs due to economic conditions that vary greatly. These yield spreads can be converted into arbitrage gains through time differences between markets, cheap transaction costs, and technological opportunities. This situation is contrary to the efficient market hypothesis and arbitrage pricing theory for efficient markets.

When investors have the possibility to predict the ADR price depending on the movements in the home country or the underlying stock, they may have the opportunity to make arbitrage gains through bilateral trading. Therefore, determining whether ADRs are more affected by current market conditions or local market conditions may be an indicator of whether there is an arbitrage opportunity for the ADR market. It may also provide a measure of the correlation between the local market and the ADR market. Indeed, the cross-listing of stocks by foreign firms in the US and elsewhere contributes to increased correlation between financial markets (Poshakwale and Aquino, 2008).

In this study, the relationship between various economic indicators and ADR price is investigated in order to determine whether Turkish ADRs have an existing arbitrage opportunity. It is important for all market parties to determine to what extent the changes in the market of the underlying asset subject to ADRs and the economic changes in the home country are reflected in the ADR price and whether they create arbitrage opportunities.

3. Literature

Although the research on ADRs is multifaceted, more studies have focused on the pricing of ADRs, dividend policy, and the relationship with corporate governance. From a general perspective, the ADR market can be considered as an extension of the basic stocks. Therefore, the ADR market should reflect the relationship between the underlying stock market and economic variables (Gupta et al., 2016).

There are many studies in the literature on the economic indicators of stocks and the markets in which they are located. However, the number of studies focusing on ADRs in this respect is limited. It is inevitable that economic changes in the base country will be effective in

ADR pricing and price forecasting, taking into account time zone differences. Therefore, the relationship between the ADR price and the economic indicators of the home country is important. In the majority of previous studies on this subject, the view that ADRs are affected by the economic indicators in the local country and the underlying stock price is dominant. Similarly, studies on Turkish ADRs have also reached similar conclusions.

Gupta et al. (2016) investigated the long-run and short-run relationship between ADR prices of 4 BRIC countries and the economic fundamentals of their underlying stocks. The main objective of the study is to understand the macroeconomic transmission mechanism of emerging market ADRs. The study is based on the 2000-2013 period, and the main economic indicators such as production index, inflation, money supply, crude oil prices, and stock market indices of the relevant countries are used. Johansen cointegration test and Vector Autoregressive (VAR) analysis were applied in the study. As a result of the study, it is concluded that in the long run, economic growth positively affects ADR returns for Brazil and China, while it negatively affects ADR returns for Russia and India. In a study on Turkish ADRs, Kaygın and Barut (2020) investigated the endogenous factors affecting the prices of 7 stocks in the period 2013-2018. They used Panel data analysis in their study. As a result of the research, a significant (positive) relationship was found between foreign and domestic prices of stocks. Similarly, the relationship between ADR price and relative financial ratios was investigated. Şencan (2021) investigated the volatility link between the underlying assets of 5 Turkish ADRs and themselves. Between 2015 and 2021, weekly data were used, and the GARCH model was applied. It was observed that the volatility of the stock market, which is accepted as the underlying, affects the ADR market. It is concluded that the shocks of the underlying stock and the linked ADRs in the past period are effective on the volatility of the current period.

Bae et al. (2008) aimed to investigate the volatility of the local and existing ADR market over ADRs based on exchange rate changes. Using weekly data of 54 ADRs from 4 different countries, the study utilized exchange rates, risk-free interest rates, and local stock market indices. The Seemingly Unrelated Regression (SUR) model was used as the method in the study. In the study, it is observed that exchange rate changes have a negative relationship with the returns of ADR underlying stocks and a positive relationship with the returns of ADRs in the US markets. In addition, according to the study, ADR returns are more closely related to local market returns than US market returns, suggesting that the local market environment plays a greater role in determining ADR returns. In addition, investors in the US or trading in the local market demand different risk premiums for the exchange rate risk in ADR investments. Esqueda and Jackson (2012) aimed to analyze the behaviour of ADR returns during the currency crisis period. In the study where 74 ADRs originating from Argentina, Brazil, Chile, and Mexico between 1994-2009 were used, the Seemingly Unrelated Regression (SUR) model and Multiple Regression (MVRM) model were applied. The study reveals that ADRs generated significant negative abnormal returns during the currency crisis. It is also concluded that ADR prices are affected by variables such as the underlying stock price, exchange rates, and host country index. Bin et al. (2003) investigated the effect of various risks, particularly exchange rate risk and interest rate risk, on the price of ADRs by considering three different periods between 1990 and 2000. Seemingly Unrelated Regression (SUR) model and GARCH model were used in the study. They found that ADR returns are sensitive to local market movements, foreign exchange fluctuations, and the US stock market. In addition, when the effect of international crises on the changes in ADR prices is

analyzed, they found that the exchange rate risk premium of the ADR of the country where a financial crisis occurred was significantly positive.

