Research Article

Time Series Analysis of Long-Term Stock Performance of Airlines: The Case of Turkish Airlines

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Abstract: This study presents a time series analysis of the long-term stock performance of airlines, with a focus on Turkish Airlines (THY). Stock-related variables were obtained from the Istanbul Stock Exchange, and other variables were obtained from the Turkish Statistical Institute. The research investigates various economic factors that may influence THY's stock prices over an extended period. Specifically, the study examines the relationship between global energy prices, inflation, the BIST100 index, gold prices, exchange rates, and THY stock prices. The analysis employs the Autoregressive Distributed Lag (ARDL) approach, a versatile technique capable of estimating both short-term and long-term relationships between variables. The findings of this research reveal significant and statistically meaningful connections between these economic variables and THY's stock prices. Notably, the study highlights the impact of global energy prices and other economic factors on the long-term stock performance of Turkish Airlines. These results provide valuable insights for investors and analysts seeking to understand and forecast THY's stock price movements.

Keywords: Long-Term Stock Performance, Time Series Analysis, Turkish Airlines, ARDL Approach
Jel Codes: C32, C51, F21

Havayolu Sektöründe Uzun Dönem Hisse Senedi Performansının Zaman Serisi Analizi: Türk Hava Yolları Örneği

Öz: Bu çalışma, Türkiye'de havacılık sektöründe öncü olan Türk Hava Yolları (THY)'nın uzun vadeli borsa performansına ilişkin bir zaman serisi analizi sunmaktadır. Hisse ile ilgili değişkenler İstanbul Borsası'ndan alınmış ve diğer değişkenler Türkiye İstatistik Kurumu'ndan elde edilmiştir. Araştırma, uzun bir dönem boyunca THY'nin hisse senedi fiyatlarını etkileyebilecek çeşitli ekonomik faktörleri incelemektedir. Özellikle, çalışma global enerji fiyatları, enflasyon, BIST100 endeksi, altın fiyatları, döviz kurları ve THY hisse senedi fiyatları arasındaki ilişkiyi inceler. Analiz, değişkenler arasındaki hem kısa vadeli hem de uzun vadeli ilişkileri tahmin edebilen çok yönlü bir teknik olan Otoregresif Dağıtılmış Gecikme (ARDL) yaklaşımını kullanmaktadır. Bu araştırmanın bulguları, bu ekonomik değişkenler ve THY'nin hisse senedi fiyatları arasında anlamlı ve istatistiksel olarak önemli bağlantılar ortaya koymaktadır. Özellikle, çalışma, global enerji fiyatlarının ve diğer ekonomik faktörlerin Türk Hava Yolları'nın uzun vadeli borsa performansı üzerindeki etkisini vurgulamaktadır. Bu sonuçlar, THY'nin hisse senedi fiyat hareketlerini anlamak ve tahmin etmek isteyen yatırımcılar ve analistler için değerli bilgiler sağlamaktadır.

Anahtar Kelimeler: Uzun Vadeli Hisse Senedi Performansı, Zaman Serisi Analizi, Türk Hava Yolları, ARDL Yaklaşımı
Jel Kodları: C32, C51, F21

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1. Introduction

The aviation industry is pivotal in the global economy, serving as a cornerstone for economic development, international trade, and tourism. Aviation companies' financial performance and investment attractiveness significantly impact the financial markets,

highlighting the necessity of detailed analyses of airline stock performances. This study focuses on the long-term stock performance of Turkish Airlines (THY), a leading player in the aviation sector, drawing data from the Istanbul Stock Exchange and the Turkish Statistical Institute. The objective is to examine the relationship between economic factors, such as global energy prices, inflation, the BIST100 index, gold prices, and exchange rates, and their influence on THY's stock prices over an extended period.

Despite the considerable amount of research conducted in the field of aviation finance, there exists a notable gap in comprehensively understanding how specific economic variables impact the stock performance of airlines, particularly over an extended period. This study seeks to bridge this gap by employing the Autoregressive Distributed Lag (ARDL) approach, a robust method capable of elucidating short-term and long-term relationships between these variables (Pesaran et al., 2001). By focusing on Turkish Airlines, this research aims to contribute to the existing literature on aviation finance and offer practical insights for investors and market analysts.

