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Estimation and Forecasting the Relationship Between Exchange Rate Changes and Islamic Stock Performance: A Case Study of The Turkish Dow Jones Islamic Index

Döviz Kuru Değişiklikleri ile İslami Hisse Performansı Arasındaki İlişkinin Tahmini ve Öngörüsü: Türkiye Dow Jones İslami Endeksi Üzerine Bir Vaka Çalışması

Abstract: This study aims to estimate and forecast the relationship between exchange rate fluctuations and the performance of the Turkish Dow Jones Islamic Index over the period from January 1, 2020, to May 17, 2024, using weekly data. The study employed the Autoregressive Distributed Lag (ARDL) model, which is considered one of the effective econometric approaches for examining dynamic relationships between economic variables. The findings revealed the existence of a long-term relationship between exchange rate fluctuations and the performance of the Turkish Dow Jones Islamic Index, as reflected in the returns of the Islamic stocks included in the index. Moreover, the results indicated that exchange rate changes exert a positive and direct impact on the index, both in the short and long run, reflecting the interactive nature of financial markets and foreign exchange markets. The data also proved effective in generating accurate in-sample predictions, thereby confirming the suitability of the chosen model and the robustness of its explanatory power. Based on these findings, policymakers can utilize the results to formulate more informed monetary and fiscal policy decisions and to determine the optimal timing for intervention in Islamic markets in line with national economic policies. Likewise, these findings provide investors and portfolio managers with practical tools to hedge against exchange rate risks, enhance the efficiency of portfolio diversification, and improve their ability to predict future stock market movements through close monitoring of foreign exchange markets.

Keywords: Estimation, Forecast, Exchange rate, Islamic stock performance, Turkey.

Jel Codes: C51, C35, F31, Z12, O53.

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Öz: Bu çalışma, 1 Ocak 2020 ile 17 Mayıs 2024 dönemi arasında döviz kuru dalgalanmaları ile Türk Dow Jones İslami Endeksi'nin performansı arasındaki ilişkiyi haftalık veriler kullanarak ayrıntılı biçimde tahmin etmeyi ve öngörmeyi amaçlamaktadır. Çalışmada, ekonomik değişkenler arasındaki dinamik ilişkileri incelemede etkili ekonometrik yaklaşımlardan biri olarak kabul edilen Otoregresif Dağıtılmış Gecikme (ARDL) modeli kullanılmıştır. Bulgular, döviz kuru dalgalanmaları ile Türk Dow Jones İslami Endeksi'nin performansı arasında uzun dönemli bir ilişkinin varlığını ortaya koymuş ve bu durum, endekse dahil edilen İslami hisse senetlerinin getirilerinde açıkça yansımıştır.
Ayrıca sonuçlar, döviz kuru değişimlerinin hem kısa vadede hem de uzun vadede endeks üzerinde pozitif ve doğrudan bir etkiye sahip olduğunu göstermiş, bu da finansal piyasalar ile döviz piyasaları arasındaki güçlü etkileşimsel doğayı yansıtmaktadır. Kullanılan veriler, örnek içi tahminlerde (in-sample predictions) yüksek doğruluk sağlamış ve seçilen modelin uygunluğunu ile açıklama gücünün sağlamlığını kesin olarak teyit etmiştir.
Elde edilen bulgular doğrultusunda, politika yapıcılar daha bilinçli ve etkin para ve maliye politikası kararları geliştirebilir ve İslami piyasalara ulusal ekonomik politikalarla uyumlu şekilde müdahale etmenin en uygun zamanlamasını belirleyebilirler. Benzer şekilde, bu sonuçlar yatırımcılara ve portföy yöneticilerine, döviz kuru risklerine karşı korunma, portföy çeşitlendirmesinin etkinliğini artırma ve döviz piyasalarının yakından izlenmesi yoluyla gelecekteki hisse senedi piyasası hareketlerini daha sağlıklı biçimde öngörme konularında pratik araçlar sunmaktadır.

Anahtar Kelimeler: Tahmin, Kestirim, Döviz kuru, İslami hisse performansı, Türkiye.

JEL Sınıflandırması: C51, C35, F31, Z12, O53.

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Introduction

The relationship between exchange rates and the performance of Islamic stocks has garnered significant attention from researchers in an increasingly globalized world. This is especially relevant in the post-COVID-19 period and during a time when exchange rates have risen sharply in Turkey, impacting various economic sectors, particularly the financial sector. This situation highlights the importance of understanding the relationship between exchange rates and Islamic stock returns, combining theory and application to assist investors in making scientifically sound investments in Islamic markets. Developing strategies to mitigate exchange rate risk is essential for investors. On the other hand, understanding this relationship may also aid policymakers in refining monetary and fiscal policies in alignment with national economic policies.

Islamic financial markets operate under a set of regulations derived from Islamic Sharia principles, which sets them apart from conventional markets. These regulations prohibit dealings with companies involved in activities forbidden by Islamic law, such as alcohol, gambling, pork products, and other prohibited activities. Furthermore, they ban transactions with institutions based on interest-based financing (Riba). This is achieved by screening companies through filters to select those that comply with Islamic principles both qualitatively and quantitatively. Consequently, Islamic financial markets exhibit unique characteristics compared to conventional markets(Daouaba, 2021).

The Dow Jones Islamic Market Turkey Index was launched in 2004 to measure the performance of stocks traded in Turkey that meet Sharia-compliant investment guidelines. This index includes sixteen stocks that comply with Sharia standards. In January 2020, the index's average market capitalization was USD 1,522.45 million(Erdoğan, Gedikli, and Çevik 2020).

To understand the relationship between exchange rates and Islamic financial markets, it is essential to estimate the connection between exchange rates and the performance of Islamic stocks in the Dow Jones Turkey Market Index and to assess the predictability of this relationship. This can assist investors, portfolio managers, and policymakers in making informed monetary, fiscal, and economic decisions, helping to mitigate the potential risks associated with exchange rate fluctuations.

Importance of the Study

The importance of this research is highlighted in the following two points:

- Clarifying the relationship between exchange rates and the performance of the Turkish Dow Jones Islamic Market Index during and after the COVID-19 pandemic, which helps investors make informed investment decisions.
- Highlighting the predictive potential of the data for the studied variables and assessing the accuracy of the economic models used to forecast exchange rate fluctuations and the performance of the Dow Jones Islamic Index in the Turkish financial market, thereby improving financial analysis and investment strategies in the future.