Figueiredo and Parhizgari (2017) investigated the conditions affecting ADR pricing using high-frequency data. The EGARCH model was used as the methodology in the study, in which a total of 73 ADRs were analyzed with minute data. The study attempts to identify the factors affecting ADR returns and their relative effects for each ADR and for subsamples based on currency, industry, and emerging or developed market classifications. Consistent with previous studies, the study finds that the main determinants of ADR returns are the returns of the relevant underlying stocks and the relevant exchange rate changes. Taking these two factors into account, we conclude that exchange rate returns represent approximately 30% of ADR total returns. Moreover, in addition to the underlying stock returns and exchange rate fluctuations affecting ADR returns, the contemporaneous returns of the US market and the returns of the relevant local stock markets were also found to have a statistically significant effect. Chen et al. (2009) used daily data for the period 2002-2005 in their study on the market sentiment of ADRs. Variance decomposition analysis and the EGARCH model were applied in the study. As a result of the study, it is stated that there is not a perfect integration between UK markets and UK ADRs and that trading location may have an impact on ADR prices. We also find that UK ADRs exhibit a U-shaped volatility curve on a daily basis.

Pan et al. (2012) investigated the impact of corporate governance and external governance on firm value based on ADRs in China, Hong Kong, and Taiwan. In line with the literature, the study examines cross-listing performance and finds that environments that provide stronger governance and investor protection lead to higher firm value. Although firm characteristics and internal governance mechanisms are important for firm value, external governance decisions outweigh these effects. Chen et al. (2020) examined ADRs within the framework of investor protection. In their study on 430 ADRs from 34 different countries between 2000-2017, they investigated the relationship between earnings management and investor protection, market surveillance, and liquidity. As a result of the research, it was found that firms with low share liquidity are more prone to earnings management than those with high liquidity.

Ejara and Ghosh (2004) comparatively analyzed ADRs and stocks in terms of initial public offerings (IPOs). In their study, the pricing and post-trade performance differences of IPOs with ADR IPOs in the period between 1990-2001 were analyzed. As a result of the study, it was found that ADR and US IPOs generally outperformed the market in less than one year, but their performance weakened in the longer term. Muscarella et al. (1996) investigated stock splits in the context of ADRs. Specifically, the study analyzed 143 cases of ADR splits between 1962 and 1993, where ADRs were split but the underlying country stocks were not. As a result of the study, it was observed that ADR prices increased after the news of a stock split. Investors generally perceive the increase in liquidity as a positive factor and therefore increase ADR prices by increasing demand.

Jun and Partington (2014) investigated the relationship between the dividend yields of ADRs traded on Australian equities and their underlying stocks. Using data on 41 Australian stocks traded in the US markets between 1992 and 2009, the study finds that dividend yields are higher in the market where the underlying stock is located due to various tax advantages. Tong et al. (2022) examined the dividend policies of ADRs and compared these policies with the dividend policies of US stocks. Based on the 2009-2018 period and using regression analysis, the study

found that ADR firms have higher dividend yields than US firms, but US firms have higher share repurchase rates than ADR firms.

Grossman and Ngo (2020) examined the impact of economic policy uncertainty on the pricing of ADRs. In their study, they investigated the hypothesis that the difference between policy uncertainty in the US and policy uncertainty in the country of the underlying asset creates an additional source of mispricing in ADR pricing. Using multiple regression analyses, 605 ADRs from 13 countries and the period 2010-2018, the study found evidence that US policy uncertainty has a different impact on the mispricing of ADRs than economic policy uncertainty in the underlying country of the asset. That is, economic policy uncertainty in the US and the source country may affect ADRs and their underlying assets differently, leading to widening price differences between the two assets and providing different arbitrage opportunities.

Chung (2006) investigated the impact of country-level investor protection mechanisms on the liquidity of cross-listed securities in the US. In the study, 204 ADRs operating in 29 different countries were analyzed in the time period coinciding with the Asian crisis, i.e., the second half of 1997. As a result of the study, it was observed that ADRs operating in countries with better investor protection mechanisms and higher levels of legal enforcement have lower asymmetric information costs and higher liquidity during crisis periods.

4. Data and Methods

In the study, various variables are utilized to measure the vulnerability of the ADR price. In order to reveal the price difference between the underlying stocks and the depositary receipts of the same stock, the data of eight firms from five different sectors operating in Borsa Istanbul, and also issued as ADRs and traded in the US, are used as dependent variables. The ADRs used in the study are selected among the ADRs that are actively traded in the ADR market today and have not been closed due to insufficient trading volume. A total of fifteen Turkish ADRs are traded. The other seven ADRs were not included in the analysis since they were traded at the same prices for a long time due to insufficient trading volume. The fact that the majority of ADRs are bank stocks explains the fact that eight stocks have five different sectors.

In addition, macroeconomic indicators, which are frequently used in the literature, are selected as independent variables to explain the price difference. Bae et al. (2008) applied a regression model using exchange rates, bilateral stock market indices, and risk-free interest rates in their study on the vulnerability of ADR prices. Similarly, Esqueda and Jackson (2012) used variables such as exchange rate, local stock price, and the stock market index of the home country in their study to analyse the ADR price. Similar to the literature, Gupta et al. (2016) expanded the variables in their study and used exchange rates, production indices, inflation rates, stock market indices, and similar variables. In this study, in line with the literature, as independent variables, stock market indices, which are the main indicators of both markets, stock prices of the main country, exchange rates, and additionally, Türkiye's CDS premium have been selected, as it contains international risk. These indicators consist of the BIST 100 index, Türkiye's CDS premium, USD/TL exchange rate, NASDAQ Composite Index, and S&P ADR Composite Index.