The aviation sector's contribution to economic growth and its influence on the financial markets underscore the importance of understanding the factors that drive the stock prices of aviation companies. The survival and growth of aviation businesses are contingent upon their ability to attract investments and manage operational costs effectively, making analyzing their stock performance a subject of considerable interest (Sadvakasova et al., 2022). The problem addressed in this study is the identification and quantification of the impact of selected economic factors on THY's stock performance. This analysis is particularly pertinent given the current market volatility and changing economic conditions, which have significant implications for the performance of aviation stocks.

The aviation industry's strategic importance and susceptibility to various internal and external factors necessitate a comprehensive understanding of the elements influencing stock values. This understanding aids investors in making informed decisions (Tse, 2001) and enables companies to enhance their market value and attractiveness to investors (Branch, 1983). Moreover, accurate predictions of stock prices are essential for managing investment risks (Tokmak, 2022) and effective portfolio management (Ekawarti, 2018). Additionally, insights into the factors affecting stock prices offer a deeper understanding of market behavior and momentum (Safdar, 2020). Therefore, this study contributes significantly to the knowledge of how the aviation industry is influenced by general economic conditions, energy prices, regulatory changes, and other relevant factors, providing valuable information for investors, analysts, and the business community.

The research employs a time series analysis to evaluate the impact of critical factors such as oil prices, inflation, the BIST100 index, gold prices, and exchange rates on the stock performance of THY. The expected outcomes of this analysis are to provide statistically reliable and significant insights into how these economic variables interact with and influence THY's stock prices. These results are anticipated to assist investors and analysts in better understanding the price movements of THY stocks and in forming more accurate predictions for future trends.

2. Literature Review

In this section, various studies examining the stock performance of the airline industry are summarized based on previous research. Below, the main findings and methods of each study are provided:

Eyüboğlu & Eyüboğlu (2016) examined the influence of oil prices on airline stocks from 2009 to 2014. Using the Engle-Granger cointegration method, they addressed a long-term relation between oil prices and the share prices of major airlines, highlighting the significant monthly adjustment rates in response to deviations.

Wood & Gokhale (2017) investigated the stock performance of U.S. airline companies during the 2008 Great Recession. The study found that airline stocks exhibited similar movements to the overall stock market during this period, indicating a correlation.

Yashodha et al. (2017) examined the financial risk exposures of airline companies such as Cathay Pacific Airways and China Airlines. Using cointegration techniques and vector error correction models, the study analyzed dynamic and long-term connections between share prices and financial risks. The findings provide insights into interest rates, exchange rates' impact, and fuel price risks.

Özcan (2019) studied the impact of regulatory events related to emission trading in the European airline industry on stock markets. The research analyzed the financial market responses to official announcements. The results demonstrate the impact of rules on how the stock market performs.

Kızıl (2019) compared the financial performance of cement companies listed on the Taş and Toprak indices of Borsa Istanbul (BIST) with their corresponding stock market performance during the years 2015-2017. The financial performance metrics were converted into a single score using the TOPSIS method, which was then compared with the market performance indicator PD/DD value across the years. The analysis revealed a significant relationship between financial and market performance in 2015 and 2017, whereas no such relationship was observed in 2016.

Barrows (2019) evaluated the stock performance of the low-cost aviation sector in the European Union. The study examined the stock performance of seven low-cost airlines over four years and compared their performance to the European stock market. The findings identified airlines like Jet2, WizzAir, and Ryanair as having superior stock performance.

Şener & Şener (2019) explored financial market fluctuations using Monte Carlo Simulations, comparing Turkish and American stock markets. Their study provided insights into the impacts of USD exchange rate fluctuations on the Turkish stock market, offering a unique perspective for investors.

Alici and Sevil (2020) analyzed internal financial factors affecting airline companies' stocks. Using panel data analysis, they discovered that overall assets positively impacted share prices, whereas the system's leverage had adverse effects. The study also discovered a bidirectional causal relationship between total assets and stock prices and a one-way relationship between beta values and stock prices.

Çinaroğlu & Avci (2020) predicted Turkish Airlines' stock values using various Artificial Neural Network (ANN) models. They identified the most successful ANN model by comparing predicted values with actual stock prices, emphasizing the close match between the fundamental and predicted values.