Research Problem

The research problem can be formulated through the following questions:

- Is there a long-term relationship between exchange rate fluctuations and the returns of the Dow Jones Turkey Market Index?
- Do the exchange rate fluctuations and returns of the Dow Jones Turkey Market Index have strong predictive capabilities?

Research Hypotheses

This study is based on the following two hypotheses:

1- H1: There is no long-term relationship between exchange rate fluctuations and the returns of the Dow Jones Turkey Market Index.
2- H2: The exchange rate fluctuations and returns of the Dow Jones Turkey Market Index have strong predictive capabilities.

Research Objectives

This study focuses on the following objectives:

1- To explore the relationship between exchange rate fluctuations and the returns of the Dow Jones Islamic Turkey Market Index.
2- To test whether the exchange rate fluctuations and returns of the Dow Jones Turkey Market Index possess strong predictive capabilities.

Temporal and Spatial Boundaries of the Study

This study utilizes weekly data from January 1, 2020, to May 17, 2024, collected from the website Investing.com (2024). The data include the exchange rate variable (USD/TRY) and the Dow Jones Islamic Turkey Market Index (DJMI).

Research Methodology

This study adopts a quantitative approach to test the hypotheses and fulfill its objectives. The Autoregressive Distributed Lag Model (ARDL) was utilized for

empirical analysis, which is also referred to as the bounds cointegration technique. This method was first introduced by Pesaran and Pesaran (1997), with further refinements made by Pesaran and Shin (1999) and Pesaran et al. (2001). The ARDL model was specifically employed to investigate the long-term relationships among the stock market, exchange rates, and other macroeconomic variables.

One of the key advantages of this technique is its effectiveness with small sample sizes, unlike the Johansen cointegration test that requires larger samples (Khan & Khan, 2018). Moreover, Nkoro and Uko (2016) highlight that the ARDL model is free from endogeneity concerns, as each variable is represented as a separate equation within the model. Additionally, the study calculated the return rate of the Dow Jones Turkey Index using the following formula:

$$R(DJIMT) = \ln(y2/y1) \qquad (1)$$

Literature Review

Several studies have explored the relationship between exchange rate fluctuations and the performance of Islamic stock indices. Dewanti et al. (2021) examined the effects of exchange rate fluctuations on Islamic stock returns in emerging Asian economies, comparing the Islamic markets of India, China, and Korea with those in Southeast Asia, including Indonesia, Malaysia, Thailand, and the Philippines. Utilizing daily data from January 2015 to June 2020 and applying the EGARCH model, the study revealed that the MSINI index is positively affected by exchange rate volatility, while the MSCNI and MSKRI indices demonstrated a significant negative impact. In contrast, Southeast Asian indices (MSPH, MSIDI, MSMYI, MSTHI) showed minimal sensitivity to exchange rate fluctuations, suggesting that investments in these markets are relatively insulated from such volatility.

Bessebaa and Benshisha (2020) aimed to assess the relationship between exchange rate fluctuations and changes in Islamic stock returns in their study on the Dow Jones Islamic Market Index, utilizing daily data from March 2013 to March 2019. By applying the GARCH model, they found significant sensitivity of Islamic stock markets to exchange rate fluctuations, underscoring the importance of exchange rate volatility in determining Islamic stock returns.

Erdoğan et al. (2020) investigated the indirect effects of volatility between Islamic stock markets and exchange rates in three emerging countries (India, Malaysia, and Turkey) using daily data from 2013 to 2019. Employing a causality-in-variance test, the study found direct volatility flows from Islamic stock markets to the foreign exchange market

occurred only in Turkey, with at least one directional indirect relationship identified during the specified period.

Shidiqie and El-Hasanah (2020) examined the asymmetric responses of Islamic financial markets through the Jakarta Islamic Index (JII) in relation to various macroeconomic variables, including money supply, GDP, exchange rates, and the Federal Reserve interest rate. Using monthly data from January 2000 to December 2019 and applying the Nonlinear Autoregressive Distributed Lag (NARDL) model, they identified a long-term relationship between the variables and found that the JII responds asymmetrically to changes in the money supply and exchange rates. The study concluded that currency appreciation impacts Islamic stock prices, while depreciation does not have similar effects.

In another study, Bessebaa (2019) assessed the impact of various macroeconomic variables on Islamic stock performance using quarterly data from 2000 to 2018, focusing on the FTSE Islamic Index of the Malaysian Stock Exchange. Through cointegration tests and the error correction model, the findings indicated a long-term relationship between macroeconomic variables and the FTSE Islamic Index, revealing a positive correlation with treasury bill interest rates and money supply, alongside an inverse relationship with exchange rates.

Khaled and Yousuf (2019) utilized the Vector Autoregression (VAR) model from 2005 to 2017, uncovering a significant positive relationship between exchange rates and stock prices in the Malaysian Islamic stock market. They argued that a stronger local currency foster increased foreign investment in Islamic stocks, elevating their prices. In contrast, Ahsan and Miah (2021) reported mixed findings in their analysis of GCC markets, applying a Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model from 2000 to 2020. They noted that while exchange rate stability is crucial, fluctuations in oil prices play a more dominant role in influencing stock prices, suggesting that global commodity prices may overshadow the direct relationship between exchange rates and Islamic stock prices.

Regional studies have highlighted varying impacts of exchange rates on Islamic stock markets. For instance, Sari and Kumara (2020) examined the Indonesian Islamic stock market using a Cointegration and Error Correction Model (ECM) from 2010 to 2019, finding that exchange rate volatility negatively affects stock prices, primarily due to reliance on imported goods and resultant cost pressures on Islamic firms. In contrast, Bashir et al. (2022) focused on the Turkish Islamic stock market, employing a Dynamic Conditional Correlation (DCC) GARCH model over the period of 2010 to 2021. They concluded that a depreciation of the Turkish Lira against major currencies had a

limited effect on stock prices, attributed to robust domestic demand and investor confidence.