For the analysis, firstly, the changes in the daily stock returns of eight companies traded in Borsa Istanbul and the daily changes in the ADR prices of the same stocks were determined. The difference between these two datasets was taken and used as the dependent variable in the study.

The purpose of this arrangement is to ensure the harmonization between stocks traded in TL in Türkiye and ADRs traded in USD in the US. In addition, since there is a difference in other variables used in the study, daily changes are calculated and included in the analysis in a similar way. The variables used in the study are shown in the table below.

Table 1. Variables Used in the Analysis

Variable	Explanations of Variables
Dependent Variable	
AKBANK	Difference of Daily Changes between Ak Bank Stock and ADR
TURKCELL	Difference in Daily Changes between Turkcell Stock and ADR
KOCHOL	Difference of Daily Changes between Koç Holding Stock and ADR
THY	Difference of Daily Changes between Turkish Airlines Stock and ADR
TTKOM	Difference of Daily Changes between Turk Telekom Stock and ADR
AEFES	Difference of Daily Changes between Anadolu Efes Stock and ADR
GARANTİ	Difference of Daily Changes between Garanti Bank Stock and ADR
TAV	Difference of Daily Changes between TAV Hava Limanları Stock and ADR
Independent Variable	
BİST100	Borsa Istanbul 100 index Daily Change
CDS	Daily Change in CDS Premiums for Türkiye 5-year USD Bonds
EXCHANGE	Daily Change in Dollar / TL
NASDAQ	Daily Change in NASDAQ Composite Index
S&P ADR	Daily Change in S&P ADR Composite Index

A total of 2419 observations between 25.09.2014 and 18.09.2024 were used in the study, and daily data for all variables were identified and used. Within the scope of the relevant dates, necessary arrangements have been made by taking into account the official business days between Türkiye and the USA. Data on the variables used in the analysis were obtained from Bloomberg (2024) and Investing (2024) financial information platforms.

In the case of a high correlation between independent variables in the models, it is decided that there is a multicollinearity problem. In such a case, the findings obtained from the model will not be reliable. For this reason, the Spearman correlation matrix was used to create the models in the study. The Spearman correlation matrix gives more reliable results than the Pearson correlation matrix in cases where the variables do not have a normal distribution. For this reason, first, the descriptive statistics of the variables were investigated in the study, and the obtained findings are given in Table 2; then, the correlation matrix is presented in Table 3.

Table 2. Descriptive Statistics

	AKBANK	BIST100	CDS	EXCHANGE	GARANTI	KOCHOL	AEFES
Mean	0.0001	0.0005	0.0011	0.0006	0.0011	0.0007	0.007
Median	0.0002	0.0011	0.0014	7.41e-05	0.0005	0.0003	0.009
Maximum	0.3480	0.2649	0.0988	0.4910	0.1864	0.1706	0.1832
Minimum	0.3982	0.3025	0.0979	0.2209	0.2429	0.2639	0.2308
Std.Dev.	0.0515	0.0540	0.0159	0.0328	0.0124	0.0389	0.0322
Skewness	0.4359	0.0952	0.4178	2.2356	0.0119	0.0932	0.1004
Kurtosis	12.2296	5.8696	7.5208	32.7297	105.999	5.1042	5.9256
Jarque-Bera statistics	8666.266***	833.993***	2130.335***	91100.33***	1069278***	450.000***	867.1305***
Observations	2419	2419	2419	2419	2419	2419	2419
	NASDAQ	**S&P ADR**	**TAV**	**THY**	**TTKOM**	**TURKCELL**	
Mean	0.0006	0.0001	0.007	0.0007	0.0007	0.0010	
Median	0.0010	0.0004	0.001	0.0000	0.0005	0.0009	
Maximum	0.0934	0.0864	0.2269	0.4562	0.2584	0.1477	
Minimum	0.1232	0.1070	0.3370	0.2919	0.7284	0.1709	
Std.Dev.	0.0136	0.0116	0.0368	0.0374	0.0430	0.0306	
Skewness	0.3907	0.7284	0.5641	0.6957	2.4685	0.0456	
Kurtosis	10.1362	12.4269	10.5995	19.8267	44.9560	6.0218	
Jarque-Bera statistics	5194.478***	9171.034***	5946.281***	28745.1***	179956.2***	921.6***	
Observations	2419	2419	2419	2419	2419	2419	

While the TTKOM variable has the highest maximum value, the S&P ADR variable has the lowest minimum value. It is seen from Table 2 that the AEFES variable has the highest standard deviation value, and the S&P ADR variable has the lowest standard deviation value.