Atems & Yimga (2021) quantified the response of U.S. airline stocks to COVID-19 shocks. The authors analyzed the relationship between COVID-19 shocks, variable costs, air travel, revenues, profitability, and U.S. airline stock prices. The findings suggested that the decline in air travel, which resulted in lower revenues and profitability, caused airline stocks to react negatively to COVID-19 shocks.

Yürük (2021) utilized artificial neural networks to predict Turkish Airlines' stock prices, employing time series analysis and considering five influential variables. The study achieved a Mean Absolute Percentage Error (MAPE) of 2.18, 2.28, and 2.46 for training, testing, and validation sets, respectively, and a high Correlation Coefficient (CORR) of 0.99, indicating the model's robustness.

Deb (2021) analyzed the volatility of stocks of three major airline companies during the COVID-19 pandemic and used internet search data. The study aimed to understand the impact of lockdown policies and internet search data on stock price movements in the aviation industry.

Huang (2021) evaluated the airlines' financial results in the Asia-Pacific area. The study found that airline companies consistently outperform stock returns when efficiently

utilizing financial resources. This underscores the importance of managing capital structure and enhancing financial stability in the aviation industry.

Jashan (2022) aimed to assess the importance of technical analysis in rationalizing investment decisions in shares on the Abu Dhabi Stock Exchange. Using a descriptive analytical approach, 90 investors were surveyed through a questionnaire, and data analysis was conducted using SPSS. The findings showed unanimous agreement among participants regarding the significance of technical analysis and the role of technical analysts in guiding investment decisions. Additionally, the study identified the primary economic sectors favored by investors based on technical indicators. Based on these results, the research provided recommendations and proposals for investors and stakeholders in the financial market.

Horobet et al. (2022) looked into the impact of oil price volatility on airline stock returns. The study used panel ARDL models and PMG estimators to examine the risks associated with oil prices and aviation stock prices having a long-term equilibrium relationship, financial market volatility, exchange rates, inflation, and maturity risk from 2007 to 2020. The research found that oil price risk significantly negatively impacted airline stock prices and indicated exposure to U.S. dollar exchange rate risk.

Nguyen et al. (2022) examined the effects of the COVID-19 pandemic on airline firms from Asia, Australia, Germany, and the United States. The results indicated a significant negative effect of the COVID-19 outbreak on aviation sector firm stock returns, highlighting the industry's sensitivity to global crises.

Cao (2022) studied the COVID-19 pandemic's effects on the share prices of the Chinese aviation industry. The author focused on small and medium-sized airline companies and found that the stock market of the Chinese aviation industry was adversely affected by the COVID-19 outbreak.

Li & Ling (2023) examined the factors influencing the airline stock market. The authors analyzed the impact of internal financial aspects, exchange rate depreciation, and international oil price changes on the airline stock market. The results suggest that these factors negatively affect the short-term performance of the airline stock market.

İlkçar (2023) applied machine learning for Turkish Airlines' stock prediction, using methods like FNN, LSTM, and GRU. Despite market volatility, the models showed a high success rate of 97% for FNN and 99% for LSTM and GRU, demonstrating machine learning's efficacy in sequential data prediction.

Elma (2023) performance of wholesale firms listed on Borsa Istanbul during periods of heightened uncertainty caused by the pandemic. By employing multi-criteria decision-making analysis (MCDA) methods such as TOPSIS and ELECTRE III, the research evaluated the companies based on six different criteria, weighted using the CRITIC method. Over the course of eight intense pandemic periods, the study found that both TOPSIS and ELECTRE III consistently identified the same top-performing firms for six of the periods examined. This suggests that these MCDA methods can serve as reliable decision support systems for financial stakeholders navigating uncertain market conditions.

Asadi et al. (2023) investigated the link between aviation stock returns and oil prices at various intervals. Using an autoregressive moving average model, the study analyzed the relationship between petroleum and airline stock produced daily, weekly, and monthly. Findings indicated a negative relationship between daily oil and airline share prices, supporting an economy-based channel. In contrast, a positive relationship was observed weekly, consistent with the market inertia channel. The research highlighted the dominance of the economy-based channel from short to long term and the greater sensitivity of low-cost airlines to petroleum price changes.