This study differs from previous research by assessing the predictive capability of the data under investigation using the Autoregressive Distributed Lag (ARDL) model. It aims to assist investors and portfolio managers in forecasting future stock market movements by monitoring exchange rate dynamics. Through this approach, the research provides a deeper understanding of the interrelationships between exchange rates and Islamic stock indices, thereby enriching the existing body of literature.

1. The Concept of Exchange Rate, Its Systems, and Types

The exchange rate is the mechanism through which currencies are exchanged, facilitating international trade and the flow of investments by enabling the movement of capital between countries. Given the significance of this concept, this section will address the definition of the exchange rate, the main systems applied in different countries, as well as its various types.

1.1. Definition of Exchange Rate

The definitions of the exchange rate vary in form, but they converge in substance. It is "the process of converting a certain number of units of one currency into a number of units of another currency, which corresponds to the value or price of a specific currency in the form of units of another currency. In other words, it is the exchange of one currency for another based on the value of the two currencies being exchanged"(Al-Jilani, 2015).

1.2. Exchange Rate Systems

The international exchange rate system has witnessed two main types of systems: the fixed exchange rate system and the floating exchange rate system. These systems were designed to facilitate trade and investment between countries around the world (Sharpe, 2012)**.** The following sections will address these systems in detail.

1.2.1. Fixed Exchange Rate System

The concept of the fixed exchange rate system is based on pegging the local currency to a specific rate against other currencies. This peg is often established on a standard, such as the gold standard, or a major currency like the U.S. dollar, or through Special Drawing Rights (SDRs). This system emerged from the Bretton Woods Agreement and was implemented after the end of World War II. Under this system, some countries pegged their currencies to the U.S. dollar, which at that time was linked to gold. However, after some time, the United States decided to decouple its currency from

gold, making the dollar reliant on the power of law. Despite this shift, some countries continued to adhere to the fixed exchange rate system, based on the rationale that it stabilizes international trade and ensures certainty in exchange rates for investors seeking to allocate capital. Although economically powerful countries have since abandoned this system, it is still in use by some nations today(Zreg , 2022).

1.2.2. Floating Exchange Rate System

In this type of system, exchange rates are determined by the free forces of supply and demand in the market. However, governments of countries operating under this system may intervene by buying and selling currency to influence the exchange rate. This form of intervention is known as managed or "dirty" floating, due to the deliberate impact on supply and demand by the authorities (James Sharpe, 2012).

The flexible exchange rate system surpasses the fixed exchange rate system for achieving two main objectives:

- Unrestricted international trade.
- Freedom to choose a method that ensures monetary stability and balance for countries.

  Every international monetary system aims to stimulate and establish multi-polar trade without barriers. To achieve this, it is essential to ensure the freedom of capital movement and the freedom to convert currencies. Friedman posits that speculation plays a significant role in achieving this balance(Biryati & Zidan , 2016).

1.3. Types of Exchange Rates

There are two primary types of exchange rates: the first type is known as the nominal exchange rate, while the second is referred to as the real exchange rate. Both types will be discussed as follows:

1.3.1. Nominal Exchange Rate

This type of exchange rate represents the price of one unit of a country's currency in terms of another foreign currency, without considering the differences in price levels between the two countries. This type of exchange rate is determined within the country by monetary authorities or through supply and demand in countries that operate under a floating exchange rate system(Ali, 2024).

1.3.2. Real Exchange Rate

The real exchange rate represents the ratio of the general price levels of the countries converted to the same unit of measurement. It is calculated using the following formula:

$$\boldsymbol{RER = \frac{P_d}{E_{d/f} P_f}}$$

where P_d and P_f refer to the price levels in the local and foreign economies, respectively, while $E_{d/f}$ symbolizes the nominal exchange rate expressed in units of the local currency equivalent to one unit of the foreign currency. Therefore, an increase or decrease in the real exchange rate indicates a rise or fall in the real exchange rate RER from the perspective of the local economy(Özbilgin, 2015).

2. Islamic Stock Indices Origins, Regulations, and Performance

The emergence of Islamic stock indices was facilitated by the phenomenon known as Socially Responsible Investing (SRI) in the last century. This movement addressed the needs of certain investors according to their religious beliefs by establishing investment funds that excluded shares of companies involved in alcohol, tobacco, nuclear energy, and other environmentally harmful industries. Additionally, some investors extended their preferences to exclude investments in companies that produce contraceptive products(Al-Najjar,2005).

With a large number of Muslims worldwide, exceeding 17% of the global population, and the geographical spread of Muslim investors with middle incomes in the West, as well as the proliferation of Islamic banks and institutions offering Islamic financing and investment services, along with the increasing number of studies and conferences related to Islamic finance and investment at a global level, this has led to the emergence of Islamic indices to satisfy Muslims' desires for investment in accordance with Islamic law(Al-Najjar,2005). There are many Islamic indices on a global scale; however, this discussion will focus on the Dow Jones Islamic indices in general, particularly the Dow Jones Islamic Turkey Index, as it represents a key variable in this study.

2.1. Dow Jones Islamic Indices

The first Islamic index compliant with Islamic law was established in 1999 under the name Dow Jones Islamic Index, which was announced in Manama, Bahrain. This index comprises approximately 70 indices that measure stocks and some other fixed-income securities, and it is supervised by a Sharia advisory board. It has been modified and developed by the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) (Zouaoui, & Al-Naas, 2020).

The index includes a group of companies that adhere to Sharia principles, filtering out those involved in industries such as tobacco, alcohol, pork, weapons manufacturing, hotels, music, sexual services, and traditional financial services like conventional banks and insurance companies, as well as other businesses that contravene Islamic law (Daouaba , 2021).