Table 3. Spearman Correlation Matrix

	AEFES	AKBANK	BIST100	CDS	EXCHANGE	GARANTI	KOCHOL	NASDAQ	SPADR	THY	TAV	TTKOM	TURKCELL
AEFES	1.0000												
AKBANK	-0.0210	1.0000											
	0.3012	-											
BIST100	0.0380*	0.0028	1.0000										
	0.0614	0.8916	-										
CDS	-0.0383*	-0.1226*	-0.3833*	1.0000									
	0.0598	0.0000	0.0000	-									
EXCHANGE	-0.004	-0.0342*	0.0161	0.0094	1.0000								
	0.8357	0.0929	0.4278	0.6442	-								
GARANTI	0.1732*	-0.0342*	-0.0046	0.0939*	0.0331	1.0000							
	0.0000	0.0000	0.8230	0.0000	0.1038	-							
KOCHOL	0.1462*	-0.3697*	-0.0077	0.0989*	0.0183	0.4421*	1.0000						
	0.0000	0.0000	0.7052	0.0000	0.3689	0.0000	-						
NASDAQ	0.0460*	0.0000	0.1744*	-0.2876*	0.0346*	-0.0058	0.0325	1.0000					
	0.0236	0.9996	0.0000	0.0000	0.0890	0.7771	0.1102	-					
SPADR	0.0323	0.1330	0.2732*	-0.3591*	0.0484*	-0.0309	0.0143	0.7532*	1.0000				
	0.1128	0.5136	0.0000	0.0000	0.1730	0.1289	0.4808	0.0000	-				
THY	0.1819*	-0.0831*	0.0197	0.0121	0.0220	0.2444*	0.2399*	-0.0031	-0.0041	1.0000			
	0.0000	0.0000	0.3321	0.5518	0.2788	0.0000	0.0000	0.8774	0.8419	-			
TAV	0.1232*	-0.1382*	0.0041	0.0231	-0.0470	0.2034*	0.2847*	0.0217	-0.0078	0.2267*	1.0000		
	0.0000	0.0000	0.8397	0.2564	0.8172	0.0000	0.0000	0.2862	0.7017	0.0000	-		
TTKOM	0.1238*	-0.1791*	-0.0136	0.0393*	0.0185	0.2927*	0.3499*	0.0071	-0.0075	0.2193*	0.2191*	1.0000	
	0.0000	0.0000	0.5052	0.0533	0.3619	0.0000	0.0000	0.7274	0.7017	0.0000	0.0000	-	
TURKCELL	0.1725*	-0.30631*	0.0015	0.0698*	0.0107	0.3905*	0.4396*	0.0273	0.0287	0.2379*	0.2305*	0.3862*	1.0000
	0.0000	0.0000	0.9429	0.0006	0.5994	0.0000	0.0000	0.1788	0.1580	0.0000	0.0000	0.0000	-

Note: * shows the correlation coefficient is statistically significant at a 10% significance level.

According to Table 3, there is a negative relationship between CDS and AEFES. This relationship is also valid for CDS and AKBANK. AKBANK and EXCHANGE are negatively related. There is a positive relationship between SPADR and BIST100, and a negative relationship between SPADR and CDS. There are positive relationships between SPADR and EXCHANGE and between SPADR and NASDAQ. These relationships are also valid between BIST100 and NASDAQ, AEFES and NASDAQ, and EXCHANGE and NASDAQ. There is a negative relationship between NASDAQ and CDS. When the results for AKBANK are examined, it is noteworthy that the positive relationships are specific to GARANTI, THY, TAV, TTKOM, TURKCELL, and KOCHOL. When the results for GARANTI are examined, it is noted that the positive relationships are specific to THY, TAV, TTKOM and TURKCELL. These variables are also valid for KOCHOL. The existence of positive relationships between THY, TAV, TTKOM and TURKCELL variables is seen in Table 3. Positive relationships were found between the AEFES variable and BIST100, GARANTI, KOCHOL, THY, TAV, TTKOM and TURKCELL variables, respectively. The highest positive significant relationship between the variables is between SPADR and NASDAQ (0.7532). In other words, there is a strong relationship in the same direction between the two variables. The negative significant relationship between the variables is between KOCHOL and AKBANK (-0.36972). Accordingly, it is seen that there is an inverse relationship between the two variables.

Models according to the correlation matrix are given below:

Model 1: $AEFES = f\ (BIST100_{t-i}, EXCHANGE_{t-i}, CDS_{t-i},\ S\&PADR_{t-i}, NASDAQ_{t-i})$ (1)

Model 2: $AKBANK = f\ (BIST100_{t-i}, EXCHANGE_{t-i}, CDS_{t-i},\ S\&PADR_{t-i}, NASDAQ_{t-i})$ (2)

Model 3: $GARANTI = f\ (BIST100_{t-i}, EXCHANGE_{t-i}, CDS_{t-i},\ S\&PADR_{t-i}, NASDAQ_{t-i})$ (3)

Model 4: $KOCHOL = f\ (BIST100_{t-i}, EXCHANGE_{t-i}, CDS_{t-i},\ S\&PADR_{t-i}, NASDAQ_{t-i})$ (4)

Model 5: $TAV = f\ (BIST100_{t-i}, EXCHANGE_{t-i}, CDS_{t-i},\ S\&PADR_{t-i}, NASDAQ_{t-i})$ (5)

Model 6: $THY = f\ (BIST100_{t-i}, EXCHANGE_{t-i}, CDS_{t-i},\ S\&PADR_{t-i}, NASDAQ_{t-i})$ (6)

Model 7: $TTKOM = f\ (BIST100_{t-i}, EXCHANGE_{t-i}, CDS_{t-i},\ S\&PADR_{t-i}, NASDAQ_{t-i})$ (7)

Model 8: $TURKCELL = f\ (BIST100_{t-i}, EXCHANGE_{t-i}, CDS_{t-i},\ S\&PADR_{t-i}, NASDAQ_{t-i})$ (8)

The t index represents the current period of the variables in the models. The Schwarz information criterion was used to determine the appropriate lag number. The maximum lag number is 8 and $0 \leq i \leq 8$. The graphs of the data used in the analysis are shown in Figure 1.