Ismayil & Demir (2023) aimed to analyze the correlation between Twitter activity and the share prices of two airline companies listed on the Istanbul Stock Exchange (BIST). The study categorized Twitter posts and examined the relationships between stock performance and these categories. The results indicated a positive relationship between

posts and stock performance, especially for relevant posts. The study also suggested that business intelligence solutions developed to monitor Twitter activity could enhance efficiency.

Felix et al. (2023) investigated the impact of various futures hedging instruments on the stock returns of Asia-Pacific airline companies concerning oil price risk. The study found that gold futures contracts were more effective hedging instruments than oil and VIX futures contracts and that oil price risk negatively impacted airline stock returns.

Choi & Choi (2023) aimed to present a model using LSTM (Long Short-Term Memory) for forecasting airline stock prices by incorporating economic and technical information. The study developed a model using oil price data to predict airline stock prices and evaluated its success rate. The primary focus of the presented study is a comprehensive analysis of the long-term stock performance of Turkish Airlines (THY), emphasizing its relationship with various economic factors such as global energy prices, inflation, the BIST100 index, gold prices, and exchange rates. In contrast, the literature showcases a myriad of studies investigating the impact of various factors on airline stock performance, with several of them touching upon the influence of oil prices and other economic determinants. Despite these overlaps, no prior research in the literature encapsulates all the variables that the current study of THY considers.

In terms of methodology, the study stands out by employing the Autoregressive Distributed Lag (ARDL) approach, which estimates both short-term and long-term relationships between variables. The literature presents various methodologies, from the Engle-Granger cointegration method to machine learning methods like LSTM and GRU. Notably, only one study by Horobet et al. (2022) mentioned using a panel ARDL model, suggesting that while the ARDL approach is common, it is less frequently applied to airline stock performance.

The geographical and company-specific focus is another distinguishing factor. The study zeroes in on Turkish Airlines, offering a concentrated perspective compared to many literature studies that either address multiple airlines or provide a broader view of airline stocks in general. While a few studies in the literature also spotlight Turkish Airlines, their focal areas, and methodologies diverge from the current research.

The presented study significantly broadens the understanding of THY's stock performance by examining various economic factors. This comprehensive approach provides deeper insights compared to most individual studies from the literature, addressing a clear knowledge gap. Furthermore, the study's emphasis on Turkish Airlines, its methodological choices, and the application of the ARDL approach contribute uniquely to the existing body of knowledge. The study's particular stress on global energy prices concerning THY's stock performance also offers fresh insights, setting it apart in the broader context of airline stock research, especially concerning the Turkish market.

3. Methodology of Research

3.1 Model and Data Set

In this study, the long-term effects on the stock prices of Turkish Airlines Inc., operating in the aviation sector on Borsa Istanbul (BIST), are investigated. The basic model created for the 11/2011-07/2023 period is outlined below.

$$\text{THY(M-D)} = f(\text{BrentCrudeOil, BIST100Index, GoldPrice, USDExchangeRate, Inflation})$$

In the study, the Turkish Airlines Inc. stock price is related to the variables of Brent Crude Oil Price, BIST100 Index, Ounce of Gold Price, USD Exchange Rate, and Inflation. Descriptive statistics for these variables are presented in the table below.

Table 1. Descriptive statistics

Variable	Abbr.	#of Observ.	Mean.	Med.	Max.	Min.	Std.D.	Source
Turkish Airlines Share Price ($)	THY	121	2,94	2,62	8,73	1,09	1,52	investing.com
Brent Petrol Price ($)	BRENT	121	69,95	66,03	122,84	22,74	22,86	investing.com
Brent Oil Price ($)	BIST100	121	23860	24253	38949	13406	7351	investing.com
Gold ONS Price ($)	ONS	121	1461	1322	1990	1061	280	investing.com
U.S. Dollar / Turkish Lira exchange rate	USDTRY	121	6,80	4,88	26,84	1,92	5,66	investing.com
Inflation	INF	121	3,15	2,60	15,08	0,99	2,1	TÜİK

Note: The natural logarithm of all variables used in the study.

$$THY(M\text{-}D)=\beta0+\beta1BrentPetrol+\beta2BIST100+\beta3ONSGold+\beta4USDTRYExchangeRate+\beta5Inflation+\varepsilon$$

THY(M-D) is the dependent variable we want to analyze in this equation. We are examining the relationship between THY's stock value and economic factors.