Numerous Dow Jones Islamic indices are spread across the globe, including the Dow Jones Titans 100 Islamic Index, which measures the performance of the top 100 global companies compliant with Sharia law, and the Dow Jones Global Titans 50 Index, which measures the performance of the largest 50 companies worldwide that operate according to Islamic principles. Additionally, the Dow Jones Islamic Asia Pacific Titans 25 Index measures the performance of 25 leading stocks in the Asia-Pacific region that are Sharia-compliant, while the Dow Jones Titans 25 Islamic Index for Europe evaluates 25 leading stocks of European companies. The Dow Jones Islamic Titans 50 Index in the United States assesses the performance of 50 Sharia-compliant companies operating within the United States. Other indices include the Dow Jones Islamic Index for the Kuwaiti capital market, the Dow Jones Islamic Index for the Turkish capital market, and the Dow Jones Islamic Index for the Gulf Cooperation Council (GCC) countries, which measures the performance of Sharia-compliant companies across five GCC member states. There are also the Dow Jones Balanced Islamic Index for BRICS countries (Brazil, Russia, India, China), among other Dow Jones Islamic indices distributed globally, whether regionally, nationally, or sector-ally. The Dow Jones Islamic indices are reviewed periodically by a specialized body to exclude non-compliant companies and to include those that meet the specified criteria for inclusion in the index (Daouaba , 2021).

Regarding the Dow Jones Islamic Index for the Turkish capital market, it was launched in 2004 and covers sixteen stocks compliant with Sharia principles. As of January 2020, the average market capitalization of this index was $1,522.45 million. It is noteworthy that the companies included in this index are filtered according to qualitative criteria (excluding companies whose primary activities are based on prohibited activities) and quantitative criteria (filtering companies based on standards that determine the ratio of lending and borrowing, as well as revenues and expenditures that are pre-defined as prohibited by the relevant Sharia board (Erdoğan et al. 2020).

2.2. Regulations for Stocks Listed in the Dow Jones Islamic Index

There are a set of qualitative and quantitative criteria used to evaluate and re-evaluate the stocks listed in the Dow Jones Islamic indices. These criteria will be addressed as follows:

2.2.1. Qualitative Criteria

The qualitative aspect involves excluding companies engaged in prohibited activities, such as those involved in tobacco, alcohol, pork, casinos, and other activities deemed unlawful by Islamic law. This also includes traditional financial institutions that engage in usury, such as conventional banks and insurance companies.

2.2.2. Quantitative Criteria

A range of criteria has been established for companies whose primary activities are compliant with Islamic law, as determined by contemporary scholars specialized in Islamic jurisprudence. These criteria focus on cases of usurious borrowing, prohibited investments, unlawful revenues, and prohibited expenses to ensure compliance with Sharia principles. In this context, the following standards will be discussed regarding the Following cases:

a. Usurious Borrowing

The proportion of debt should not equal or exceed 33% of the company's total assets.

b. Prohibited Investment

This criterion is not applied by the Dow Jones Islamic Index.

c. Presence of Unlawful Revenues

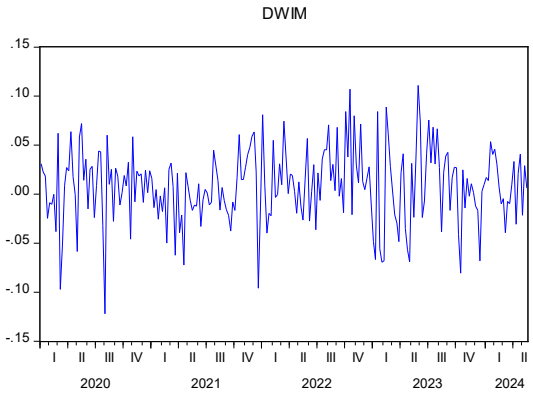
Non-operational revenues should not exceed 9% of operational revenues[1].

d. Prohibited Expenses

The proportion of prohibited expenses should not exceed 5% of the company's total expenses (Daouaba, 2008).

2.3. Performance of Returns on the Dow Jones Islamic Index for the Turkish Capital Market

Figure 1: Performance of Returns on the Dow Jones Islamic Index for the Turkish Capital Market



Source: The figure is derived from Web Investing.com

As shown in Figure 1 above, the returns of the Dow Jones Islamic Index experienced significant negative volatility from January 2020 to December 2021, which can be attributed to the COVID-19 pandemic.

In 2021, the severe negative volatility decreased somewhat, accompanied by positive fluctuations in the performance of the index under study, indicating a form of recovery during the same year.

In 2023, negative volatility increased significantly during certain weeks, countered by positive fluctuations in other weeks.

However, from the beginning of 2024 until May of the same year, the negative performance of the index was greater than its positive performance.

3. Fundamental Theories Related to the Relationship Under Study

This study will rely on theories that elucidate the relationship between exchange rates and financial markets. These theories include

3.1. Traditional Theory

This theory posits that a decline or increase in currency value can result in profits or losses recorded by a company, ultimately impacting its stock price. According to this theory, a depreciation of the local currency leads to an increase in exports, which in turn boosts the company's profits. This increase in profits attracts investors, causing stock prices to rise(Javangwe & Takawira, 2022).

3.2. Portfolio Balance Theory

This theory suggests a negative relationship between exchange rates and stock prices. It asserts that exchange rates are determined by the conditions of financial markets. For instance, in a bull market, demand for stocks increases, driving up stock prices. This rise indicates positive expectations for local economic growth, which leads to higher interest rates and consequently attracts foreign capital to the local economy. As a result, exchange rates strengthen due to their adjustment to domestic and foreign financial assets. Additionally, the increase in stock values enhances the wealth of companies, enabling them to expand production and sales. Conversely, in a bear market, stock prices decline, leading to a decrease in exchange rates (Phylaktis & Ravazzolo, 2005).

3.3. Flow-Oriented Theory

Proposed by Dornbusch and Fischer in 1980, this theory assumes that exchange rates positively influence stock returns. Consequently, exchange rates have a favorable impact on stock prices, whereby a depreciation of the currency stimulates demand for a company's exports. This means that a weaker currency enhances the competitiveness of exports by increasing foreign demand. However, a decline in exchange rates raises the costs of imported production input due to the higher expense associated with the depreciating local currency. Ultimately, this situation can result in lower sales, which adversely affects company profits and subsequently leads to a decrease in stock prices(Dornbusch & Fischer, 1980).

4. Methodology

This study relied on a quantitative analysis approach using the Autoregressive Distributed Lag (ARDL) model, which was developed by Pesaran and Shin (1999) and later re-evaluated by Pesaran et al. (2001), to analyze the short- and long-term relationships between the selected variables.