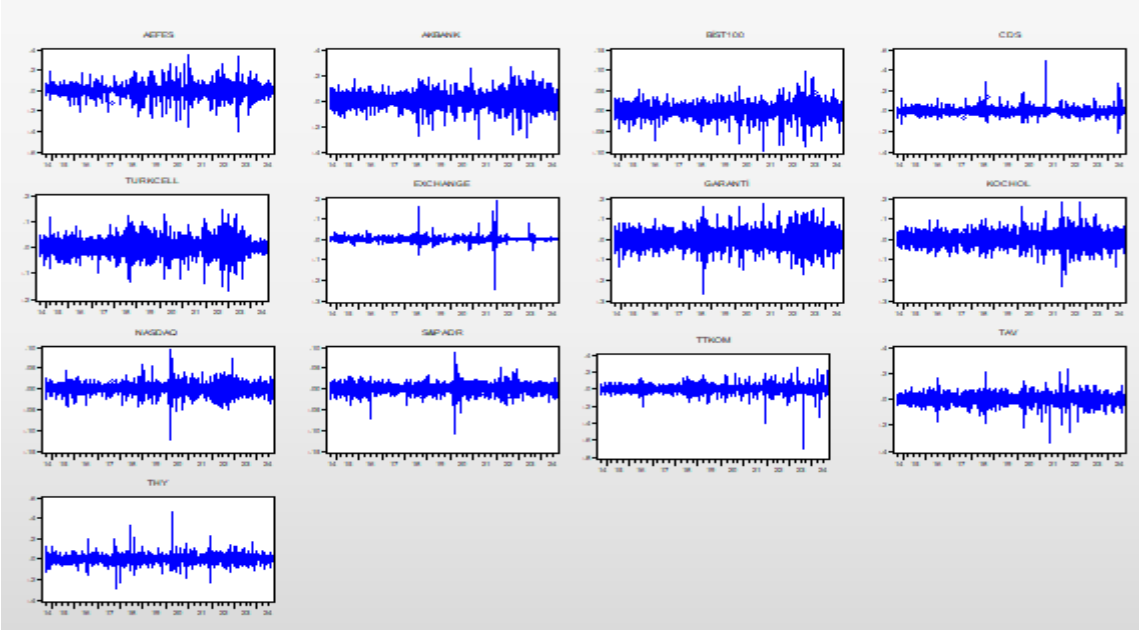

Figure 1. Graphs of the Variables Used in the Analysis

As can be seen from the correlation matrix, a high correlation between independent variables was not detected. Accordingly, the above models were created. Another essential issue in regression analysis is determining the levels and differences where the variables are stationary to avoid the spurious regression problem when working with time series. The most preferred unit root test in the finance literature is the Dickey-Fuller (1979-1981) unit root test. Dickey-Fuller (DF) test, which is based on the distribution of the least squares estimator of the parameters. In the DF test, the error term is assumed to be non-autocorrelated. However, the autocorrelation of the error term renders the use of the distribution in the DF test ineffective. Therefore, Dickey and Fuller developed the extended DF test (ADF) by adding the lagged values of the dependent variable to the model for the case where the error term is autocorrelated (Gujarati and Porter, 2012). The three equations for the ADF unit root test are as follows (Dickey and Fuller, 1981):

$$\Delta y_t = \delta y_{t-1} + \sum_{i-1}^{p} \beta_i \Delta y_{t-i} + \varepsilon_i \quad (9)$$

$$\Delta y_t = \mu + \delta y_{t-1} + \sum_{i-1}^{p} \beta_i \Delta y_{t-i} + \varepsilon_i \quad (10)$$

$$\Delta y_t = \mu + \beta t + \delta y_{t-1} + \sum_{i-1}^{p} \beta_i \Delta y_{t-i} + \varepsilon_i \quad (11)$$

Dickey-Fuller tests assume that error terms are statistically independent and have constant variance. When using this methodology, it is necessary to ensure that there is no correlation between the error terms and that they have constant variance. Phillips and Perron (1988) extended Dickey-Fuller's assumption for error terms. For this purpose, they developed a nonparametric unit root test. The Phillips-Perron (PP) test uses the same regression equations as in the Dickey-Fuller test but solves the autocorrelation problem by making a nonparametric correction to the τ statistic of the parameter (δ) of the previous term in the equation. The thresholds for the tests remain the same. As in the ADF test, the PP test is also applied in three different ways: without constant, with constant, with constant, and with trend, and its equation is as shown below:

$$\Delta y_t = a y_{t-1} + x_t^{\prime}\delta + \varepsilon_t \quad (12)$$

For the information obtained from the models to be reliable, whether the Least Squares assumptions are provided should be investigated. One of these assumptions, the standard normal distribution assumption, is that the error terms show a standard normal distribution feature. The Jarque-Bera test is used to determine whether this assumption is met. This test procedure is as follows:

$$JB = n\left[\frac{S^2}{6} + \frac{(K-3)^2}{24}\right] \sim \chi^2(2) \quad (13)$$