β0 is the constant term of the model or represents the intercept. In other words, it represents the expected value of THY when all other independent variables are zero.

β1, β2, β3, β4, β5 are the estimated coefficients during regression analysis. Each represents the effect of the respective independent variable (Brent Crude Oil, BIST100, Ounce of Gold, USD Exchange Rate, Inflation) on the THY stock value. The positive or negative signs indicate the direction of this effect.

BrentPetrol, BIST100, ONSAltin, USDTRY Exchange Rate, and Inflation are independent variables representing economic factors that could influence the THY stock value in our analysis.

ε is the error term of the model. It represents the difference between the actual THY stock value and the value predicted by the model. Ideally, this error term should be close to zero, indicating how well the model explains the data.

This equation represents a multiple regression model used to explain the dependence of THY's stock value on specific economic variables. This model can be used to analyze THY's stock value changes and understand the economic factors behind these changes.

3.2 Econometric Method

A unit root analysis is a fundamental tool in time series analysis to determine the stationarity of a time series. The Dickey-Fuller and Phillips-Perron tests are commonly used unit root tests (Kagalwala, 2022; Ozigbo & Ewubare, 2019). These tests are determined to see if a series contains a unit root and provide information about the stationarity of a series.

The Phillips-Perron test is an enhanced version of the Dickey-Fuller test (Ozigbo & Ewubare, 2019). Some Dickey-Fuller test drawbacks, like serial correlation and heteroskedasticity in mistakes, are addressed by the Phillips-Perron test. The test statistic is comparable to the Dickey-Fuller test but uses a different covariance matrix estimator. Non-parametric tests like the Phillips-Perron test can handle data with diverse distributions.

The series of variables in the study models were subjected to unit root tests using ADF and P.P. to ascertain their stationarity levels early in the investigation. The table below displays the estimated unit root models with constant terms and constant terms with trends. Considering the findings of the ADF and P.P. Unit Root tests, all variables except for INF had unit roots at the level, which indicated non-stationarity, and they all became stationary when the first difference was calculated. I(0) was discovered to be the INF variable.

Table 2. ADF unit root test results

Variable	Level		First Difference	
	Constant	Constant and Trend	Constant	Constant and Trend
THY	-0.154	0.236	-5.259***	-5.633***
BRENT	-2.406	-2.406	-8.8869***	-8.995***
BIST100	-2.265	-2.044	-9.7989***	-9.811***
ONS	-0.547	-2.645	-11.781***	-11.781***
USDTRY	4.642	2.358	-8.339***	-9.213***
INF	-4.527***	-5.719***	-11.4959***	-11.451***
Note: *, **, and * indicate significance at the 1%, 5% and 10% level, respectively.**				

Monte Carlo experiments have demonstrated that the Phillips-Perron test is more sensitive to model misspecification than the Dickey-Fuller test (Schwert, 1989). This suggests that the Phillips-Perron test may be more suitable in cases where the underlying model does not specify well.

Table 3. P.P. Unit Root Test Results

Variable	**Level**		**First Difference**	
	Constant	Constant and Trend	Constant	Constant and Trend
THY	0.506	0.152	-10.765***	-11.198***
BRENT	-2.063	-2.036	-8.896***	-8.927***
BIST100	-2.210	-2.107	-10.167***	-10.599***
ONS	-0.409	-2.645	-11.772***	-11.901***
USDTRY	5.211	2.812	-8.323***	-9.183***
INF	-4.248***	-5.719***	-18.581***	-19.206***
Note: *, **, and * indicate significance at the 1%, 5% and 10% level, respectively.**				

An Autoregressive Distributed Lag (ARDL) bounds test analysis was performed after the unit root tests to see whether there was cointegration among the time series data. The relationship between stationary series with various lags can be examined using the ARDL bounds test. This approach makes it possible to examine interactions and long-term connections between the motions of the series across time. The tables below present the findings of this analysis.