The ARDL model offers several advantages compared to traditional methods for evaluating short- and long-term relationships and cointegration. The first advantage is that this model can be applied when the degree of integration of the study variables differs, such as I(0) and I(1), provided that none of the variables are integrated at the second degree I(2) (Pesaran et al., 2001). The second advantage is that the boundary test using the ARDL model, in its unconstrained Error Correction Model (ECM) form, allows for the determination of appropriate lags that reflect the data generation process, within a framework based on a general-to-specific determination (Laurenceson and Chai, 2003).

To estimate the relationship between exchange rate changes and the performance of Islamic stocks, and to determine whether these changes have short-term or long-term effects on the index under study, the ARDL model introduced by Pesaran and Pesaran (1997) will be applied. The model is specified as follows:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \cdots + \beta_k Y_{t-p} + \alpha_0 X_t + \alpha_1 X_{t-1} + \alpha_2 X_{t-1} + \cdots + a_q X_{q-1} + \varepsilon_t \qquad (1)$$

Model (1) contains lags for both dependent and independent variables. The traditional Error Correction Model (ECM) is represented as follows:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta Y_{t-1} + \sum_{j0}^{q1} \gamma_j \Delta X_{1t-j} + \sum_{k0}^{q2} \delta_k \Delta X_{2t-k} + \varphi Z_{t-1} + e_t \quad (2)$$

In equation (2), Z is the error correction term that links the long-term and short-term relationships.

The unrestricted model of the Autoregressive Distributed Lag (ARDL) model in the study is given by equation (3) as follows:

$$\Delta DWIMT = a_1 + a_{EX} EX_{t-1} + \sum_{i=o}^{p} a_i \Delta DWIMT_{1t-j} + \sum_{j=o}^{q} a_j \Delta EX_{1t-j} + \mu_t \quad (3$$

The variable DWIMT represents the performance of the Dow Jones Islamic Index for the Turkish financial market, EX refers to the exchange rate changes of the US dollar to the Turkish lira.

The null and alternative hypotheses for equation (3) are formulated as follows:

$$H_0 = aEX = 0$$

$$H_1 = aEX \neq 0$$

To determine the presence of a long-run relationship (cointegration) between the study variables, the calculated F-statistic is compared with the upper and lower critical values. If the calculated F-statistic exceeds the upper critical value, it suggests the presence of cointegration. If the calculated F-statistic is less than the lower critical value, this suggests no cointegration among the study variables. If the F-statistic falls between the upper and lower critical values, the result is considered inconclusive (Hussain et al., 2012).

Cointegration is determined based on the significance of the error correction term (ECM) coefficient. The coefficient of the error correction term in the model is estimated as shown in equation (4).

$$\Delta DWMIT_t = \delta_0 + \sum_{i=1}^{p} \delta_i \Delta EX \ + \omega ECM_{t-1} + \varepsilon_t \ (4)$$

The presence of the error correction term (ECM) in the model reflects changes in the dependent variable in both the short and long term (Masih & Masih, 1997). It indicates the extent of adjustment made to the dependent variable in response to any fluctuations in the previous time period. A positive coefficient for the error correction term indicates divergence, while a negative coefficient indicates convergence. The closer the error correction term (ECM) coefficient is to 1, the higher the level of convergence in response to disequilibrium. Conversely, the closer it is to zero, the lower the level of convergence (Hussain et al., 2012).

As part of analyzing the dynamic impact of exchange rate fluctuations on the performance of the Turkish Dow Jones Islamic Index, the Autoregressive Distributed Lag (ARDL) model was extended to include dynamic forecasting within the sample. This type of analysis allows for examining how Islamic stocks respond to shocks in the independent variable (exchange rate) over time, making it a valuable tool for financial planning and policy formulation (Pesaran & Shin, 1999, p. 391).

The construction of dynamic forecasts is based on the estimated model, where future values of the dependent variable are calculated based on past and predicted values of both the dependent and independent variables, as illustrated by the following expression:

$$\hat{Y}_{t+h\backslash t} = f\left(\hat{Y}_{t+h-t}, \hat{X}_{t+h-1}, \dots\right) \quad (5)$$

This formulation allows for simulation of future scenarios and assessment of dynamic responses to hypothetical shocks (Gujarati & Porter, 2009, pp. 871–872).

To assess the accuracy of these forecasts, three commonly used statistical tools are employed, each reflecting the degree of deviation between the predicted and actual values. First, the Root Mean Squared Error (RMSE) measures the average magnitude of the forecast error and is calculated using the following formula:

$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(Y_t - \hat{Y}_t)^2} \quad (6)$$

A lower RMSE indicates a better predictive performance. (Makridakis, Wheelwright, & Hyndman, 1998, p. 330).

5. Analysis of the Relationship Between Study Variables

5.1. Model Description

The model for analyzing the relationship between the study variables is described by the following function:

$$\mathrm{DWIMT} = f(\mathrm{V} - \mathrm{EX}) \quad (7)$$

To estimate the relationship, the empirical model will be based on the following equation:

$$\text{DWIMT} = \alpha + \beta_1 EX + \varepsilon_t \qquad (8)$$

where (DJMT) represents the performance of the Dow Jones Islamic Index for Turkey, while the variable (EX) denotes the fluctuations in the exchange rate of the dollar against the Turkish lira.

5.2. Model Estimation

This study employs the Autoregressive Distributed Lag (ARDL) model to estimate and forecast the relationship under investigation, as it provides accurate and efficient estimates. This model has the advantage of allowing for lags in both the independent and dependent variables.

5.2.1. Descriptive Statistics

Table 1: Descriptive Statistics

	DWIMT	**EX**
Mean	0.008	0.007
Median	0.009	0.004
Maximum	0.110	0.223
Minimum	-0.122	-0.432
Std. Dev.	0.037	0.041
Probability	0.089	0.000
Sum	1.887	1.684
Sum Sq. Dev.	0.326	0.3856
Observations	229	229

The results in Table 1 above indicate that the average return of the Dow Jones Islamic Index for Turkey is 0.008, with a maximum value of 0.110 and a minimum value of -0.122. This suggests that the performance of the Dow Jones Islamic Index for Turkey is positioned in the positive region, but it is also close to zero and in proximity to negative values, indicating a weakness in the performance of this index.