The test's null hypothesis states that the error terms have a normal distribution, while the alternative hypothesis states that they do not conform to a normal distribution. This test statistic conforms to the chi-square distribution with a degree of freedom of 2. If the test statistic is greater than the critical value, it is decided that the error terms are not normally distributed. The autocorrelation problem occurs when there is a relationship between the lagged values of the error term. The Breusch-Godfrey LM test was used in the study to determine the existence of this problem. In addition, the existence of heteroscedasticity in the model should be investigated. For this purpose, the Breusch-Pagan test was used in the study. When utilizing time series datasets, it is common to encounter serial correlation and heteroskedasticity within the data. These instances elevate the likelihood of acquiring serially associated mistakes with non-constant variance. If our primary focus is on statistical conclusions, we should opt for HAC robust standard errors within the context of time series analysis (Wooldridge, 2013).

5. Findings

To avoid the spurious regression problem in the study, the stationarity level and differences of the variables should be determined before model estimation. Here, traditional unit root tests, Augmented Dickey-Fuller (ADF), and Phillips-Perron (PP) unit root tests were used, and the test results are shown in Table 4.

Table 4. Unit Root Tests

	AEFES	**AKBANK**	**BIST100**	**CDS**	**EXCHANGE**	**GARANTI**	**KOCHOL**
ADF test t-Statistic	-25.8100***	-47.6641***	-49.4805***	-46.2109***	-25.8628***	-28.1361****	-29.0335***
PP test t-Statistic	-75.8456***	-47.6840***	-49. 5074***	-46.1282***	-43.6413***	-100.3899***	-106.2278***
	NASDAQ	**S&P ADR**	**TAV**	**THY**	**TTKOM**	**TURKCELL**	
ADF test t-Statistic	-18.4721***	-33.4761***	-37.2188***	-34.1008***	-30.8092***	-26.7811***	
PP test t-Statistic	-54.9202***	-52.3859***	-92.089***	-72.5669***	-77.4665***	-97.7247***	

Note: *** shows that the variable is stationary at 1% significance level.

When the ADF and PP test results from traditional unit root tests are considered together, it can be said that all variables are stationary at level *I*(0). After investigating the stationarity, before reporting the model results, the Least Squares Assumptions of the estimated models should be analyzed to determine whether they are valid. For this purpose, the study used the Breusch-

Pagan-Godfrey test, the Breusch-Godfrey-LM test, the Jarque-Bera test, and the Ramsey RESET test. The Breusch-Pagan-Godfrey test is used to investigate the existence of heteroscedasticity. The Breusch-Godfrey-LM test is used to examine the existence of an autocorrelation problem, and the Jarque-Bera test is used to analyze the normality assumption. The Ramsey Reset test was used to investigate the specification of that regression. The results obtained are reported in Table 5.

Table 5. Diagnostics Tests

	Jarque-Bera	Breusch-Pagan-Godfrey	Breusch-Godfrey LM	Ramsey Reset
Model 1	10445.91***	2.6762	106.1654***	0.0852
Model 2	2210.591***	95.6717*	11.78299***	0.5165
Model 3	570.7802***	20.1741	414.7586***	1.0911
Model 4	735.5785***	28.4195**	439.4909***	1.5378
Model 5	6060.514***	44.2334***	233.9133***	0.3047
Model 6	31897.85***	30.1800**	109.9672***	0.0053
Model 7	285023.4***	67.0712***	63.9320***	2.1569
Model 8	578.3546***	40.2297***	435.2554***	0.1036

Note: ***, **, and * show the model assumptions are not valid at 1%, 5%, and 10% significance levels, respectively.

We determined the heteroscedasticity problem in all models (except Model 1 and Model 3), that the error terms were not normally distributed in all models, and that there was an autocorrelation problem. Also, according to the Ramsey Reset test results, we determined that appropriate specifications were in all models. In cases where the models' assumptions cannot be provided, the models should be estimated with robust estimators in the regression analysis. Therefore, HAC robust standard errors were considered when evaluating all models in the study. Accordingly, the obtained model results are given in Table 6.

The change in BIST100 value two periods ago increases AEFES return in the current period by 0.4912 points and the change in EXCHANGE one period ago increases AEFES return by 0.1741 points.

While the change in BIST100 value one period ago affects AKBANK's return positively in the current period, the change in exchange rate and CDS premium in the current period, one period ago, and two periods ago affect AKBANK's return negatively. Similarly, the change in NASDAQ two periods ago decreases AKBANK's return by 0.2191 points.

While the change in the BIST100 value one period ago decreases the return of GARANTI, the change in the BIST100 value 2 and 3 periods ago increases the same return. Similarly, changes in one-period ago EXCHANGE, current and one-period ago CDS premiums, and two-period ago S&P ADR values increase the return on GARANTI. However, changes in the two-period CDS premium, current and one-period ago S&P ADR values decrease the return on GARANTI.