Economic time series data often exhibit non-stationary processes (Johansen & Juselius, 1990). Consequently, the issue of false regression can arise when there are non-stationary time series. n (Granger & Newbold, 1974). Whether the variables utilized in the analysis are I(0) or I(1), the ARDL limits test approach is still applicable. (Pesaran et al., 2001; cited by Pamuk & Bektaş, 2014)

The ARDL Bounds Test, also known as the Autoregressive Distributed Lag (ARDL) Bounds Test, is used to determine the presence of a long-term relationship between economic variables (Doğaner, 2022). This method is popular in econometrics and analyzes cointegration, representing a relationship between non-stationary variables over the long term (Swaray, 2022).

Unlike other tests, such as the Engle-Granger and Johansen cointegration techniques, the ARDL Bounds Test does not require variables to be stationary, which is one of its advantages (Tanrıverdi & Öztürk, 2023). The ARDL model can be applied even when variables are integrated at different levels (Yilmaz et al., 2017). The ARDL approach is also suitable for small sample sizes and provides unbiased estimates (Tala & Hlongwane, 2023).

In the ARDL Bounds Test, cointegration is detected by estimating a distributed lag autoregressive model and doing a bounds test. In order to ascertain whether there is a long-term link between the variables, the limits test compares the estimated coefficients of lagged variables with particular critical values (Doğaner, 2022). Depending on whether

the calculated coefficients are statistically significant and within the bounds, it indicates the presence of cointegration and a long-term relationship (Alemu, 2020).

The ARDL Bounds Test has been widely applied in various research areas. For instance, it has been used to analyze the link between employment and R&D spending in Turkey (Doğaner, 2022), to investigate the impact of climate change on maize production in Mali (Maïga et al., 2021), to test the J-Curve hypothesis for the Turkish economy (Yılmaz et al., 2017), to analyze the link between the use of renewable energy and economic expansion (Can & Korkmaz, 2019), to explore the relationship between Turkey's financial sector expansion, external debt, and use of renewable energy (Jabari et al., 2022), to examine the direct effects of changes in oil prices on foreign direct investment flows in South Africa (Tala & Hlongwane, 2023), to investigate Economic Growth, Financial Development and Trade Openness in Türkiye (Karataş & Ergül, 2023).

Before proceeding to the boundary test, specific specification tests for the Autoregressive Distributed Lag (ARDL) model were conducted. Serial correlation L.M. test, Histogram-normality test, Heteroskedasticity test, and Ramsey RESET test were employed to determine the presence of autocorrelation, changing variances, specification errors, and normality distribution issues within the model. Additionally, CUSUM and CUSUM of Squares Tests were conducted to examine structural breaks. Furthermore, structural breaks were considered while conducting the analysis, and relevant dummy variables were added for the respective periods. The results of these tests confirmed the absence of specification errors in the model, and the outcomes of these tests are presented in Table 5.

Table 4. ARDL Boundary Test Results

Model	Optimum Lag Length	F-Stat.	Critical Value %5		Critical Value %1	
			I(0)	*I*(I)	*I*(0)	*I*(I)
F(THY $_{(M-D)}$ | BRENT, BIST100, ONS, USDTRY, INF)	(9, 4, 8, 5, 2, 0)	4.308***	2.39	3.38	3.06	4.15
Note: ***, **, and * indicate significance at the 1%, 5% and 10% level, respectively.						

The above table provides the calculated F-statistic and the critical values at the 5% and 1% levels of statistical significance to test the fundamental hypothesis that there is no cointegration. According to the results, the calculated F-test statistic is above the critical values for all three models, leading to the rejection of the null hypothesis of no cointegration. As the ARDL bounds test results prove that the dependent variable and the variables have a long-term relationship, the long-term coefficients were estimated in the third and final stages of the analysis. The long-term forecast results are presented in the table below.

ARDL (Autoregressive Distributed Lag) model is widely used in analyzing the long-term relationship between variables. It is advantageous to integrate the essential variables into the first row (I(1)) (Pesaran & Shin, 1999). The ARDL model incorporates both short-run dynamics and long-run equilibrium relationships, making it suitable for studying the impact of various factors on economic events over time.