Additionally, the average change in the exchange rate is 0.007, with a maximum value of 0.223 and a minimum value of -0.432. This indicates a weak performance of the dollar exchange rate against the Turkish lira.

5.2.2. Unit Roots Tests

Upon completing the description of the variables under study, both the Augmented Dickey-Fuller (ADF) test and the Residual Augmented Least Squares **-** Augmented Dickey-Fuller (RALS-ADF) test will be applied to verify the absence of unit roots in the variables. These tests have been conducted, and the results are presented in Tables (2)(3)(4)(5) as follows:

Table 2: Augmented Dickey-Fuller

Variables	Augmented Dickey-Fuller at I(0)					
	Constant		Constant and Trend		Without Constant and Trend	
	T-statistic	Prop	T-statistic	Prop	T-statistic	Prop
DWIMT	-13.120	0.000***	-13.150	0.000	-12.646	0.000***
EX	-0.289	0.9230	-2.1842	0.495	3.7089	0.999

***=0.10, **=0.05, ***=0.01 significance level**

Table (2) clearly shows that the p-value for the Islamic Dow Jones Index is less than 5% in all three cases (without constant, with constant, and with constant and trend), indicating that the time series of this variable is stationary at level. In contrast, the p-value for the exchange rate variable is greater than 5%, suggesting that the series is non-stationary at level.

Since the exchange rate variable was found to be non-stationary at level, the Augmented Dickey-Fuller (ADF) test was applied to the first difference, and the results are presented in the following table:

Table 3: Augmented Dickey-Fuller

Variables	Augmented Dickey-Fuller at I(1)					
	Constant		Constant and Trend		Without Constant and Trend	
	T-statistic	Prop	T-statistic	Prop	T-statistic	Prop
EX	-21.607	0.000***	-21.560	0.000***	-20.633	0.000

***=0.10, **=0.05, ***=0.01 significance level**

As shown in Table (3), the p-value in all three cases (with constant, with constant and trend, and without constant) is Less than 5%, indicating that the series is stationary at the first difference.

After applying the Augmented Dickey-Fuller (ADF) test, the Residual Augmented Least Squares - Augmented Dickey-Fuller (RALS-ADF) test — which accounts for the

non-normality of residuals — was conducted, and the results are presented in the following table:

Table 3: Residual Augmented Least Squares - Augmented Dickey-Fuller

Variables	RALS-ADF at (0^{st})					
	Constant		Constant and Trend		Without Constant and Trend	
	RALS-ADF t-test	Critical value 5%	RALS-ADF t-test	Critical value 5%	RALS-ADF t-test	Critical value 5%
DWIMT	-3.892	-2.86	- 4.712	-3.43	-2.145	-1.95
EX	-2.674	-2.86	-3.215	-3.43	0.543	-1.95

The results of the RALS-ADF test indicate that the variable DWIMT exhibits a test statistic lower than the 5% critical value across all three cases (without constant and Trend, with constant, and with constant and trend), with values of -2.145, -3.892, and -4.712, respectively, compared to the corresponding critical values of -1.95, -2.86, and -3.43. Since the test statistics are lower than the critical values in all scenarios, we reject the null hypothesis and conclude that the DWIMT series is stationary at level. This conclusion holds even in the presence of non-normal residuals, which supports the application of the RALS-ADF test over the traditional ADF test.

Regarding the EX-variable, the results of the RALS-ADF test for the exchange rate variable (EX) indicate that the test statistics were higher than the 5% critical value in all three specifications (without constant and Trend, with constant, and with constant and trend). The test statistics were 0.543, -2.674, and -3.215, respectively, while the corresponding critical values were -1.95, -2.86, and -3.43. Since the test statistics do not fall below the critical values, the null hypothesis of the existence of a unit root cannot be rejected in any of the examined cases. This implies that the exchange rate series is non-stationary at level.

Since the EX-variable series is non-stationary at level according to the RALS-ADF test, the same test will be applied to this series at the first difference, as shown in the following table:

Table 4: Residual Augmented Least Squares **-** -Augmented Dickey-Fuller

Variables	RALS-ADF at (0^{st})		
	Constant	Constant and Trend	Without Constant and Trend

	RALS-ADF t-test	Critical value 5%	RALS-ADF t-test	Critical value 5%	RALS-ADF t-test	Critical value 5%
EX	-5.214	-2.86	-5.892	-3.43	-4.153	-1.95

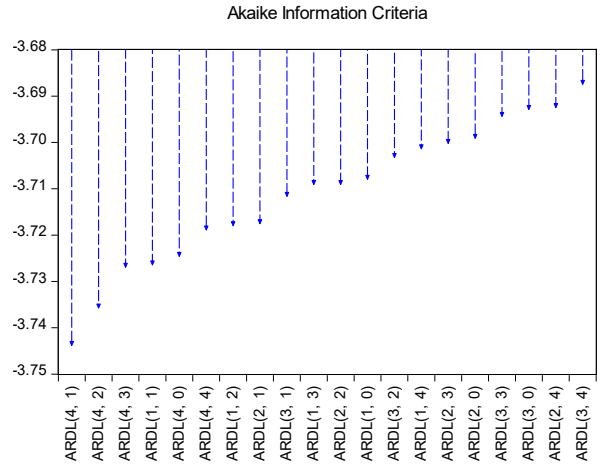
The results of the RALS-ADF test for the exchange rate variable (EX) at the first difference in the table (4) indicate that the test statistics were lower than the critical values at the 5% significance level in all examined cases (without constant, with constant, and with constant and trend). In the case of "without constant and trend," the test statistic was -4.153, which is lower than the critical value of -1.95, meaning the null hypothesis is rejected, indicating stationarity of the series at the first difference. In the case of "with constant and trend," the test statistic was -5.892, which is lower than the critical value of -3.43, also suggesting rejection of the null hypothesis and stationarity of the series. In the case of "with constant only," the test statistic was -5.214, which is lower than the critical value of -2.86, indicating rejection of the null hypothesis and stationarity of the series at the first difference. Based on these results, it can be concluded that the exchange rate variable series becomes stationary at the first difference**.**

5.2.3. Criteria for Selecting the Optimal Lag Length

After the data description process, the next step is to select the optimal lag length by applying the Akaike Information Criterion (AIC), which will help determine the optimal period length to be used in the subsequent stages of the study.