Changes in the BIST100 value one period ago affect KOCHOL return negatively, while changes in the BIST100 value two and four periods ago affect KOCHOL return positively. Changes in the CDS premium in the current and previous periods, S&P ADR two periods ago, NASDAQ value in the current period, and NASDAQ value in the previous period affect KOCHOL return positively. Changes in one-period prior S&P ADR and two-period prior NASDAQ values decrease KOCHOL return.

Table 6. Results of the Models

Dependent Variable	AEFES	AKBANK	GARANTI	KOCHOL	TAV	THY	TTKOM	TURKCELL
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
$BIST100_t$	0.1027	-0.0701	0.0598	0.0503	0.1003	0.0800	0.0270	0.0359
	(0.0947)	(0.0559)	(0.0553)	(0.0542)	(0.0631)	(0.0510)	(0.0736)	(0.0464)
$BIST100_{t-1}$	0.0053	2.1843***	-0.7057***	-0.7303***	-0.4206***	-0.1413**	-0.3656***	-0.5611***
	(0.0755)	(0.0911)	(0.0755)	(0.0562)	(0.0723)	(0.0673)	(0.0803)	(0.0056)
$BIST100_{t-2}$	0.4912***	0.1060	0.7938***	0.7167***	-	0.7298***	0.6775***	0.7343***
	(0.0802)	(0.0966)	(0.0683)	(0.0760)		(0.0834)	(0.0925)	(0.0595)
$BIST100_{t-3}$	-	-	0.0993**	0.0204	-	-0.0991*	-	-0.0625
			(0.0524)	(0.0412)		(0.0615)		(0.0420)
$BIST100_{t-4}$	-	-	-	0.1062***	-	-	-	0.0405
				(0.0400)				(0.0367)
$EXCHANGE_t$	-0.1192	-0.2319**	0.0854	0.0293	0.1004	0.0711	0.0978	0.0935**
	(0.0739)	(0.1104)	(0.0581)	(0.0458)	(0.1180)	(0.1101)	(0.0920)	(0.0485)
$EXCHANGE_{t-1}$	0.1741**	-0.2827***	0.1349**	-	0.0051	0.0607	0.0085	0.0526
	(0.0844)	(0.1008)	(0.0600)		(0.1806)	(0.0753)	(0.0619)	(0.0634)
$EXCHANGE_{t-2}$	-	-0.3254***	0.0563	-	0.1389	0.2651**	0.1657***	0.1664***
		(0.1175)	(0.0782)		(0.1377)	(0.1232)	(0.0589)	(0.0523)
$EXCHANGE_{t-3}$	-	-0.0855	-	-	0.0051	-	0.1122	0.0962
		(0.0762)			(0.1806)		(0.1267)	(0.0626)
$EXCHANGE_{t-4}$	-	-0.1002	-	-	-	-	0.2757	0.0703*
		(0.0780)					(0.1882)	(0.0438)
CDS_t	-0.0332	-0.1291**	0.0924***	0.0976***	0.0747***	0.0380	0.0786**	0.0481**
	(0.0391)	(0.0346)	(0.0307)	(0.0280)	(0.0320)	(0.0356)	(0.0408)	(0.0223)
CDS_{t-1}	0.1073***	-0.1707***	0.1779***	0.0701***	0.0195	0.1172***	0.0950*	0.0834***
	(0.0469)	(0.0529)	(0.0345)	(0.0274)	(0.0438)	(0.0389)	(0.0591)	(0.0283)
CDS_{t-2}	-	-0.0538**	-0.0758***	-	-0.0076	-0.0240	-0.0561*	-
		(0.0267)	(0.0302)		(0.0342)	(0.0324)	(0.0344)	
CDS_{t-3}	-	-	-	-	-	0.0485***	0.0721***	-
						(0.0234)	(0.0307)	
S&P ADR_t	-0.1007	-0.1506	-0.1273	-0.0500	-0.2337**	0.0158	0.0464	0.0594
	(0.1598)	(0.1300)	(0.1014)	(0.0856)	(0.1012)	(0.1102)	(0.1619)	(0.0942)
S&P ADR_{t-1}	-	0.1644	-0.2378***	-0.3386***	-0.0047	-0.0117	-0.3188***	-0.1740**
		(0.1151)	(0.0733)	(0.0980)	(0.1115)	(0.0636)	(0.1078)	(0.0854)
S&P ADR_{t-2}	-	0.1222	0.2312***	0.3448***	0.2809***	0.1421	-	-0.0482
		(0.1384)	(0.0811)	(0.0929)	(0.1183)	(0.0995)		(0.0880)
S&P ADR_{t-3}	-	-0.0166	-	-	-	-	-	-
		(0.1327)						
$NASDAQ_t$	0.1735	0.0696	0.1163	0.1242*	0.2401***	-0.0428	-0.0160	0.0204
	(0.1259)	(0.1125)	(0.0957)	(0.0774)	(0.0895)	(0.0825)	(0.1432)	(0.0820)
$NASDAQ_{t-1}$	-	-0.0273	-	0.0284	-0.0291	-	-	-0.0120
		(0.1089)		(0.0762)	(0.0976)			(0.0771)
$NASDAQ_{t-2}$	-	-0.2191*	-	-0.1390*	-0.1304	-	-	0.2044***
		(0.1184)		(0.0802)	(0.0988)			(0.0823)
$NASDAQ_{t-3}$	-	-0.1652	-	-	0.0979*	-	-	-
		(0.1149)			(0.0559)			
Constant	-0.0008	-0.0003	-4.99E-08	0.0004*	0.0005	-0.0004	-0.0005	0.0001
	(0.0006)	(0.0008)	(0.00003)	(0.0002)	(0.0004)	(0.0005)	(0.0006)	(0.0003)
R^2	0.3164	0.5128	0.2984	0.3461	0.1552	0.2425	0.2426	0.3311
χ^2	70.7625***	1330.226***	406.6079***	494.3404***	89.4654***	157.9395***	187.3845***	329.0479***