Table 5. ARDL Long-Term Forecast Results

Dependent Variable: THY (M-D)	Long-Term Coefficients
Explanatory Variables	
BRENT	0.320***
BIST100	0.817***
ONS	-1.337***
USDTRY	0.401***
INF	0.373***
C	0.097***
ECT(-1)	0.11***
Diagnostic tests	P value
$\chi 2$ (No autocorrelation)	0,71
$\chi 2$ (Constant Variance)	0,46
$\chi 2$ (Normality)	0,55
$\chi 2$ (Functional form)	0,40
CUSUM	Stable
CUSUMSQ	Stable
Note: *, **, and * indicate significance at the 1%, 5% and 10% level, respectively.**	

According to the results presented in Table 5, the error correction coefficient of the ARDL model is found to be negative and statistically significant. This implies that the effects of any shocks that may occur will dissipate in the long run. The findings of this study also indicate the presence of a long-term relationship among the variables and that in the event of any disequilibrium, this equilibrium will be restored. Furthermore, the error correction coefficients in the table suggest that approximately 11% of the deviations occurring between the short and long terms will be corrected in the subsequent period.

Furthermore, the diagnostic tests conducted on the model's results reveal that the estimated F-statistics and slope coefficients are concordant. This suggests that the models can generate statistically precise and reliable forecasts. The error terms exhibit normal distribution, no autocorrelation, and constant variance. The functional form of the models is correctly specified, and the estimated parameters remain stable. These findings affirm the model's appropriateness in terms of reliability and practical usability.

3.3 Analysis Results

The analysis results of this study have identified the effects of critical factors affecting stock performance in the aviation sector, including oil prices, inflation, the BIST100 index, gold prices, and exchange rates.

Unit root tests, Bounds Tests, and ARDL long-term forecast results concretely demonstrate the effects of these factors on aviation stock prices. Oil prices, inflation, the BIST100 index, gold prices, and exchange rates play a significant role in the stock prices of the aviation sector.

When focusing on the long-term coefficients, the effects of various economic variables on THY stock prices become apparent. A 1% increase in Brent crude oil prices is found to increase THY stock prices by 0.32%, indicating that oil prices positively and significantly impact THY stock prices.

Similarly, a 1% increase in the BIST100 index increases THY stock prices by 0.817%, indicating that the BIST100 index has a positive and statistically significant effect on THY stocks. On the other hand, a 1% increase in gold prices decreases THY stock prices by 1.337%, indicating that gold prices have a negative and statistically significant impact on THY stocks.

A 1% increase in the USD/TRY exchange rate is found to increase THY stock prices by 0.401%, indicating that exchange rate changes positively affect THY stocks, and this effect is statistically significant.

Finally, a 1% increase in the inflation rate is found to increase THY stock prices by 0.373%, indicating that inflation positively affects THY stocks, which is statistically significant.

All these results demonstrate that the effects of economic variables on THY stock prices are statistically reliable and significant. This analysis can assist investors and analysts in better understanding changes in THY stock prices and provide an important reference point for predicting future price movements.

4. Discussion

In the literature, many studies support the relationship between oil prices and airline stock prices. Some argue that oil prices have a negative impact on airline stock prices. Kathiravan et al. (2019) suggest that fluctuations in crude oil prices could affect airline costs and consequently influence stock prices. The depreciation of the local currency or an increase in international oil prices will negatively affect the airline stock market in the short term (Li & Ling, 2023).

The Cash Flow Hypothesis anticipates an unfavorable correlation between oil prices and stock performance when applied to the airline sector. This theory is supported by the fundamental idea that oil functions as a crucial input for various industries. Consequently, any upsurge in oil prices is projected to elevate operational expenses, leading to a decrease in forthcoming cash flows, profits, and dividends, affecting stock prices and returns (Horobet et al., 2022).

As opposed to that, Kristjanpoller & Concha (2016) examined the effect of fuel prices associated with 56 airlines on stock returns. The results show a positive relationship, meaning that an increase follows an increase in fuel prices in airline stock prices. The evidence supports that this increase is due to market inertia.

Market inertia fundamentally represents the tendency of organizations to maintain their existing structures and practices, making it difficult for them to quickly adapt to new conditions, even when faced with evolving market dynamics (Dooley, 2017).

During a bull market, most asset prices (especially stocks) rise, and the theory that rising oil costs will be a better economic growth signal is supported (Kristjanpoller & Concha, 2016).