From Figure 2 below, it is evident that there are 20 models generated from determining the optimal lag length using the Akaike Information Criterion (AIC). The appropriate period for selecting the best lag length is based on the lowest value obtained from the AIC values shown on the vertical axis of Figure 2. Consequently, the optimal lag length is (4,1) ARDL, which will be relied upon in the subsequent stages of the study.

Figure 2: Akaike Information Criterion (AIC)



4.2.4. Results of the Cointegration Test (ARDL Bound)

The ARDL model was estimated based on the optimal lag length of (4,1) obtained from the Akaike Information Criterion (AIC), and the results are presented in Table 2 as follows:

Table 2: ARDL Bounds Cointegration Test Results

F-Bounds Test				
Test Statistic	**Value**	**Signf**	**I (0)**	**I (1)**
F - Statistic	15.914***	10%	3.02	3.51
k	1	5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58
Actual Sample	225		**Finite Sample: n** = 80	
		10%	3.113	3.61
		5%	3.74	4.303
		1%	5.157	5.917
H_0: There is no long-term relationship. **H_1:** There is long-term relationship.				

***=0.10, **=0.05, ***=0.01 significance level**

The results from Table 2 indicate that the calculated F-statistic is 15.914, which is higher than the upper bound (1) at all critical values (1%, 2.5%, 5%, and 10%). This finding leads to the rejection of the null hypothesis, which states that there is no relationship between the levels and supports the alternative hypothesis that asserts the existence of a relationship between the levels. Consequently, it can be concluded that there is a long-term relationship between exchange rate fluctuations and the performance of the Dow Jones Islamic Index in the Turkish financial market, as expressed by the returns of the index under study.

4.2.5. Long-term Relationship Estimation Using the ARDL Model

After estimating the long-term relationship using the ARDL model, the results presented in Table (3) indicate that the coefficient of the exchange rate changes (USD/TYR) is 0.42, which is positive. This signifies a direct relationship between the rate of exchange rate changes (USD/TYR) and the performance of the Dow Jones Islamic Index for Turkey, as expressed by the index return in the long term.

Specifically, if there is a positive change of one unit in the exchange rate, it will lead to an increase in the index return by approximately 42%. Conversely, if there is a negative change of one unit in the exchange rate, this will result in a decrease in the index return by 42%.

Table 3: Long-term Relationship Estimation

Variable	Coefficient	Std.Erorr	t-Statistic	Prob
EX	0.422	0.152	2.773	0.006***
C	0.005	0.003	1.459	0.146

***=0.10, **=0.05, ***=0.01 significance level**

The estimated relationship can be formulated as follows:

$$EC: DJMIT = (0.4223*VUSD + 0.0050) \quad (5)$$

4.2.6. Estimating the Short-Run Relationship Using the Error Correction Model (ARDL).

The results in Table 4 below indicate that the performance of the exchange rate, represented by the returns of the exchange rate (V-USD/TYR), also has a positive impact on the returns of the Dow Jones Islamic Index in the short run. The coefficient value is 0.157, which is statistically significant, as the p-value of the t-statistic for this coefficient is 0.000, which is less than 5%.

As for the correction coefficient (CointEq(-1)), it stands at -0.747, which is a negative value. The p-value of the t-statistic for this coefficient is 0.000, indicating that short-term imbalances can be corrected by approximately 74% within about one week and three days.

Table 4: Estimating the Short-Run Relationship Using the Error Correction Model

ARDL-ECM				
Variable	**Coefficient**	**Std.Erorr**	**t-Statistic**	**Prob**

D(DWIMT (-1))	-0.120	0.094	-1.275	0.203
D(DWIMT (-2))	-0.115	0.081	-1.417	0.157
D(DWIMT (-3))	-0.197	0.063	-3.121	0.002***
D(EX)	0.157	0.041	3.775	0.000***
CointEq(-1)*	-0.747	0.107	-6.941	0.000***

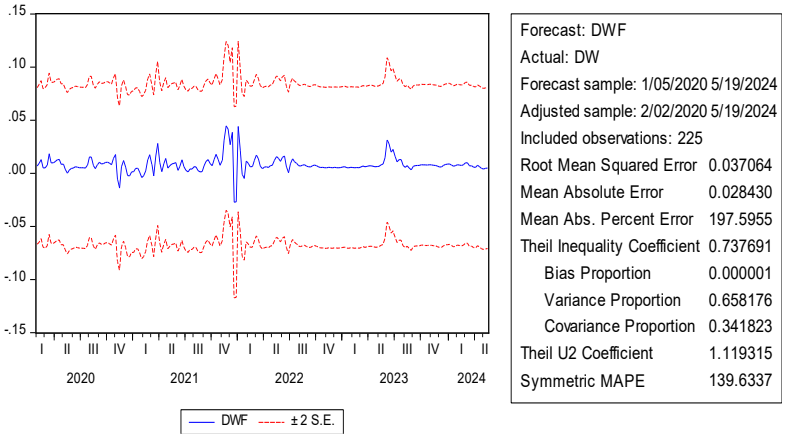
R-squared	0.477	Mean dependent var	0.000
Adjusted R-squared	0.468	S.D. dependent var	0.050
S.E. of regression	0.036	Akaike info criterion	-3.761
Sum squared resid	0.293	Schwarz criterio	-3.685
Log likelihood	428.126	Hannan-Quinn criter.	-3.730
		Durbin-Watson stat	2.001

***=0.10, **=0.05, ***=0.01 significance level**

4.2.7. Forecasting Using the ARDL Model

It is evident from Figure 3 below that the value of the Root Mean Squared Error (RMSE) is used to assess the predictive ability of the model. The lower the RMSE value, the higher the predictive quality of the model. In this case, the RMSE value is 0.037, which is very small, indicating that the model has a high predictive capability within the sample.

Figure 3: Dynamic Forecasting Based on the ARDL Model



4.3. Model Diagnosis.

To diagnose the quality of the results obtained from the ARDL model, the following tests were conducted:

4.3.1. Breusch-Godfrey Serial Correlation LM Test.

Table 9: Breusch-Godfrey Serial Correlation LM Test.