Notes: ***, **, and * show the coefficient is statistical significance at 1%, 5%, and 10% significance levels, respectively. Maximum lags are selected 8 and Schwarz information criteria is used for optimal lag selection.

Changes in BIST100 value one period ago and S&P ADR value in the current period decrease TAV return, while changes in CDS premium and NASDAQ values in the current period, S&P ADR two periods ago, and NASDAQ three periods ago increase TAV return.

It is observed from Table 6 that one-period and three-period prior BIST100 decrease the return of THY, while two-period prior BIST100 and EXCHANGE increase the return of THY. Similarly, changes in the CDS premium one and three periods ago increase the return on THY.

Changes in one-period-ahead BIST100, one-period-ahead S&P ADR, and two-period-ahead CDS premium decrease TTKOM return. However, two-period-ahead BIST100, two-period-ahead EXCHANGE, current period CDS premium, one and three-period-ahead CDS premiums have a positive and significant effect on TTKOM return.

Changes in one-period ago BIST100 and one-period ago S&P ADR have a negative effect on TURKCELL return. BIST100 two periods ago, EXCHANGE in the current period, and EXCHANGE two and four periods ago have a positive effect on the same return. Similarly, changes in the CDS premium in the current period, the CDS premium one period ago, and NASDAQ two periods ago increase the return of THY.

6. Conclusion

ADRs are investment instruments issued by certificate method in the US capital markets in relation to equities. They are frequently used by international firms due to their cost advantages and sourcing benefits. As with all investment instruments, market participants make price forecasts for ADRs. However, unlike others, since the underlying stocks of ADRs are traded in different countries, many parameters need to be taken into account in price forecasts. These parameters range from the economic indicators of the home country to the market conditions in which the ADR is located.

Depending on the parameters, the main objective of the study is to investigate whether market participants realize arbitrage gains from bilaterally traded stocks as a result of price discovery. In fact, given the time differences between the two markets, there is a possibility that predicting the impact of economic changes in the home country on the ADR price may lead to arbitrage gains. The continuity of arbitrage opportunities indicates that the ADR has moved away from a random walk; that is, its price does not follow a random direction but is predictable. In a similar situation, it can also be interpreted that market efficiency has decreased within the framework of the efficient market hypothesis. In other words, identifying the main country factors affecting the price of ADRs is important to provide insight into the efficiency of the ADR market. Moreover, the persistence of arbitrage opportunities may lead to long-term arbitrage opportunities, contrary to the Arbitrage Pricing Theory, which states that the market will reach equilibrium after short-term arbitrage. In this context, it is important to determine the vulnerability of ADR prices.

Although there are many studies on ADRs in the literature, the number of studies on Turkish ADRs is limited. In this study, it is made to determine whether the prices of Turkish ADRs are affected by various economic indicators. A 10-year time period between 2014 and 2024 is taken as the basis for the analysis. As a result of the analysis, it is determined that each ADR is affected by different indicators at different rates. As a result of the study, it is thought that investors are sensitive to the reflections in the markets. Similarly, it is not concluded that these reflections have a uniform effect on the eight returns considered. According to the findings, the return differences between ADRs and underlying stocks are affected by the macroeconomic indicators selected as independent variables at different levels and in different directions. In other

words, it is determined that the return differences between ADRs and stocks can be converted into arbitrage opportunities by utilizing various indicators. The results are in line with the studies of Gupta et al. (2016), Figueiredo and Parhizgari (2017), Esqueda and Jackson (2012), and Bae et al (2008).

The increasing use of technology in financial markets and the proliferation of ADR-like investment instruments in developed markets indicate that the number of ADRs of stocks traded in emerging markets, such as Turkish markets, will increase over time. Therefore, it is important for market participants to investigate the factors affecting the price of ADRs. Since ADR price discovery provides arbitrage opportunities, it is recommended to investigate the issues affecting the price of ADRs in future studies, as it will directly contribute to mutual funds and portfolio management. In addition, it would be beneficial for brokerage houses and investors to address the effects of ADRs on transaction costs, market liquidity, and security selection decisions of market users. In addition, it is thought that a broader analysis by specifically evaluating the price difference between each ADR and stock will provide more precise results.

Declaration of Research and Publication Ethics
This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement
The authors declare that they have contributed equally to the article.

Declaration of Researcher's Conflict of Interest
There is no potential conflicts of interest in this study.

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