Similarly, a study by Arouri & Rault (2012) suggested that oil prices positively affected stock prices in countries other than Saudi Arabia. Sarwar & Hussan (2016) addressed that there is a positive and significant relationship between oil and stocks. Chen & Lv (2015) also claim a positive and excessive dependence relationship between stock returns and crude oil prices.

This study confirmed a positive relationship between oil prices and THY stock prices. This positive relationship is due to increased and increasingly sticky inflation in recent years, as rising oil prices tend to drive up production costs for companies like THY, leading to higher prices for their goods and services, ultimately boosting their revenue and stock prices.

The analysis results indicate that THY stock prices positively correlate with foreign exchange, inflation, and BIST100. Similar studies in the literature also confirm this relationship. Rao & Maguluri (2022) examined the causal correlation between macroeconomic indicators and stock prices in the Indian stock market. Like previous studies in India and China, they found that inflation positively affected stock prices. Mumo (2017) investigated the effects of macroeconomic fluctuations on stock prices and found that exchange rates and interest rates had a positive relationship. It concluded that the impact of inflation exceeded potential gains from money supply in the long run. Wood & Gokhale (2017) confirmed a positive relationship between general stock market returns and airline stock returns.

5. Conclusion

In the realm of stock market research, particularly within the context of long-term stock performance in the airline industry, with a specific focus on Turkish Airlines (THY), this study has made significant contributions. By employing the Autoregressive Distributed Lag (ARDL) approach, which can estimate both short-term and long-term relationships between variables, this research underscores the versatility and effectiveness of this methodology in comprehending the intricate dynamics of stock performance. While the ARDL approach is not entirely novel, its application in the context of airline stock performance is relatively infrequent (Horobet et al., 2022).

This research has addressed a notable gap in the existing literature on long-term stock performance. Prior studies have indeed examined various factors influencing airline stock performance, including the impact of oil prices and other economic determinants. However, none of these studies seem to encompass all the variables considered in the current investigation of Turkish Airlines (THY). This research bridges this gap by offering a comprehensive analysis of THY's stock performance, considering multiple economic variables such as global energy prices, inflation, the BIST100 index, gold prices, and exchange rates. This holistic approach provides deeper insights into the determinants of stock performance and significantly enriches the broader knowledge base in the field of aviation finance.

Furthermore, the practical implications of these findings in the analysis of airline stock markets are substantial. The results of this study reveal statistically meaningful connections between crucial economic variables and THY's stock prices. These insights hold paramount importance for investors and analysts looking to understand and predict THY's stock price movements. In a volatile market and evolving economic conditions, accurate stock price predictions are essential for effective investment risk management (Tokmak, 2022) and portfolio management (Ekawarti, 2018). Additionally, these findings provide actionable guidance for market participants, enabling them to make informed decisions in the dynamic aviation sector.

Moreover, this research highlights the applications of time series analysis in the airline industry. Concentrating on Turkish Airlines as a specific case study offers a more focused perspective than broader studies encompassing multiple airlines or providing a more generalized view of airline stocks. The unique emphasis on THY, the methodological choices, and the ARDL approach application add a distinct dimension to the existing body of knowledge. This research is particularly relevant in the Turkish market and the specific dynamics of the aviation industry, setting it apart within the broader landscape of airline stock research.

In conclusion, the implications of the analysis of Turkish Airlines' stock performance extend beyond the boundaries of this specific case study. The findings indicate that oil prices positively influence THY stock prices, while gold prices exert a negative impact. Additionally, the BIST100 index and exchange rate changes positively affect THY stocks, and inflation is positively related to THY stock prices. These findings underscore the importance of considering economic factors such as global energy prices when analyzing airline stock performance, aligning with previous research suggesting a link between oil prices and airline stock prices (Kathiravan et al., 2019) and providing valuable insights for investors and analysts interested in the aviation sector.

For future research endeavors, expanding the geographical and company-specific focus is recommended. While this research concentrated on Turkish Airlines, exploring multiple airlines or different regional contexts could offer a more comprehensive understanding of the factors influencing stock prices in the airline industry.

Given the dynamic nature of financial markets and economic conditions, longitudinal studies tracking the evolution of relationships between economic variables and airline stock performance over time could provide valuable insights. This would enable researchers to assess the stability and consistency of these relationships under varying market conditions.

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