F - Statistic	0.111	**Prob. F (2,216)**	0.894
Obs*R-squared	0.232	**Prob. Chi-Square (2)**	0.890
H₀: There is No Serial Correlation. **H₁:** There is Serial Correlation.			

It is evident from Table 9 that the value of R^2 observations is 0.232 and its p-value is 0.890, which is greater than 5%. Therefore, the null hypothesis of no serial correlation is accepted, and the alternative hypothesis is rejected. Consequently, it can be stated that the residuals exhibit no serial correlation.

4.3.2. Heteroskedasticity Test: Breusch-Pagan-Godfrey

Table 10: Breusch-Godfrey Serial Correlation LM Test

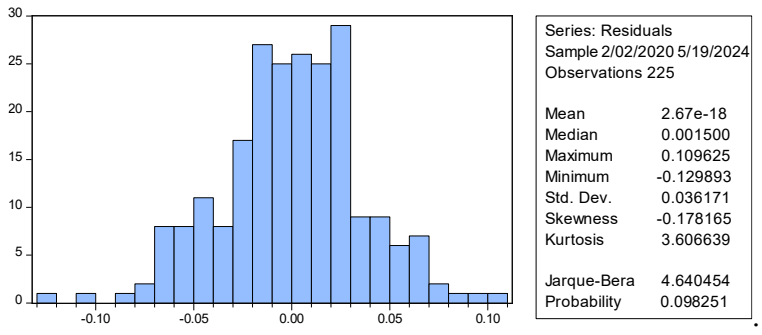
F - Statistic	0.461	**Prob. F (6,218)**	0.836
Obs*R-squared	2.820	**Prob. Chi-Square (2)**	0.831
H₀: There is No Heteroskedasticity. **H₁:** There is Serial Heteroskedasticity.			

It is evident from Table 10 that the value of the observations (R^2) reached 2.820, and its p-value was 0.8310, which is greater than 5%. Therefore, we accept the null hypothesis, which states that there is no heteroskedasticity in the residuals and reject the alternative hypothesis. Thus, it can be concluded that the residuals exhibit no heteroskedasticity.

4.3.3. Residual Distribution Test (Jarque-Bera)

It is evident from Figure 4 that the value of the Jarque-Bera test is 4.640, and the p-value of the test is 0.098, which is greater than 5%. This indicates that the residuals are normally distributed

Figure 4: Residual Distribution Test (Jarque-Bera)



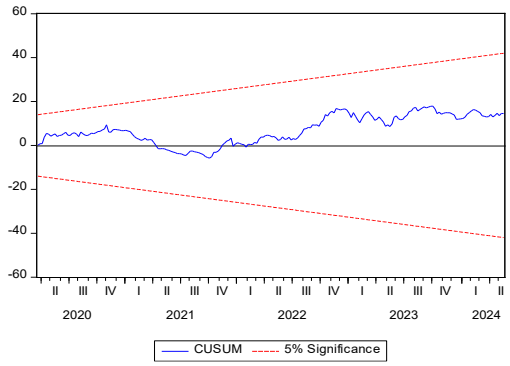
4.3.5 Stability Tests

At this stage, both the **Cusum** and CusumQ test will be applied to ensure the stability of the model.

a. Cusum Test

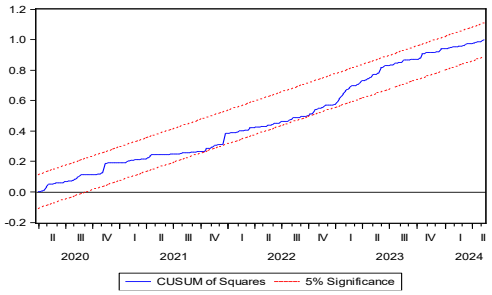
From Figure 5, it is evident that the model exhibits stability at a significant level of 5%.

Figure 5: Stability Test (Cusum Test)



b. CusumQ Test

Figure 6: Stability Test (CusumQ)



From Figure 5, The results of the CUSUMQ test revealed that the cumulative sum of squares of the residuals remained within the 5% significance level confidence bounds throughout the study period, indicating the stability of the model's parameters and the absence of statistically significant structural changes. Therefore, the model can be reliably used for estimation and forecasting.

Conclusion

This study concluded that there is a long-term relationship between exchange rate returns and the returns of the Turkish Dow Jones Islamic Index. This indicates that both the exchange rate changes, and the returns of the Dow Jones Islamic Index move together over time. These findings align with the research of Shisiqie and El-Hasanah (2020) on the Jakarta Islamic Index (JII) and the study by Abdul Qadir Basbah (2019) concerning the Financial Times Islamic Index of the Malaysian Stock Exchange (FTSE). Additionally, the results demonstrated a positive impact between the study variables in both the short and long term, corroborating findings from Dewanti et al. (2021)

regarding the Indian Islamic Index (MSINI) and Shidiqie & El-Hasanah (2020) for the Jakarta Islamic Index (JII).

Specifically, if the Turkish lira's exchange rate decreases by one unit, it would result in an increase in the index return by approximately 42% in the long term. In the short term, a one-unit positive increase in the exchange rate would lead to a 15% increase in the returns of Islamic stocks, with the same effect observed for both short-term and long-term fluctuations.

In this context, a decline in the currency's value stimulates demand for export-oriented companies, indicating that a lower currency value enhances the competitiveness of the exports of companies listed within the index, increasing demand from foreign investors. Conversely, companies reliant on imports will face higher production input costs due to the depreciation of the local currency, and thus will not benefit from the decline in the local currency against other currencies. Therefore, it is advisable for monetary and financial policymakers to establish mechanisms to create a balanced exchange rate that benefits both export-dependent companies and those reliant on imports of raw materials or final goods.

Furthermore, the study found that short-term imbalances could be corrected by approximately 74% within about a week and three days. This result indicates the system's rapid adjustment speed. In cases where monetary and financial authorities take measures to correct exchange rate imbalances, Islamic stock returns could return to about 74% of their previous level within approximately a week and three days, reflecting the responsiveness of Islamic stock returns to corrections.

The study also established that the data under consideration has predictive capabilities within the sample, which naturally contributes to enhancing the ability of investors and portfolio managers to hedge against risks related to exchange rate fluctuations.

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